Coastal Rivers

Watershed Management Plan

Surface Water Improvement and Management Program

Suwannee River
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SunCom 821-3220

The Surface Water Improvement and Management Program is funded annually by the Florida Legislature, based in part on funding estimates made in this plan and by the Department of Environmental Protection. Project funding is split between the State (80%) and the Suwannee River Water Management District (20%). SWIM Plans are implemented to the extent that funding is made available by the Legislature, DEP, and the SRWMD Governing Board.

Statutory authority and guidance for the SWIM Program is provided in sections 373.451 - 373.459, Florida Statutes.

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I. Executive Summary

The Surface Water Improvement and Management (SWIM) program for the Steinhatchee River began in 1988, and was expanded to include all of the Coastal Rivers watershed in 1991. Water quality and biological monitoring are conducted monthly on the Econfina, Fenholloway, and Steinhatchee rivers and in Deadman Bay, the Steinhatchee River's estuary. Geographic Information System (GIS) databases have been developed to further analyze and model the watershed. Geographic data developed through the SWIM program include land cover, soils, topography, and water quality. This information is being used in analyses of the watershed for existing and potential pollution loading, and for land acquisition suitability.

The Coastal Rivers Watershed

The watershed covers nearly 1,870 square miles in north central Florida along the Big Bend Coast and includes the area between the Suwannee and Aucilla rivers. The three major rivers are the Steinhatchee, Fenholloway, and Econfina. Tributaries to these three rivers, the numerous named and unnamed tidal creeks on the coast, and coastal waters to the limit of Florida's jurisdiction (nine nautical miles seaward of the coast) are included.

The three rivers originate in two large wetlands areas, San Pedro Bay and Mallory Swamp. The rivers are all relatively short in length and have moderate discharge--similarities that brought about the development of a single plan to manage water quality and habitat values. Although some basic characteristics are shared by each of the three rivers, each has its unique traits and needs that are addressed in the plan.

Water quality is good except for the Fenholloway River, which receives treated effluent from the City of Perry wastewater treatment plant and pulp mill effluent from the Buckeye, Florida mill at Foley. Hydrologic alterations in the Steinhatchee watershed, which disrupted the natural drainage patterns, have been studied through the SWIM program and actions have been taken by the landowners to reduce impacts. Further restoration of headwater wetlands in the watershed are planned.

Priority Issues

Six priority issues are identified for the 1995 Coastal Rivers SWIM Plan.

<u>1. Resource Monitoring</u>

Resource monitoring includes water quality, biological, and land cover monitoring. Monitoring provides baseline data to compare future conditions with, and it also provides an ongoing check on the overall health of the river system. The monitoring networks need to be maintained, and additional monitoring efforts conducted to

support related management strategies. The Resource Monitoring program is designed to address this issue.

2. Identifying and Managing the Impact of Pollution Sources

Although most of the system's water quality is good, there are existing and potential threats to water quality and ecological communities. Two regulated point sources of pollution discharge to the Fenholloway River, causing poor water quality. Many land use activities pose nonpoint source pollution threats, and need to be identified and managed. A GIS-based modeling approach will be used to identify priority subwatersheds for more detailed assessment, including field surveys, intensive sampling, and contaminant transport modeling. This will provide a tool to help link land and water planning in the watershed.

3. Land Acquisition and Management

Public acquisition and management of lands within the watershed are effective resource management tools that, due to limited funding and District policy, have to focus on the most important areas. Several projects have been identified within the watershed in the District's 1995 Land Acquisition and Management Plan (LAMP). The most significant of these is a 38,000-acre combination of tracts including areas along the Econfina and Steinhatchee rivers. This project would put most of the river front in public ownership.

4. Hydrologic Restoration

Many areas in the headwater swamps of the watershed have been altered since the 1950s to make the lands more productive for pine silviculture. These ditches and canals have altered the natural hydrologic regime of the watershed, particularly in the timing and amount of freshwater inflow to the estuaries. This, in turn, causes changes in the delicate balance of fresh and salt water that supports a healthy and productive coastal ecological community. Many activities undertaken in the Steinhatchee watershed have improved conditions. Other areas in the watershed need to be evaluated and addressed wherever possible.

5. Technical Assistance and Intergovernmental Coordination

Multiple jurisdictions and agency responsibilities, across all levels of government, require close coordination if management efforts are to succeed. A major management issue within the watershed is providing technical assistance to local governments and other agencies. Several ongoing coordination efforts provide an opportunity to improve coordination among the many governmental entities with jurisdiction in the watershed.

6. Public Involvement and Education

Just as other agencies and governments are important partners in the overall management strategy for the watershed, an informed and involved public is needed. Involving the public in management efforts brings in valuable assistance to agencies, and it also provides a perspective that assures a broader approach to managing activities within the watershed. Environmental educational programs for public

schools in the District are supported by the SWIM program, and a landowner's guide for waterfront property owners is planned.

Management Strategies and Schedule

The table below summarizes the programs, projects, and tasks that are planned to address the priority issues described above.

	1997	1998	1999
1. RESOURCE MONITORING			
1.1 Water Quality Monitoring			
1.1.1 Monthly Sampling	→	→	→
1.1.2 Lab Analysis	→	→	→
1.1.3 Data Management	→	→	→
1.1.4 Water Quality Reports	→	→	→
1.1.5 Special Event Monitoring	→	→	→
1.2 Biological Monitoring			
1.2.1 Quarterly Monitoring	→	→	→
1.2.2 Biological Monitoring Report	→	→	→
1.3 Land Cover/Use Monitoring			
1.3.1 Land Cover/Use Mapping	→		
1.3.2 Seagrass Mapping		→	→
2. RESOURCE PLANNING			
2.1 Geographic Info. System			
2.1.1 Database Maintenance	→	→	→
2.1.2 Future Land Use Maps	X	X	X
2.2 Pollution Source Identification			
2.2.1 Point Source Coordination	→	→	→
2.2.2 Watershed Assessment	→		
2.2.3 Field Surveys	→	→	→
2.2.4 Priority Area Mgmt. Plans	→	→	
3. PROGRAM IMPLEMENTATION			
3.1 Technical Assistance			
3.1.1 Land/Water Tech. Assistance	→	→	→
3.1.2 Land/Water Coordination	→	→	→
3.1.3 Regional Plan Assistance	X		
3.2 Local Plan Review			
3.2.1 Plan Amendment Review	→	→	→
3.3 Interagency Coordination			
3.3.1 Technical Assistance	→	→	→
3.3.2 Enforcement Coordination	→	→	→
3.4 Policy/Program Coordination			
3.4.1 Tech. Advisory Group(s)	X	X	X
3.4.2 Regulatory Technical Support	→	→	→
3.4.3 Nonreg. Program Support	→	→	→

3.5 Public Education			
3.5.1 Environmental Education	X	X	X
3.5.2 Public Involvement	→	→	→

4. RESTORATION IMPLEMENTATION			
4.1 Wetlands/Hydro. Restoration			
4.1.1 Current Projects	X		
4.1.2 Future Projects	→	→	→
4.1.3 Compliance Assistance	→	→	→
4.2 Stormwater Management			
4.2.1 Stormwater Problem Study	→		
4.2.2 Stormwater Mgmt Improvement	→	→	→
5. WATERBODY PLANNING			
5.1 Annual SWIM Plan Review			
5.1.1 SWIM Plan Review	X	X	X
5.1.2 SWIM Plan Revision			X
5.2 Annual Priority List Review			
5.2.1 Annual Priority List Review	X	X	X

A Special Note on SWIM Funding

The SWIM program is funded annually by the Florida Legislature, based in part on funding estimates made in this plan and by the Department of Environmental Protection (DEP). Project funding is split between the state (80 percent) and Suwannee River Water Management District (SRWMD) (20 percent).

Funding amounts have varied each year since 1987 and directly control the degree to which the SWIM plans are implemented. The SWIM program for protecting the Coastal Rivers and estuarine systems can only be implemented to the extent that funding is made available by the Legislature, DEP, and the SRWMD Governing Board.

II. Watershed Management Goals

This plan fulfills the requirements of sections 373.451 - 373.459, Florida Statutes, as the third-ranked priority watershed of the District's SWIM program. The Coastal Rivers watershed was added to the District's SWIM Priority List in 1990 (to expand and replace the Steinhatchee River watershed), and the initial edition of this plan was adopted in 1991. This plan revision replaces the 1991 edition.

This plan includes all related land and water resources associated with the Coastal Rivers watershed and coastal ecosystem. The extent to which related resources such as aquifer recharge areas and isolated wetlands are addressed in the management

programs is determined on a priority basis, as management issues and funding allow. That is, the focus of this plan is the river-bay systems, and priority is assigned to upgradient and inland areas afterwards. This does not preclude the ability to address water and related resource issues anywhere in the watershed as they arise, however.

Coastal Rivers Watershed Management Goals

I. Maintain or improve current water quality conditions within the watershed, focusing on the Big Bend coastal seagrass ecosystem and the streams that flow into it.

Linkages:
Priority Issue 1, Resource Monitoring
Priority Issue 2, Identifying and Reducing Pollution
Priority Issue 3, Land Acquisition and Management
Priority Issue 4, Hydrologic Restoration
Priority Issue 5, Technical Assistance and Coordination

Management Strategy 1, Resource Monitoring (Water Quality, Biological Monitoring)
Management Strategy 2, Resource Planning (Identify Pollution Sources)
Management Strategy 3, Program Implementation (Technical Assistance, Intergovernmental Coordination)
Management Strategy 4, Restoration Implementation (Restoration "Priority List")

II. Prevent future hydrologic alterations that would adversely affect wetlands, groundwater recharge characteristics, wildlife habitat, and estuarine ecosystems.

Linkages:
Priority Issue 1, Resource Monitoring
Priority Issue 3, Land Acquisition and Management
Priority Issue 5, Technical Assistance and Coordination
Management Strategy 1, Resource Monitoring (Water Quality, Hydrologic Monitoring)
Management Strategy 3, Program Implementation (Technical Assistance, Intergovernmental Coordination)

III. Balance demands for water resources with the availability and quality of surface and ground waters. Availability is defined as the potential quantity of water that can be withdrawn, removed, or retained without causing significant harm to the water resources or associated natural systems (§62-40.210(13,32), F.A.C.).

Linkages:
Priority Issue 1, Resource Monitoring
Priority Issue 5, Technical Assistance and Coordination

Management Strategy 3, Program Implementation (Technical Assistance, Intergovernmental Coordination)

IV. Develop and maintain an integrated water resource monitoring network that can provide adequate data to establish and track conditions within the watershed, including water quality, aquatic biological, land use and land cover, and surface and groundwater levels and flows.

Linkages: *Priority Issue 1, Resource Monitoring*
Priority Issue 5, Technical Assistance and Coordination

Management Strategy 1, Resource Monitoring (Water Quality, Biological, Land Cover Monitoring)

V. Identify areas needing site-specific restoration activities and work with all responsible or interested entities to restore natural ecosystem values and functions.

Linkages: *Priority Issue 2, Identifying, Managing Pollution Sources*
Priority Issue 4, Hydrologic Restoration
Priority Issue 5, Technical Assistance and Coordination

Management Strategy 2, Resource Planning (Identify Pollution Sources)
Management Strategy 3, Program Implementation (Intergovernmental Coordination)
Management Strategy 4, Restoration Implementation (Restoration "Priority List", Stormwater Management)

VI. Improve the public's understanding and knowledge of the Coastal Rivers and seagrass ecosystem through environmental education, public participation, and the availability of data, reports, maps, and other resource information.

Linkages: *Priority Issue 5, Technical Assistance and Coordination*
Priority Issue 6, Public Involvement and Education

Management Strategy 3, Program Implementation (Technical Assistance and Public Involvement and Education)

VII. Ensure that the future growth and development of the Coastal Rivers watershed is compatible with the continued health of watershed ecosystems by guiding more intensive land uses to suitable land areas and areas served by public facilities.

Linkages: *Priority Issue 3, Land Acquisition and Management*
Priority Issue 5, Technical Assistance and Coordination

Management Strategy 2, Resource Planning (Identify Pollution Sources)
Management Strategy 3, Program Implementation (Technical Assistance, Plan Review, Intergovernmental Coordination)

III. Watershed Description and Background Information

Watershed Description

The Coastal Rivers watershed extends along the Gulf coast from the Econfina River in the northwest to Sanders Creek in the southeast, and inland to the rivers' headwaters. The 1,870 square-mile area includes parts of Taylor, Madison, Lafayette, and Dixie counties. The primary surface waters of this system include the Econfina, Fenholloway, and Steinhatchee rivers, Sanders Creek, Spring Warrior Creek, and Rocky Creek. Numerous other smaller creeks and tributaries are included. All coastal waters to the limit of State jurisdiction (nine nautical miles seaward of the coast) are included. Map 1 shows the location and major features of the Coastal Rivers watershed.

Physiography and Topography

The Coastal Rivers watershed lies within the Gulf Coastal Lowlands and Coastal Swamp geomorphic regions, which are characterized by low physical relief and poor drainage. The inland, upstream portions of the watershed lie on older marine terraces that gradually step down to more recent terraces along the coast. The extensive headwater swamps (e.g., San Pedro Bay and Mallory Swamp) are "perched" on these higher terraces. Surface waters coalesce into defined, but braided, stream channels along the upper portions of the watershed. As these small, intermittent streams move down toward the coast, the rivers are formed.

Elevations within the area range from 140 feet mean sea level (MSL) in Madison County to sea level at the coast. Variations are subtle, as evidenced by the extensive wetlands systems that cover the watershed. Some of the more pronounced topographic features within the watershed are relic dunes inland from the coast that rise up to 30 feet above the surrounding flatwoods.

Climate

The area's climate is humid and subtropical, with an average annual temperature of about 71°F. June through August is the warmest period, with daytime temperatures averaging in the low- to mid-90s. January and February are usually the coldest, with at least several nights of freezing temperatures. Because the area is near the coast and influenced by the moderating effects of the Gulf of Mexico, it is somewhat cooler in summer and warmer in winter than locations further inland.

The normal annual rainfall total at Steinhatchee is about 57 inches per year, with most of the precipitation falling in the summer--June through September. Most of this rainfall is returned to the atmosphere through evaporation and transpiration, feeding a cycle of predictable summer afternoon showers and thunderstorms.

Winter frontal activity brings in the other "wet season," when rainfall events are less intense, of longer duration, and more likely to cause flooding. Lower temperatures and dormant vegetation significantly reduce wintertime evapotranspiration, leaving more of the rainfall to fill wetlands and surfacewater channels and floodplains. Extreme events, such as hurricanes or the unnamed storm in March 1993, are always a possibility and can bring devastating results to coastal communities.

Hydrogeology

The Floridan aquifer system is unconfined and under water table conditions in the Coastal Rivers watershed. The uppermost geologic unit of the aquifer in the area is either Suwannee Limestone or limestones of the Ocala Limestones. The limestones are porous and permeable, and overlain by a thin layer of sandy soil. This allows rainfall to percolate rapidly to the aquifer and as a consequence makes the aquifer vulnerable to contamination. Wetlands areas in the upper watershed, such as San Pedro Bay and Mallory Swamp, exist because they are typically underlain by less permeable soils.

The coastal area inland several miles is a discharge area for the Floridan aquifer system. Most of the watershed has moderate to high recharge potential for the aquifer. Areas where the aquifer is close to or at the land's surface, during normal or high groundwater levels, have low recharge potential because storage space in the limestone or soil is limited and rainfall is forced to run off to the nearest surfacewater body. Areas with a thicker overburden of sands and lower relative groundwater levels have more storage space and a correspondingly high recharge potential.

Interaction of surface and ground waters is an important hydrologic feature of the watershed. Because of the relatively thin overburden between the land's surface and the aquifer, there is a high degree of interaction between surface and ground waters--to the point that, in much of the watershed, the two can be considered the same resource. River corridors are especially important, because they tend to occupy fracture zones and are where the greatest interaction of surface and ground waters occurs. Springs are almost always found along the river corridors, and serve as a conduit between surface and ground waters. When surfacewater levels exceed groundwater levels, recharge to the aquifer usually occurs. When the potentiometric surface of ground water is higher, the springs contribute flow to the rivers.

Two examples illustrate the complex natural hydrology of the watershed, and its vulnerability to alteration. When flow in the Steinhatchee drops below 500 cubic

Map 1. Location and Hydrologic Features of the Coastal River Watershed

feet per second (cfs) above the US 19/98 bridge it is captured by the Floridan aquifer system, resurfacing just downstream from the US 19/98 bridge. Similarly, the Econfina River has a small land bridge below US 19. The Fenholloway River is impacted by large groundwater withdrawals for the Buckeye, Florida pulp mill in Foley. The large cone of depression around the mill's supply wells draws the river's water into the aquifer during normal to low flows. This is a particularly important water management issue due to the poor water quality of the river.

Hydrology and Water Quality

The streams of the Coastal Rivers watershed exhibit similar characteristics. The three major rivers originate from headwater swamps--San Pedro Bay and Mallory Swamp--and have naturally acidic, highly colored water low in dissolved oxygen. Flows are highly variable, depending for the most part on surfacewater runoff although groundwater input does play a minor role in maintaining base flow.

There have been extensive modifications made to the natural drainage patterns of the watershed over the years by the timber companies that own most of the land. Large areas of the headwater wetlands have been ditched and drained for timber production, resulting in higher peak flows and quicker response following major rainfall and storm events. Recent modifications to some of these drainage features attenuate some of the peak flows to more closely emulate natural drainage conditions.

The City of Perry experiences stormwater management problems, and has a combination of drainage improvements that have altered the natural drainage of the most urbanized area in the watershed. Historically, these drainage projects have been concerned with simply moving storm waters out of the city, and have not completely addressed water quality treatment. Since 1986, most activities related to stormwater management have been regulated by the District and are required to provide stormwater treatment for water quality. The area is currently being evaluated for the development of a master stormwater management plan, which may provide opportunities for additional water quality treatment and hydrologic improvements.

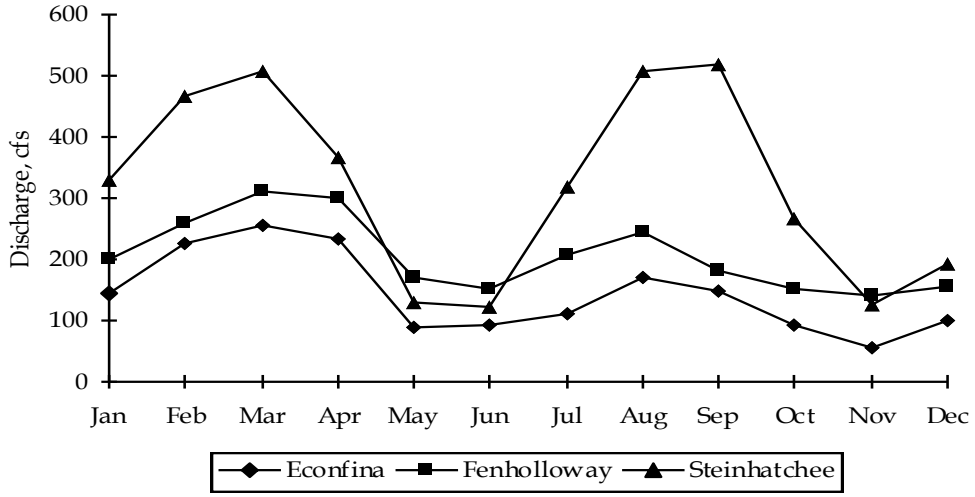
Table 1 shows summary data for the flows of the three major rivers in the watershed, and Figure 1 illustrates their monthly mean discharge. All three rivers have their highest discharge in late winter and early fall, with lowest flows usually in early summer and late fall. Interestingly, the Steinhatchee River exhibits the most variability in flow, which may be due to past hydrologic alterations combined with unique watershed features.

Table 1. Discharge Data for Coastal Rivers

River (Station Location)	Area Drained	Average Discharge	Maximum Discharge	Minimum Discharge
Econfina River (near Perry)	198 mi^2	142 cfs	2,540 cfs (9/17/57)	2.3 cfs (7/8/55)
Fenholloway River (at US 27)	60 mi^2	53 cfs	3,210 cfs (9/12/64)	0.32 cfs (8/25/93)
Fenholloway River (at SR 356)*	160 mi^2	208 cfs	1,360 cfs (9/18/64)	35 cfs (10/8/90)
Steinhatchee River (near US 19/98)	350 mi^2	322 cfs	17,600 cfs (9/13/64)	2.5 cfs (7/18/81)

*Includes mill effluent
Source: USGS, 1995

Figure 1. Monthly Mean Discharge Data for Coastal Rivers.



Source: USGS, 1993

Appendix A provides water quality data collected by the SWIM program since 1994 for the Econfina, 1989 for the Fenholloway, and 1990 for the Steinhatchee. Other water quality data for these rivers have been collected by DEP and others and are summarized in the 1994 Water Quality Assessment Report, Technical Appendix 305(b) prepared by DEP.

Econfina River

The Econfina River begins in the northwestern corner of San Pedro Bay near the community of Shady Grove and flows through pine flatwoods on its 35-mile course to

the Gulf of Mexico. Apart from bridges at crossings, the only developed areas along the entire river are at Shady Grove and Econfina Landing, a small fish camp and community near the river's mouth. There are only three small, unnamed tributaries to the Econfina near Shady Grove.

The river and its estuary have been studied as a comparison to the heavily-impacted Fenholloway River (see Appendix E). The river currently meets or exceeds all standards for Class III waters. Improving trends are identified by DEP overall and particularly for total phosphorus, turbidity, total coliform bacteria, and temperature. A decreasing trend in secchi disc depth, a measure of water clarity, is noted (FDEP 1994a).

Fenholloway River

The Fenholloway River also begins in San Pedro Bay and has a 35-mile course to the Gulf. The river is currently designated Class V, Industrial and Navigation. Effective December 31, 1997, the river will be redesignated Class III. The upper river is a small, winding blackwater stream that, during dry periods, has very little to no flow. The lower river receives treated effluent from the pulp mill at Foley that results in poor water quality from low dissolved oxygen, high BOD, high conductivity, and other symptoms of high organic loading. At times, the entire flow of the river at the discharge point is effluent from the mill. The river also receives treated wastewater effluent from the City of Perry, via Spring Creek.

In January 1994 DEP began an intensive hydrogeological investigation to define a conservative potentially impacted corridor within which water from the Fenholloway River may be expected to interact with ground water in the adjoining aquifers. This study was in response to concerns about poor quality river water entering private wells along the river corridor. The study involved installing 36 monitoring wells and conducting eight water quality sampling events and numerous water level collection events. The study identified an area along the middle river corridor that is highly susceptible to surface-groundwater interaction. The results of the study are presented in "Delineation of Ground and Surface Water Areas Potentially Impacted by an Industrial Discharge to the Fenholloway River of Taylor County, Florida," Florida DEP, May 1995 (See Appendix E).

The Fenholloway River is further discussed in the Priority Issues section.

Steinhatchee River

The Steinhatchee River watershed is described in detail in the 1988 SWIM Plan (SRWMD, 1988) and the Steinhatchee River Annual Report (1994). The river begins in San Pedro Bay and Mallory Swamp and flows about 30 miles to the Gulf at the community of Steinhatchee and the estuary in Deadman's Bay. River flow is

augmented by drainage from the major tributaries Owl, Reedy, Kettle, Eightmile, Rocky, Boggy, and Sand Hill creeks. Overall, the river drains about 580 square miles.

The river's watershed has been altered by past land drainage activities, road building, and other alterations. The cumulative effect of these alterations has been to increase peak runoff by an estimated 38 percent in the watershed from 1953 to 1988, based on a study conducted through the SWIM program in 1989-1992. The result has been a river that discharges more water faster than would otherwise be in natural conditions, disrupting the hydrologic balance of the estuary. Improvements undertaken voluntarily by the major corporate landowners to the various drainage canals and facilities within the watershed have slowed the rate of runoff within the watershed, more closely emulating natural conditions. Due to changes in land ownership, the District is working with the new land owners to advise them of the importance of maintaining these facilities.

The Steinhatchee River's water quality is good and meets its Class III designation for fishable-swimmable waters. There are no permitted point source discharges to the river. Nonpoint sources of pollution within the watershed include stormwater runoff from roads and the town of Steinhatchee, septic tanks along the river, and silvicultural activities in the upper watershed.

Ecological Communities and Fish and Wildlife Resources

The various natural communities present in a watershed each contribute to the attributes of the watershed regarded as valuable by man. For example, wetlands provide surfacewater benefits by storing floodwaters and by filtering sediments and nutrients from surface runoff; flatwoods can be important groundwater recharge areas; coastal marsh habitats are important nursery areas for many species of finfish and shellfish of recreational and commercial value. An understanding of the natural systems/ecological resources of the basin is an integral part of the SWIM process, since, as noted previously in this report, the natural systems of the basin play important roles in protecting water quality.

Aquatic Ecosystems

The three major aquatic ecosystems in the basin are the riverine, lacustrine (lake), and coastal ecosystems. The roles these habitats fulfill in the basin include:

1. Fish and wildlife habitat;

2. Floodwater storage and attenuation;

3. Protection of water quality;

4. Economic benefits (commercial and recreational fisheries, etc.).

The riverine ecosystems constitute the major type of freshwater aquatic system in the watershed. Major features associated with these river systems which contribute to their ecological value include the riparian swamp forests and various natural features associated with the river channel. The riparian swamps of most of the major rivers in the basin tend to be dominated by oak (*Quercus spp*.), sweetgum (*Liquidambar styraciflua*), ash (*Fraxinus*), bays and other hardwoods, cabbage palm (*Sabal palmetto*), and red cedar (*Juniperus silicicola*), rather than cypress. These forests contribute leaf litter to the streams that constitute an important basic food source in the aquatic food chain of the river. River channel features include:

- the littoral (submerged bank) areas, which may provide important fisheries habitat;
- snag areas, submerged logs, and brush which have been shown to be important habitat areas for riverine invertebrates;
- shoal areas, which are known to support abundant and diverse populations of benthic invertebrates.

Lacustrine (lake) systems are present but not a major type of aquatic ecosystem in the basin. They are found mostly along the edges of the basin in Dixie and Lafayette counties and as relict lagoonal areas behind the aeolian dune systems along the coast. These lake systems exhibit variable limnological characteristics (Canfield, 1981), ranging from acidic, soft water lakes of low mineral content, to alkaline, hard water lakes of high mineral content. In general, however, all of these lakes are characterized as oligotrophic to oligo-mesotrophic systems, with low phytoplankton populations. Water clarity was poor in some lakes due to large amounts of suspended sediments or high color (Canfield, 1981). Some of these lakes are characterized by a poorly developed littoral shelf vegetation, others have a littoral vegetation dominated by various sedges. Some of the relict lagoon lakes are unusual in that they are almost completely vegetated with a dense cover of sawgrass (*Cladium jamaicanese*) with sparse, scattered "hummocks" of wax myrtle (*Myrica cerifera*) and cypress, giving these systems an appearance strikingly like that of the Everglades.

Coastal aquatic habitats in the basin include the estuaries and adjacent coastal marine waters. A major natural feature of these areas are the seagrass beds. This region of the Florida coast encompasses the largest area of contiguous seagrass in the state(Department of Natural Resources [DNR], 1988). Zimmerman and Livingston (1979) characterized the seagrass habitats in Apalachee Bay, the northern portion of the coast of this basin. Their descriptions are generally applicable to other areas of the coast in this basin. Dominant seagrass inshore include shoal grass (*Halodule wrightii*),

widgeon grass (*Ruppia maritima*), and *Halophila engelmannii*. Offshore areas are dominated by manatee grass (*Syringodium filiforme*) and turtle grass (*Thalassia testudinum*). Other components of the flora include various species of siphonaceous algae (*Halimeda, Caulerpa*, and others) and red drift algae (*Gracilaria spp., Digenia simplex, Laurencia poitei*). McNulty, et al. (1972) and the Florida Marine Research Institute (K. Haddad, pers. comm.) provided mapped data on seagrass acreage. Earle (1969) conducted a survey of marine algal flora in the area in the mid-1960s.

Other major habitat types include oyster reef habitats, brackish water submerged vegetation beds, salt and brackish marshes (discussed below), and unvegetated flats areas. McNulty, et al. (1972) provided some information on locations of commercial oystering areas in the region. Saville (1966) compared aspects of the aquatic ecology of the Waccasassa and Fenholloway estuaries. Hooks, et al. (1976) and Dugan and Livingston (1982) studied the benthic macroinvertebrate communities in the Econfina and Fenholloway estuaries. DER sampled benthic macroinvertebrates at three estuarine stations in the basin (Econfina River, Steinhatchee River, and Spring Warrior Creek) in 1987-1989. Livingston (1982, 1984) studied fish trophic relationships in Apalachee Bay and the Econfina and Fenholloway estuaries.

Palustrine Habitats (Wetlands)

Palustrine habitats are a major component of the land cover in this basin. Mapped data on wetland coverage include the maps compiled by the U.S. Fish and Wildlife Service (USFWS), National Wetlands Inventory, and a recent land cover mapping effort conducted by the SRWMD.

This basin contains a wide variety of wetland types, which may be generally characterized as the following:

a. forested wetlands dominated by needle-leaved deciduous trees, bald or pond cypress (*Taxodium distichum* or *T. ascendens*, respectively), and forested wetlands dominated by an overstory of needle-leaved evergreen trees (typically slash pine, *Pinus elliotii*, or loblolly pine, *P. taeda*)

b. forested wetlands dominated by various types of broadleaf evergreen hardwoods (including sweet bay, *Magnolia virginiana*, southern magnolia, *M. grandiflora*, and loblolly bay, *Gordonia lasianthus*)

c. forested wetlands dominated by various types of broad-leaved deciduous hardwoods (oaks, various gums, river birch, red maple)

d. herbaceous marshes ranging from sedge bogs, through wet prairies (vegetated with *Pontedaria*, *Sagittaria spp*., sawgrass and other sedges) to permanently flooded marshes dominated by floating leaved aquatics such as *Nymphaea* and *Nuphar*.

e. oligohaline marshes vegetated by sawgrass, bulrushes (*Scirpus spp*.), and needlerush (*Juncus roemerianus*)

f. coastal salt marshes vegetated by smooth cordgrass (*Spartina alterniflora*), needlerush, and marsh hay cordgrass (*S. patens*)

These wetland resources fulfill a variety of functions including fish and wildlife habitat, flood storage, runoff filtration, coastal storm surge buffering, and nursery areas for economically important species (commercial and recreational fisheries and game species).

Transitional and Terrestrial Habitats

The transitional habitats (those ecotone areas between wetland and upland communities) and the terrestrial habitats of the basin serve a variety of roles for basin wildlife and people. Major transitional habitat types include:

Coastal wet prairie/flatwoods areas. These areas, located landward of the coastal marshes, are vegetated with *Spartina baker*i, various sedges, cabbage palm, red cedar, slash pine (*Pinus elliotii*), salt bushes (*Baccharis spp*..), and wax myrtle.

Lowland hardwood hammocks. These areas are landward of forested riparian swamps and along the landward edge of forested wetland areas. They are vegetated with live and laurel oak, pignut hickory, loblolly pine, cedar, and cabbage palm.

These transitional areas provide additional landscape diversity and serve to protect the integrity of the adjacent wetlands.

Upland or terrestrial habitats in the basin have historically been dominated by pine flatwoods area. These forests are dominated by slash, longleaf, or loblolly pine (the particular species depending largely on soil type and degree of wetness). Smaller areas of the basin are vegetated with more xeric plant communities such as xeric hammocks, sand pine scrub, and mixed upland forests.

Wildlife and Protected Species

A number of species of fish and wildlife with protected status are known to occur in the basin. For purposes of the SWIM planning process, "protected status" includes species

listed as endangered, threatened, or under review for listing by the USFWS; those listed as endangered, threatened, or species of special concern by the FGFWFC; plant species listed as endangered, threatened, or rare in the Preservation of Native Florida Flora Act; and species listed in the six-volume series "Rare and Endangered Biota of Florida," published by the Florida Committee on Rare and Endangered Plants and Animals (FCREPA). A detailed listing of these types of species is provided in FGFWFC (1990). A listing of selected vertebrate species that have been observed or reported from the basin is provided in Table 2. Note that this list is not intended to be exhaustive but simply to point out some of the more familiar species.

At least sixteen colonial wading bird rookeries have been identified in the basin from recent aerial surveys conducted by the FGFWFC in the region (D. E. Runde, FGFWFC, pers. comm.). Several more rookeries are located along the fringes of the basin, and the birds in these colonies likely use the basin for feeding.

Table 2. List of Protected Species in the Coastal Rivers Watershed

SPECIES	STATUS	
	federal	state
Gulf Sturgeon	UR	SSC
American alligator	T	SSC
Atlantic loggerhead turtle	T	T
Atlantic green turtle	E	E
Alligator snapping turtle	UR	SSC
Bald eagle*	E	T
Swallow-tailed kite	UR	-
Snowy egret	-	SSC
Tricolor heron	-	SSC
Reddish egret	UR	SSC
Little blue heron	-	SSC
American oystercatcher	-	SSC
Wood stork	E	E
Brown pelican	-	SSC
Florida mouse	UR	SSC
Florida black bear	UR	T
West Indian manatee	E	E

E = endangered; T = threatened; UR = under review; SSC = species of special concern. * - documented breeding sites in basin

Growth and Development Trends

With an estimated 1995 population density of 15 persons per square mile, the Coastal Rivers watershed is sparsely populated. In fact, most of the residents in the watershed live in the five main communities of Perry, Cross City, Steinhatchee, Horseshoe Beach, and Dekle/Keaton Beach. Most of the land area in the watershed is unpopulated and in large-tract ownership by timber companies and the State of Florida.

Based on recent population trends, the watershed will likely experience a growth of about one percent a year, or about 250 persons per year (Table 3 and Figure 2). Any number of unforeseen events could change this number, but one fact remains--additional growth in the coastal area is limited to the existing communities due to public ownership of most of the coastline. The presence of numerous existing platted lots in and around the coastal communities, however, indicates a potential for future growth. Most of the region's new residents are settling in unincorporated areas.

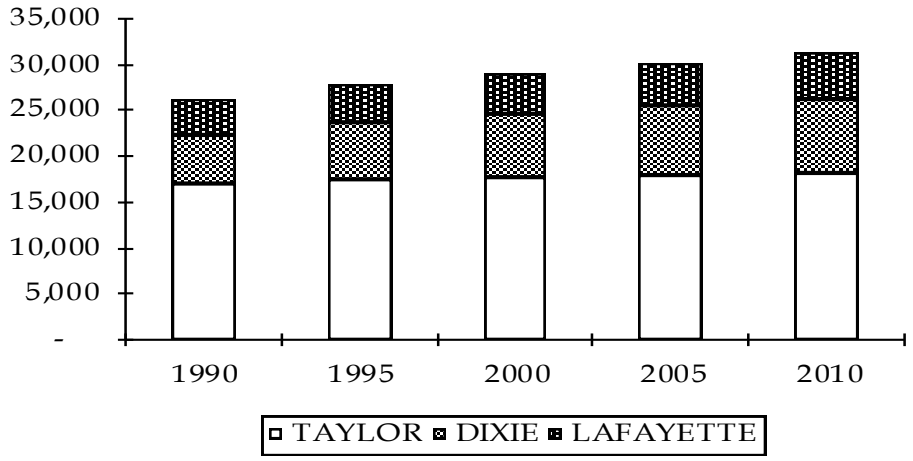
Table 3. Population Estimates and Projections

	1990	1995	2000	2005	2010
TAYLOR	17,111	17,495	17,697	17,900	18,102
DIXIE	5,293	6,151	6,902	7,551	8,201
LAFAYETTE	3,905	4,129	4,479	4,759	5,040
TOTAL	26,309	27,775	29,078	30,210	31,343

Projected Increase, 1990 - 2010: 19% or an additional 5,000 residents

Source: SRWMD, State Data Center 1994

Figure 2. Population Estimates and Projections, Coastal Rivers Watershed

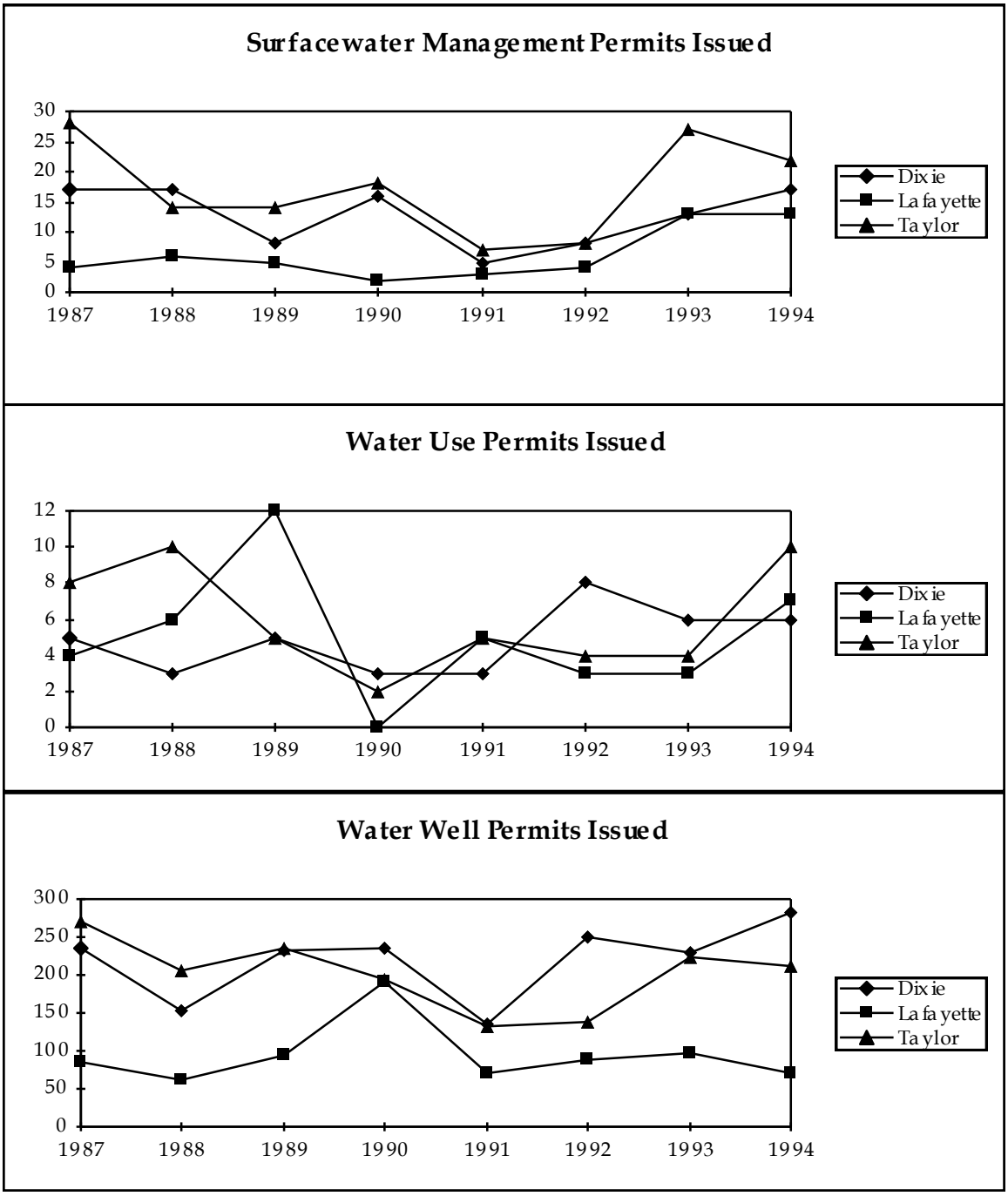


Source: SRWMD, State Data Center 1994

Since the winter storm in March 1993 that devastated the coastal communities of Horseshoe Beach, Dekle Beach, and Keaton Beach (among other Gulf coastal communities), rebuilding has become an issue. Many of the home sites do not comply with current standards for lot size, septic tank placement, and conformance with coastal zone and flood insurance regulations. Because of the environmental sensitivity and hazardous nature of the coastal area, further development and redevelopment in these areas will have to be balanced with the need to protect natural systems, property, and lives. This includes such activities as canal and channel dredging and spoil disposal, road building, and construction activities.

District permitting activity in the watershed has been steady since the SWIM program began in 1987. The total number of permits in Dixie, Lafayette, and Taylor counties are shown on Figure 3. Water well permits indicate primarily rural residential growth; surfacewater management permits indicate subdivision, commercial, and silvicultural activity; and water use permits indicate agricultural and commercial operations.

Figure 3. Permits issued by the SRWMD in the counties of the Coastal Rivers Watershed, 1987 - 1994



Water Resource Use

Virtually all consumptive uses of water in the watershed rely on ground water from the Floridan aquifer system. The groundwater withdrawals for the Buckeye pulp mill in Foley, currently permitted at 55 million gallons per day (mgd), dominates the area's water use. Public water supplies exist in Perry (1.9 mgd), Keaton Beach (.03 mgd), Taylor Beach (.07 mgd), Horseshoe Beach (.04 mgd), Steinhatchee (.19 mgd), and Cross City (1.1 mgd).

Other Management Programs in the Coastal Rivers Watershed

Big Bend Seagrasses Aquatic Preserve

The Big Bend Seagrasses Aquatic Preserve is the largest in the state, covering an area of about 450,000 acres of sovereignty submerged lands from the St. Marks River south to the Withlacoochee River. This preserve represents the largest span of pristine seagrass beds and salt marshes in the state (DNR, 1988).

The preserve was designated in June 1985 for the primary purpose of preserving the biological resources of the preserve and its associated waters. The area covered consists predominantly of salt marsh vegetation and extensive seagrass beds. About 55,500 acres of adjacent uplands were purchased by The Nature Conservancy in 1986, and resold to the state in 1987. Subsequent acquisitions have brought the total acreage up to 68,000 acres. Salt marshes and hammocks are to be managed along with the preserve; uplands areas are managed jointly by DEP, FGFWFC, and the Division of Forestry (DOF).

The major management objective of the preserve program is to ensure the maintenance of essentially natural conditions. Management will also be directed to ensure public recreational opportunities while assuring the continued propagation of fish and wildlife. This task will be guided by the identification and mapping of natural resources and habitats necessary to meet these objectives. An additional management objective is to review and comment on applications for the use of state-owned submerged lands. Accomplishing these objectives will require a fully implemented management program with sufficient staffing and funding resources.

A draft management plan for the preserve was prepared in 1988. A final management plan has not been prepared and there are no management activities currently underway to implement the draft plan.

Land Acquisition and Management

State of Florida

Lands within the watershed are acquired and managed by the state through the Conservation and Recreational Lands Trust Fund and the Preservation 2000

program. Agencies involved include DEP and FGFWFC. Public lands within the watershed acquired by the state are the 68,000 acre Big Bend Coast Tract described above and shown on Map 2.

Additional lands are targeted for acquisition in the 1994 CARL Priority List total 11,000 acres and are comprised of several inholdings. These lands, when acquired, will be managed along with the current public lands of the Big Bend Coast Tract.

Local Governments
Local governments can purchase lands to implement their comprehensive plans through the Florida Communities Trust Fund, part of the Preservation 2000 program. No local land acquisition programs in the watershed have occurred to date.

Suwannee River Water Management District
The District uses funds from the Save Our Rivers and Preservation 2000 trust funds to acquire lands for water management purposes. Lands acquired to date are shown on Map 2 and include significant acreage on the Econfina and Steinhatchee rivers. Additional proposed acquisitions are described in the 1996 Land Acquisition and Management Plan (which is updated annually). These lands are managed cooperatively with the FGFWFC and Division of Forestry (DOF). Areas that have been converted to silvicultural operations are being restored to native vegetation as the planted trees mature and can be harvested. Revenues generated are returned to the land acquisition and management program.

U. S. Fish and Wildlife Service
The Lower Suwannee River National Wildlife Refuge covers part of the coastal area within the Coastal Rivers watershed just north of the Suwannee River. Additional acquisitions for the refuge have been identified but are outside the Coastal Rivers watershed.

Regulations
Suwannee River Water Management District
The District regulates certain activities that involve surface and groundwater resources in the watershed. Surfacewater management regulations (Chapter 40B-4 and 40B-400, Florida Administrative Code [F.A.C.]) require stormwater management and treatment to ensure that post-development runoff closely matches pre-development conditions for amounts and timing of water releases, and for water quality treatment. Water uses are regulated under Chapter 40B-2, F.A.C. Water well construction is regulated under Chapter 40B-3, F.A.C. In response to the 1993
Legislature, the District has been delegated certain responsibilities related to wetlands dredge and fill and other activities (e.g., docks and marinas). This rule, Environmental Resources Permitting, is codified in Chapter 40B-400, F.A.C.

Map 2. Existing and Proposed Public Lands

Department of Environmental Protection
DEP administers the state's National Pollution Discharge Elimination System regulations, which govern the discharge of point source pollutants in the state. Other relevant regulations include wastewater treatment plants, public water supply facilities, linear transmission facilities (pipelines etc.), landfills, and large-quantity hazardous waste generators. Leases for the use of state-owned sovereign submerged lands are also reviewed by DEP and recommendations made to the Governor and Cabinet, acting as the Trustees of the Internal Improvement Trust Fund.

Local Governments
Counties and cities within the watershed are required, under Chapter 163, F.S., to adopt and implement comprehensive plans and land development regulations. Among other charges, these plans and regulations are required to protect important water-related features and fish and wildlife habitat.

Monitoring
State of Florida
DEP monitors water quality throughout the state through several different programs. In the Coastal Rivers watershed, these include coastal monitoring related to shellfish harvesting and limited freshwater/riverine water quality monitoring. These monitoring programs are closely coordinated with SWIM monitoring efforts.

U. S. Geological Survey (USGS)
The USGS conducts hydrologic monitoring on the Steinhatchee, Fenholloway, and Econfina rivers. This monitoring effort produces the data summarized earlier of fish and wildlife. This task will be guided by the identification and mapping of natural resources and habitats necessary to meet these objectives. An additional management objective is to review and comment on applications for the use of state-owned submerged lands. Accomplishing these objectives will require a fully implemented management program with sufficient staffing and funding resources.

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IV. Priority Issues and Analyses

The six priority issues for the Coastal Rivers Watershed SWIM program are listed below in order and described in detail in the following section. The Management Strategies section includes five major programs. The priority issues list below notes in italics which of the five programs address the issue.

1. **Resource monitoring** *(Resource Monitoring program)*
2. **Identifying and managing the impact of pollution sources** *(Resource Planning, Program Implementation, and Restoration Implementation programs)*
3. **Public conservation lands acquisition and management** *(Resource Planning program)*
4. **Hydrologic Restoration** *(Restoration Implementation program)*
5. **Technical Assistance and Intergovernmental Coordination** *(Resource Planning and Program Implementation programs)*
5. **Public Involvement and Education** *(Program Implementation and Waterbody Planning programs)*

Resource Monitoring
<u>Establishing and Maintaining Ambient Networks</u>
Various monitoring efforts have been conducted in the past within the Coastal Rivers watershed, but there is yet to be established a permanent ongoing, long-term water quality and biological monitoring program. In the past the SWIM program has monitored the Econfina, Fenholloway, and Steinhatchee rivers but funding

constraints have caused some stations to be dropped. An estuarine monitoring network to complement riverine monitoring needs to be established.

Hydrologic monitoring is related to water quality and biological monitoring. Water quality is directly influenced by water quantity. Currently, hydrologic monitoring including rainfall, river level and discharge, and lake level and groundwater levels are conducted outside the SWIM program but support SWIM program objectives.

Additional Monitoring Needs

Water quality and hydrologic monitoring is needed during and after storm events or within particular subwatersheds. Such data will be used to validate the results of the watershed assessment project (see below) and to provide data specific to stormwater pollutant loading from different land uses. These data are also essential to support nonpoint source investigations. Special event monitoring is supplemental to the ambient monitoring network.

Land Use and Land Cover Monitoring

Monitoring changes in land cover and land use are an important part of an overall resource monitoring strategy for the watershed. Land use activities and land cover characteristics are determinants of water quality, flow rates and water levels (hydrologic balance), and habitat quality.

Historic land use and land cover data for the watershed are limited. To help provide a benchmark for the SWIM program, satellite imagery was processed in 1988 to map regional land cover. This data provided a baseline land cover data set for the watershed, but has limitations for use in detailed assessments.

Detailed land cover and use information will be available in 1996 as a GIS coverage and database. Using aerial photography from 1993/94, this information is being collected at Level III of the Florida Land Use, Cover, and Forms Classification System (FLUCFCS), the same classification system the satellite imagery was processed with. These data will provide a greater level of spatial and classification accuracy than the satellite data.

Periodic updating is needed to maintain current data on land use and land cover as the watershed develops. New land use and land cover mapping should be obtained on a regular basis (e.g., every five years) based on the rate of growth and development experienced. Since growth and development are not uniformly spread throughout the watershed, priority areas (defined through the watershed assessment process described later) should be the focus of this monitoring effort.

Seagrass Mapping and Monitoring

The ecological significance of seagrass beds is well documented in scientific literature. The seagrass beds of the Big Bend area are a critical habitat and nursery for estuarine

and marine life in the Gulf of Mexico. The establishment of the Big Bend Seagrasses Aquatic Preserve by the Florida Legislature in 1985 emphasizes the area's importance.

Although the seagrasses have not been mapped in detail, a generalized map produced by the Marine Research Institute of DEP provides some information. The Big Bend area is reported to be one of the largest seagrass beds in the state (DNR, 1988). It is essential that current conditions be documented to provide a baseline against which future conditions can be compared, and to measure the success of protective and management measures. Threats to the seagrass beds come from two sources: water quality alterations (particularly color, sedimentation, and salinity) and impacts from boats (prop scarring). The extensive inshore grass flats of the Big Bend coast are very vulnerable to prop scarring from boat traffic, which peaks during the summer recreational scallop season. Low tide is usually the most popular for scalloping, and is the most vulnerable time for prop scarring.

A report by the Florida Marine Research Institute (Sargent, et al, 1995) states that most of the seagrass impacts from prop scars off Taylor and Dixie counties is in the "light scarring" category. Areas impacted are primarily just offshore north and south of the Steinhatchee River, with areas of moderate scarring in the vicinity of Pepperfish Key and Rocky Creek. The report indicates that, compared statewide, this area is not heavily impacted. However, boating activity has increased in the area, especially around Steinhatchee. Vessel registration records indicate that about 85 percent of the 4,641 vessels registered in Taylor and Dixie counties are pleasure craft, indicating a good target for educational and awareness programs.

Table 4. Seagrass Acreage and Prop Scarring

County	Total Seagrass Acres	Light Scarring	Moderate Scarring	Severe Scarring	Total Scarring
Dixie	111,130	2,470 ac. (2.2%)	1,020 ac. (0.9%)	0 ac. (0.0%)	3,490 ac. (3.1%)
Taylor	162,860	8,100 ac. (5.0%)	0 ac. (0.0%)	0 ac. (0.0%)	8,100 ac. (5.0%)

The report finds that "...the large amount of light scarring may have partially been and artifact of the small-scale maps that prevented detailed polygon delineation this [Big Bend] region." More accurate mapping of the Coastal Rivers seagrass beds is needed to

better define the scope of the problem and to provide more accurate data for comparison to future conditions.

An important recommendation of the report is that a multiple-approach management program be used to protect marine seagrass beds. The report concludes, "A combination of management techniques, along with long-term commitment, must be used to reduce the frequency and degree of scarring in seagrass beds. Some programs being implemented and tested use multifaceted approaches such as better educating the boating public, better marking of channels, limiting powerboat access in certain sensitive areas, and more effectively enforcing existing laws. Monitoring managed areas, both from the air and onsite, is critical in determining the effectiveness of a management program."

Pollution Sources

Threats to the water quality of the river and estuarine system stem from residential, commercial and industrial, or agricultural land uses, recreational uses of surface waters, water withdrawals, or other activities. The degree of threat, or severity of impact resulting from human activities depends on several factors including the physical characteristics of the land and waters, the type of activity, and measures taken to reduce adverse impacts.

Most development activities in the watershed are regulated to some degree by federal, state, regional, or local agencies. Pollution sources are the most obvious threats to the quality of the river system, and are classified as point and nonpoint sources. Point sources are direct discharges of pollutants, and are regulated by DEP. Nonpoint sources are indirect discharges of pollution, are harder to identify, and are regulated in a less structured process. Most nonpoint source controls in the watershed are addressed by voluntary means--the use and application of Best Management Practices (BMPs) by agricultural and silvicultural operations. New intensive agricultural operations, particularly dairies and feedlots, are regulated by DEP because of the higher degree of threat these activities pose to water resources. Other nonpoint sources are controlled by regulations, including the District's Surfacewater Management Rule, septic tank rules, and local land use planning and land development regulations.

Point Sources

Three permitted point sources of pollution are in the watershed. The City of Perry wastewater treatment plant discharges treated effluent to Spring Creek, a tributary of the Fenholloway River. Buckeye, Florida, a cellulose pulp mill, discharges treated effluent to the Fenholloway River. Cross City operates a wastewater treatment plant that discharges to California Swamp and ultimately to the Gulf of Mexico.

The Fenholloway River dominates any discussion about point sources of pollution in the watershed. The 1947 Florida Legislature passed House Bill No. 242, which allowed

industry to deposit sewage, industrial, and chemical waste into the Fenholloway and Gulf, with the only limitation that "the navigation of such waters shall not be impeded or obstructed." The legislation was intended to attract industrial development in Taylor County. The Buckeye mill was constructed in the early 1950s and has been in operation since the mid-1950s. Significant investments have been made over the years in improving the quality of the mill's air and water discharges.

Although the Fenholloway River currently meets its designated use, the U. S. Environmental Protection Agency (EPA) disapproved Florida's Class V designation of the Fenholloway in 1987 (DEP 1994b). A Use Attainability Analysis was conducted by DEP and Buckeye and completed in 1994. In order to meet Class III standards in the river, the mill's discharge would have to be removed. The preferred alternative is a combination of headwater wetlands restoration in San Pedro Bay, technological improvements in mill processes, and relocating the outfall to the lower river. This combination of activities should allow the Fenholloway to achieve Class III or "fishable-swimmable" standards, while also improving color and dissolved oxygen levels in the river's estuary. The river's reclassification to Class III is effective December 1997.

Removing the mill's effluent outfall from the river will reduce flows in the middle and lower river, since the discharge at times makes up the entire flow of the river. Under natural conditions the river had little to no flow during dry periods, but the situation is compounded by the large cone of depression from the mill's supply wells. Wetlands restoration in San Pedro Bay will help maintain flow in the river, but may not be sufficient to ensure a continual, year-round flow. Although the relocated-outfall issue is not directly a SWIM responsibility, it is a critical part of an overall watershed management strategy. The role SWIM could play, as described in the Management Strategies section, is three-fold: participate in planning and implementing the restoration of headwater wetlands; monitor water quality in the river and estuary; and work with DEP and Buckeye, Florida Inc. in the restoration of seagrasses in the Gulf of Mexico around the river's mouth.

Nonpoint Sources

Stormwater runoff from urban areas, roads, construction sites, agricultural and silvicultural areas, landfills, leaking underground storage tanks, and septic tank leachate are examples of potential nonpoint sources of pollution. Approaches to controlling pollution from nonpoint sources involves the application of BMPs such as sediment control during construction of roadside swales, as opposed to the more technological remedies that are used for point sources.

Stormwater Management

The District has administered Chapter 40B-4, F.A.C., Surfacewater Management, since 1986. This rule requires proper stormwater management for new development and redevelopment activities. Rule criteria require the management of water quantity to

keep post-development runoff similar to pre-development conditions. Water quality treatment is required as well, and varies depending on the physical setting of the site and the type of water body discharged to. Sensitive areas such as interior-drained or stream-to-sink watersheds have more stringent water quality criteria. Facilities discharging to Outstanding Florida Waters such as the Big Bend Seagrasses Aquatic Preserve also have more stringent water quality treatment criteria.

Silviculture Best Management Practices
Nonpoint sources of pollution associated with forestry activities are controlled through the application of BMPs detailed in Silviculture Best Management Practices 1993, Florida Department of Agriculture and Consumer Services, Division of Forestry. Revised practices advocated in the 1993 manual provide for a larger buffer adjacent to surface waters and suggested improvements to cutting practices in sensitive areas, stream crossing guidelines, and other measures to reduce the adverse impacts of silvicultural operations.

Onsite Sewage Treatment and Disposal Systems
Areas that are not served by central sewage treatment plants rely on onsite sewage treatment and disposal systems (OSTDS). The traditional form is a septic tank and drain field. Chapter 10D-6, F.A.C., requires a minimum of two feet of unsaturated soil between the bottom of the drain field and the seasonally high water table to adequately treat domestic wastewater.

Where OSTDS are not properly installed or maintained, or where drain fields are not adequately separated from the water table, waste water discharged from the tank is not adequately treated. Nutrients and bacteria can be carried to ground water or surface water, causing potential health problems and leading to eutrophication of surfacewater bodies. Areas of human habitation that are not served by any wastewater facilities, such as hunt camps, are an even greater threat to water quality.

Recent revisions to Chapter 10D-6, F.A.C., have restricted the placement of septic tanks within the 10-year floodplain or regulatory floodway of surface waters. Within these areas advanced treatment systems that provide greater treatment of wastewater prior to discharge to a drain field are required. Implementation of these rule revisions is hampered in the Coastal Rivers watershed because the 10-year floodplains have not been mapped. Considering the proposed acquisition of lands along the Econfina and Steinhatchee rivers, this issue may be of lower priority. Further consultation with local public health officials (Projects 2.2 and 3.3 in the following section) may help guide any future mapping needs.

Watershed Assessments to Identify Nonpoint Sources of Pollution
Land use is an important determinant of a watershed's water quality and ecological integrity. Land use decisions are made by local governments in accordance with

comprehensive plans prepared under the guidelines in Chapter 9J-5, F.A.C. Minimum criteria in the rule require local governments to consider the suitability of land for use, including residential, commercial, industrial, agricultural, conservation, and public uses.

Most of the comprehensive plans applicable to the watershed were not based on a thorough analysis of environmental conditions such as soils, topography, wetlands, and ground water because adequate information was not available. Also, future land use patterns designated in the plans generally conforms to historic land use patterns--mostly silviculture, agriculture, conservation, and rural residential.

Through the SWIM program, data are now available to conduct such analyses and to provide recommendations to local governments for appropriate land use designations. Watershed models can be developed to help evaluate potential impacts to water quality from proposed future land uses.

Two basic steps define the watershed assessment process. An initial screening step using watershed-wide criteria is used to identify priority subwatersheds. Once these priority subwatersheds are identified, management plans are developed to address the land-use specific impacts identified. For some areas, particularly more developed and faster developing areas like Perry or Steinhatchee, more detailed analyses may have to be conducted. These second-level analyses may include basin-specific hydrologic and contaminant-transport modeling, determining actual pollutant loading rates for various land uses, and other more detailed assessments. Products from the assessment project will be used to assist local government comprehensive planning efforts, and to develop a strategy to determine cumulative impacts within the watershed or subwatersheds.

Land Acquisition and Management

One of the more direct resource management and protection tools available is land acquisition and management. Using funds from the Water Management Lands and the Preservation 2000 Trust Funds, the District can acquire fee simple interest in lands important to water management. Lands are purchased on a voluntary sale basis.

The District's land acquisition program has prioritized the 100-year floodplain of the Suwannee River and its tributaries. Consequently, little acquisition activity has occurred in the Coastal Rivers area until 1991, when the District acquired over 5,200 acres in the Steinhatchee River watershed. In 1986 The Nature Conservancy acquired the Big Bend tracts, over 68,000 acres of coastline from the St. Marks River to the Withlacoochee River. The land was resold to DEP (then DNR) in 1987.

The District is currently in the process of acquiring large tracts along the Econfina and Steinhatchee rivers as part of the Rivers of the Big Bend project. These lands are shown as proposed acquisitions on Map 2, page 23, and include about 9,000 acres and 44 miles

of river frontage on the Econfina River, and about 21,600 acres and 30 miles of river frontage along the Steinhatchee River.

Land management activities are important to restore and/or protect the natural resource values of acquired lands. Public use of these properties must be managed. Many of the lands acquired by the District are restored to native ecological communities, necessitated by past alterations. Ecological inventories provide a baseline data set from which land management plans are developed and implemented.

Hydrologic Restoration

Some of the canals and drainage facilities in the Steinhatchee watershed have been retrofitted to retain runoff and allow a slower, more natural drainage following storm events. Continued hydrologic monitoring is needed to determine the long-term effectiveness of these measures. Other drainage facilities in the Coastal Rivers watershed, constructed prior to the District's surfacewater management rules in 1986, need to be identified and evaluated. There may be a need for additional retrofitting or modification if it can be determined that adverse impacts have occurred. The City of Perry and surrounding areas are currently being evaluated for developing a master stormwater management plan due to flooding and other problems with the current drainage system.

As described earlier, the restoration of wetlands areas in San Pedro Bay is currently a factor in the reclassification of the Fenholloway River. Retaining more water in the swamp and slowing its release to the Fenholloway is a potential way to maintain a more even flow distribution in the river system if the mill's discharge is relocated to the lower river (the mill's discharge currently makes up the entire river flow at times). This can be accomplished by restoring the holding and assimilative capacity of important wetlands areas in the headwaters of the river. This would also restore wildlife habitat.

Technical Assistance and Intergovernmental Coordination

Local Planning

Comprehensive land use plans have been adopted by all local governments within the watershed under the 1985 Growth Management Act. These plans have a direct impact on the water-related resources of the watershed by designating or allocating land uses within the area, and establishing policies to appropriately use and manage lands.

Because many of the local governments in the watershed have limited staff and resources to develop and implement the plans, technical assistance is needed to help ensure the quality and natural functions of the river system. Further, revisions to Chapter 373, F.S.[1], made by the 1989 legislature, require the District to provide technical assistance to local planning programs. This assistance provides a linkage between

[1] Section 373.0391, Florida Statutes

watershed- or resource-based plans and programs with land use plans administered by local government.

Regional Planning

The third Environmental Lands Management Study Commission recommended changes to the state's land and resource planning framework in 1993, including substantial revisions to the regional planning requirements of the Growth Management Act. Regional policy plans are required to be revised, focusing on five key areas, including regionally significant natural resources. Natural resources of regional significance are one of the new required elements, including accurate mapping and policies and strategies aimed at protecting the function of regionally important systems.

The District's SWIM program has an opportunity to integrate SWIM projects with regional planning efforts by providing technical assistance in the form of GIS coverages as well as policy development. In addition to local technical assistance, this strengthens the connection between the District's SWIM planning efforts and the land use-based planning efforts of local governments and regional planning councils. Although the District has formal plan review requirements for both the local and regional plans, there is no formal linkage between water resource planning such as SWIM and land use planning. Coordinating the development of regional plans, policies, and strategies that deal with water and related resources assures increased consistency between the efforts.

Program Coordination

An important management concern for the SWIM program involves coordination with the District's other planning and implementation programs. SWIM is not in itself a regulatory program, yet many of the resource protection tools needed to implement SWIM goals are in the regulatory arena. Similarly, the District's land acquisition and management responsibilities accomplish key SWIM goals by protecting important lands. Outreach activities, including technical assistance described above, environmental education, and public information can also help accomplish SWIM goals.

For example, GIS data developed through the SWIM program are used by the District's land acquisition staff to evaluate, on a watershed basis, appropriate areas for acquisition based on several criteria (including water quality and habitat protection). Environmental education efforts are also closely coordinated with SWIM staff.

Public Involvement and Education

WaterWays/Environmental Education

Environmental education is an important part of natural resource management and protection programs. Including basic environmental education curricula in grade schools helps students understand how river systems work, and the important functions they serve. With an adequate understanding of natural systems, students are instilled with a set of values that recognize the importance of protecting water quality, water levels, floodplains, and fish and wildlife habitat.

SWIM environmental education activities are aimed at providing grade school teachers with the tools and knowledge needed to help make students aware of natural resources. Included are teacher workshops, newsletters, reference and source materials, in-classroom presentations and speakers, serving on local and state advisory boards, conducting field trips, participating in the EnviroThon Program, and responding to specific requests for information or assistance. Students at Taylor High School received state awards in 1994 for their participation in an environmental education program that involves monitoring the Econfina River.

V. Management Strategies for the Coastal Rivers Watershed

The management strategies for the Coastal Rivers watershed reflect a continuation and modification of those identified in the 1991 SWIM plan for the system (SRWMD, 1991). The five program areas are Resource Monitoring, Resource Planning, Program Implementation, Restoration Implementation, and Waterbody Planning. Each of these are in turn comprised of a number of projects intended to address the priority issues identified earlier.

Projects are further broken down into the tasks--specific actions--which the SRWMD intends to undertake to implement the management strategies. Completing the programs, projects, and tasks is dependent upon the availability of adequate funding and the direction of the SRWMD Governing Board.

1. Resource Monitoring

Program Definition: Resource Monitoring involves those activities related to the collection and analysis of data. Examples include water quality sampling, biological sampling, land cover and land use mapping, and trends analyses. The Resource Monitoring program also encompasses the analyses conducted on or with the data collected to determine changes or trends.

Resource monitoring is the cornerstone of the SRWMD's SWIM program. An ongoing monitoring program of the state of the natural systems is important to the health of the river system. The Resource Monitoring program is comprised of three elements: water quality monitoring, biological monitoring, and land cover/land use monitoring. Hydrologic monitoring is conducted under the District's Surfacewater Program; coordination with this program is part of the SWIM strategy.

The SWIM long-term water quality and aquatic biological monitoring program began in 1989. Water quality samples were collected and analyzed at 14 stations throughout the watershed at bimonthly and monthly intervals (the original bimonthly sampling

schedule was switched to monthly beginning February 1990, and the number of stations reduced to 6 in 1992). Biological sampling of benthic macroinvertebrates, phytoplankton, or periphyton has been conducted at 1 station on a quarterly basis.

Land cover and land use directly influence the quality of natural systems, including riverine or other aquatic systems. Habitat and land cover alterations from development activities, conversion of natural ecosystems to agricultural production, disruptions to natural surface- and groundwater flows, and the introduction of pollutants into rainfall runoff all constitute threats to natural systems. Regional land cover data were obtained from satellite imagery in 1988 and converted to a GIS coverage. This coverage, although useful for considering large areas, is not detailed enough for land use determinations or for smaller areas. A land use and land cover GIS coverage is currently being developed from 1994 aerial photography. This coverage, described later, will provide additional detail for this monitoring effort.

Project 1.1: Water Quality Monitoring

Project Goal: Maintain a monitoring network capable of providing continuous data related to water quality in the watershed, particularly to identify changes and trends in water quality.

The first need in monitoring water quality is to develop and document a water quality monitoring network design that provides sampling specifications and methods, sample handling and analyses, data management and analyses, and information reporting mechanisms. A water monitoring network was initiated in 1989 for the Steinhatchee River and the tributaries thought to provide water quality information needed to adequately characterize conditions in the watershed. Tables 5 and 6 list the sample collection locations, the variables tested, and the frequency each variable is tested. These tables list the network as of June 1995. Modifications were made to the network in 1990 and 1992.

Task 1.1.1: Conduct monthly water quality sampling 1997-1999

Midchannel, mid-depth water samples will be obtained and measurements made *in situ* for basic physical descriptors twelve times yearly (once monthly) at 10 stations (Tables 5 and 6 and Map 3).

Task 1.1.2: Laboratory Analyses 1997-1999

Analyses for the parameters and variables listed in Table 6 will be conducted twelve times yearly (once monthly) for each of the sampling stations by the contracted laboratory.

Map 3. Monitoring Station Location, Coastal Rivers Watershed

Table 5. Water Quality Sampling Stations

Station Number	Station Name and Location
ECN005C1	Econfina River at US 27
ECN015C1	Econfina River at US 98
FEN010C1	Fenholloway River at US 27
FEN020C1	Fenholloway River at US 98
FEN030C1	Fenholloway River off CR 326
STN020C1	Steinhatchee River near Steinhatchee Springs
STN031C1	Steinhatchee River above Steinhatchee Falls
STN040C1	Steinhatchee River at Steinhatchee
STN050C1	Deadman Bay, near Marker 17
STN060C1	Deadman Bay, near Marker 11

All stations are monitored for water chemistry.

Table 6. Water Quality Variable List and Frequencies

Parameter	Variable	STORET Code
Water Column (Field)	Sample and Total depth	
	Water temperature (°C)	10
	pH	400
	Dissolved oxygen	299
	Salinity	480
	Conductivity (field)	94
	Conductivity at 25°C	95
	Secchi depth	78
	Stage	65
Physical/Biological	Color	81
	Turbidity	82079
	Residue, total nonfilterable	530
	Residue, fixed nonfilterable	540
	Total Dissolved Solids	515
	Alkalinity as $CaCO_3$	410
	Total organic carbon	680
	Dissolved organic carbon	681
Major Ions, total	Potassium	937
	Sodium	929
	Magnesium	927
	Calcium	916
	Chloride	940
	Fluoride	951
	Sulfate	945
Nutrients	Nitrite plus Nitrate	630
	Total Kjeldahl N	625
	Ammonia N	610
	Orthophosphate	671
	Total Phosphorus	665
Sediments	Composition	multiple
	Total Phosphorus	668
	Trace Metals	multiple

Task 1.1.3: Data management and analysis 1997-1999

Maintain a data management system that provides easy access to statistical tools and to STORET transfer. The system must include a documented protocol for data quality control procedures that will be followed. Document and perform statistical analyses of monitoring data to identify trends and provide a basis for identifying and resolving water quality problems.

One of the principle goals of water quality monitoring is the dissemination of data collected and analyses conducted. Compiling and reporting results of data analyses, with target audiences of both the Governing Board and the public, is the second aspect of the monitoring program. Significant changes in water quality will trigger additional monitoring and field studies to identify causes and alternative management approaches.

Task 1.1.4: Estuarine Monitoring 1998-1999

An estuarine component of the monitoring network will be added to define current water quality conditions. With the exception of the Fenholloway River's mouth, the state waters are designated as Outstanding Florida Waters. Defining current conditions is necessary to protect the coastal ecosystem from adverse impacts of current and future uses (i.e., industrial discharges).Task 1.1.5: Water quality reports 1997-1999

Reports will be made on an annual basis to the Governing Board with graphic materials available to the public. Trends involving basic parameters characterizing the rivers, tributaries, and estuaries will be presented, with discussion of possible causal relationships. Annual reports will be published each December summarizing water quality conditions. This report will be provided to agencies, local governments, and interested citizens.

Task 1.1.6: Special event monitoring 1997-1999

Water quality sampling and analysis for special events, such as individual, site-specific storm or rainfall events, provides data supplemental to the main monitoring network and provides data to be used in watershed assessments. Additional monitoring to identify the causes of degraded water quality detected through the ambient monitoring network will be undertaken when needed. Stormwater management facilities discharging to surface waters will also be monitored. This task will aid implementation of water quality management goals by documenting pollutant loading to specific water bodies or stream reaches, which will support restoration or preventive implementation actions.

Project 1.2: Biological Monitoring

Project Goal: Establish a biological component to the Coastal Rivers watershed monitoring network to define conditions of aquatic biota on an ongoing basis, determine relationships between water quality, hydrology, and aquatic communities, and report these data and conclusions to the District Governing Board and other resource management agencies.

Monitoring aquatic biota generates valuable data to supplement water quality monitoring. The organisms that live in a water body integrate the effects of various anthropogenic stresses and are particularly useful for evaluating nonpoint pollution impacts. Biological monitoring conducted in the watershed over the past 5-10 years has been sparse, and additional biological monitoring would be of direct management benefit. DEP sampled benthic invertebrates at six riverine sites and three estuarine sites in the watershed in 1987-1989. During this same period the FGFWFC monitored river fishes in small tributaries in the Steinhatchee sub-basin at eight sites. Under SWIM, the District has maintained one riverine benthic invertebrate monitoring site on the Steinhatchee River since 1991 (monitored quarterly). In 1994, District staff established two seagrass monitoring plots in Deadman Bay off the mouth of the Steinhatchee River. These are monitored annually for seagrass species composition, cover, and shoot density. Currently DEP monitors riverine benthic invertebrates twice yearly at one site each on the Econfina River and Spring Warrior Creek.

Task 1.2.1: Implement quarterly aquatic biology monitoring network, 1997-1999

The existing benthic invertebrate monitoring site on the Steinhatchee River will continue to be monitored. This monitoring uses dip net sampling to qualitatively assess the status and condition of the invertebrate community at this site. The two seagrass sites monitored annually in Deadman Bay will also be continued.

Initiation of quarterly biological monitoring at additional sites in the watershed needs to be considered but will depend upon available funding. Joint monitoring with DEP at their sites on the Econfina River and Spring Warrior Creek may be a way to coordinate efforts and maximize the collection of useful data for the dollars expended. Additional monitoring needs to be conducted in the estuarine and near shore coastal waters to generate baseline data to ensure that the high quality of these areas is maintained. This may occur in conjunction with DEP's Florida Marine Research Institute and will be explored.

Task 1.2.2: Biological monitoring report 1996-1998

Results of the biological monitoring program will be analyzed and reported in conjunction with the water quality reports described under Task 1.1.4. Additional verbal and/or written reports may be given to the Governing Board, other agencies, and the public as requested, and data are supplied to other agencies or groups on request.

Project 1.3: Land Cover and Land Use Monitoring

Project Goal: Monitor changes in land cover and land use throughout the Coastal Rivers Watershed to define and analyze long-term regional trends in land conversion and development activity.

Task 1.3.1: Land Use and Land Cover Mapping 1997

Continuing from 1996, finalize the GIS Land Use and Land Cover coverage and database using Level III classifications in the Florida Land Use, Cover, and Forms Classification System.

Task 1.3.2: Seagrass Mapping 1998

Using the most recent available aerial photography, develop a GIS coverage of seagrass beds in the coastal waters of the Coastal Rivers watershed. Classify areas by type of vegetation, density of growth, condition (impacts from boat traffic, etc.), and other relative factors.

2. *Resource Planning*

Program Definition: The Resource Planning program encompasses those activities related to the development of plans and strategies for watershed management, and includes activities such as watershed assessments and GIS development. Included are digital database development, special studies aimed at specific geographic areas (e.g., subwatersheds), conducting specific analyses for the provision of technical assistance to other agencies, and the further identification of management needs and issues.

Project 2.1: GIS Database Development and Maintenance

Project Goal: Develop and maintain a computerized, geographically referenced database of the physical, hydrologic, and cultural features that comprise the Coastal Rivers watershed.

Task 2.1.1: Database Documentation and Maintenance 1997-1999

This is an ongoing task to keep the GIS databases operational and to provide user information related to GIS coverages.

Task 2.1.2: Future Land Use Map Automation 1997-1999

Future Land Use Maps adopted by local governments within the watershed were digitized and a coverage created in 1993. Since the maps can be amended up to twice a year by local governments, this task will maintain the coverage up-to-date. This task will be closely coordinated with the North Central Florida Regional Planning Council (NCFRPC), which provides technical planning assistance to many of the local governments in the watershed.

Project 2.2: Identifying and Evaluating Point and Nonpoint Sources of Pollution

Project Goal: Develop a comprehensive inventory and priority list of existing and projected point and nonpoint sources of pollution to the Coastal River system, including alternatives for eliminating or reducing pollution loadings.

The point sources of pollution described earlier are regulated by DEP. Their impacts to the resources of the Coastal Rivers watershed are understood better than nonpoint sources. A means to reliably quantify the impact of nonpoint sources on the rivers and estuaries is needed. Mapping these areas and constructing a database containing known, discrete data is a necessary first step. The end result of this project is to identify nonpoint sources, their impact to the system, and ultimately to enable regulatory or voluntary controls to be enacted to stop the degradation of the water resources.

Task 2.2.1: Point Source Coordination 1997-1999

The SWIM program is not regulatory, yet the decisions, processes, and results of the permitting process profoundly affect the management of the rivers and estuaries. The intent of this task is to appropriately involve the SWIM program in the review of point source discharge permit applications, renewals, and modifications--particularly for the Fenholloway River.

Task 2.2.2: GIS Analyses/Watershed Assessment 1997

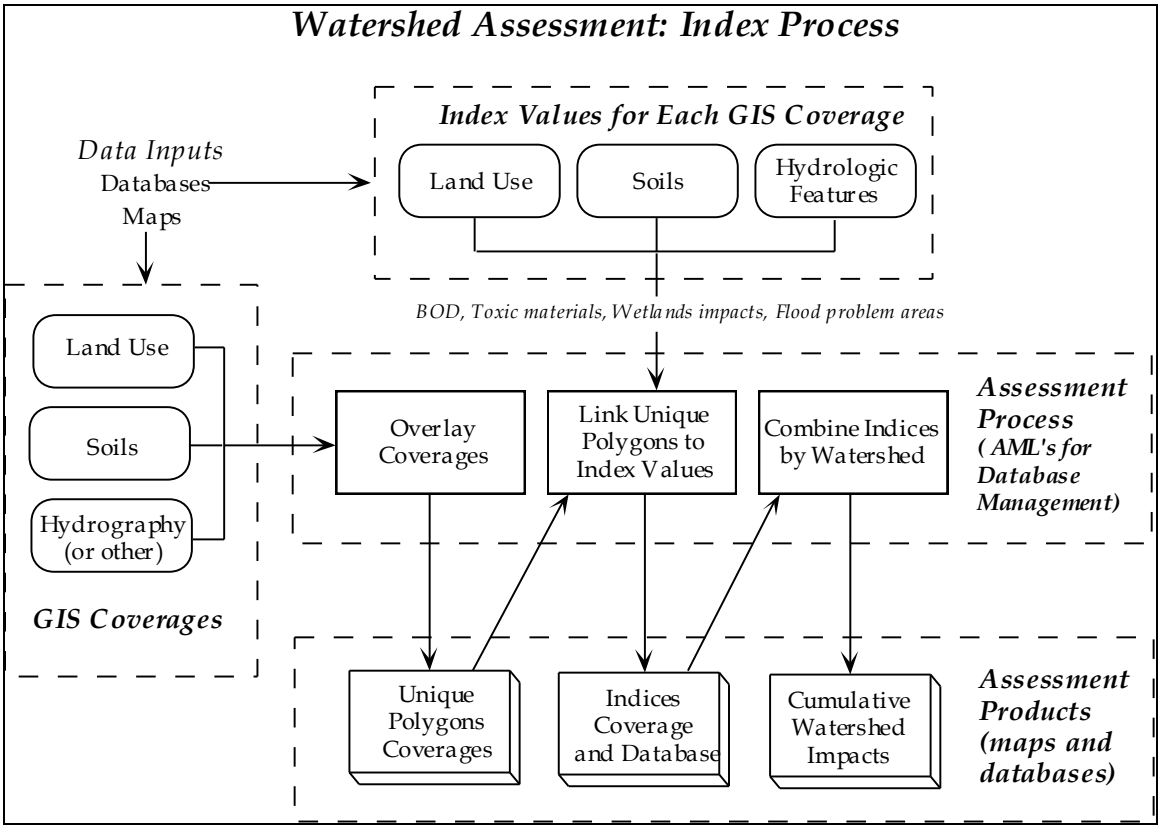
Using GIS coverages and databases, watershed assessments will be conducted to help identify and rank areas that are potential nonpoint source problems. This task is a screening process to identify priority subwatersheds and/or river or stream reaches for further analysis, including possible Pollutant Load Reduction Goals (the process is illustrated in Figure 4).

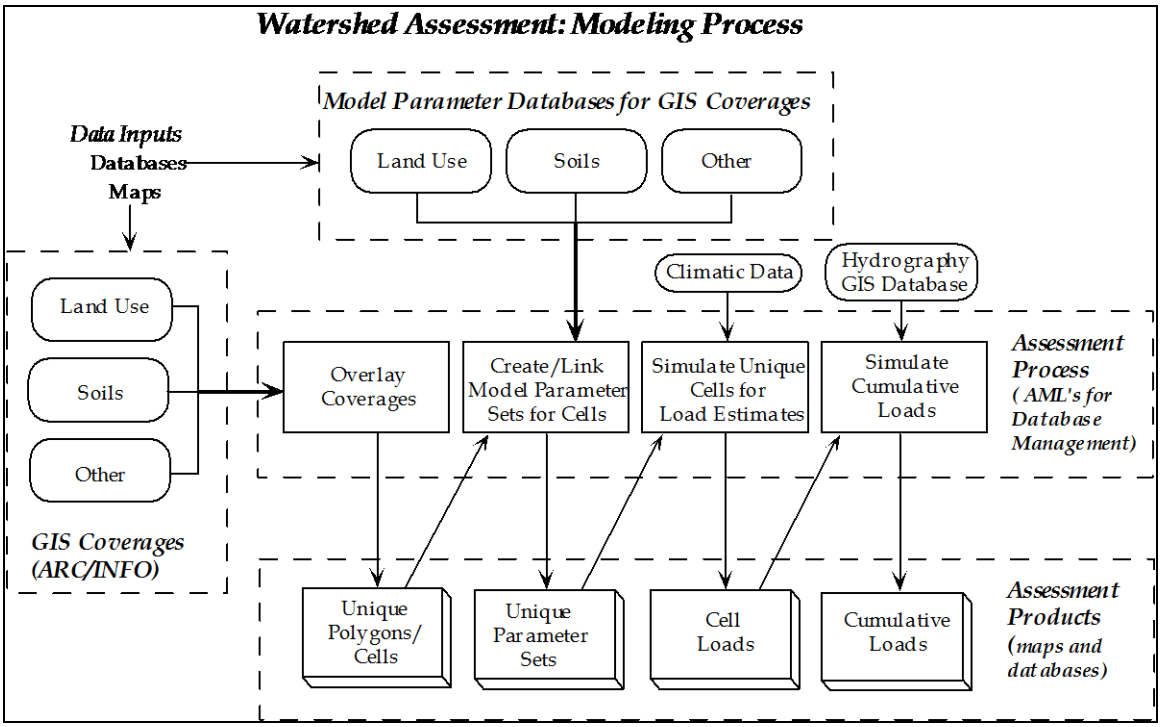
GIS coverages applicable to this task that have been developed through the SWIM program, and other District programs, include:

- soils
- existing land use and land cover

- topography
- watershed boundary and type
- future land use
- hydrogeologic conditions

Figure 4. Watershed Assessment Process




Watershed Assessment: Modeling Process
Model Parameter Databases for GIS Coverages
Data Inputs
Databases
Maps
Land Use
Soils
Other
Climatic Data
Hydrography GIS Database
Land Use
Soils
Other
GIS Coverages (ARC/INFO)
Overlay Coverages
Create/Link Model Parameter Sets for Cells
Simulate Unique Cells for Load Estimates
Simulate Cumulative Loads
Assessment Process (AML's for Database Management)
Unique Polygons/ Cells
Unique Parameter Sets
Cell Loads
Cumulative Loads
Assessment Products (maps and databases)

The assessment process will be applied and fine-tuned using a pilot area outside the Coastal Rivers watershed in 1995, and applied to the Coastal Rivers area in 1996. The assessment will use two approaches to evaluate the relative impact of water quality degradation and wetlands impacts. An index approach, which assigns a relative weight to predetermined factors such as soil/land use combinations and resulting pollutant load estimates, will be used for appropriate parameters. A more detailed modeling approach will be used for nutrients.

The assessment results will be used to develop a list of priority subwatersheds for more detailed analysis. This detailed analysis will provide the basis for future management decisions, including quantified pollutant load reduction goals specific to each watershed and/or water body. Additional monitoring and research needs will be identified where appropriate to support District and other agency action to protect water quality, habitat, and related resources.

Task 2.2.3: Field Surveys 1997-1999

Further field studies are proposed for site specific source checks, mapped area confirmation, compliance checks, and general reconnaissance. Once particular areas are targeted for further investigation, field surveys are conducted to obtain more detailed information, verify potential pollution sources and the extent of hydrologic alterations, and to further refine modeling or other analyses.Field surveys will be used to finalize computer mapping and aerial photography work efforts. They are a final refinement of watershed mapping (and subsequent analyses) as well as a means for visual, first-hand checking of suspected pollution sources.

Task 2.2.4: Subwatershed Priority List and Management Plans 1998

Based on the preceding tasks, a priority list of subwatersheds will be developed. Management plans/guides will be developed for those land uses within the watershed that were identified as problems during watershed assessment runs. These plans or guides will provide specific information for those identified land uses to mitigate the off-site impacts of these activities. Both agricultural and urban management guides or BMPs will include practices to manage runoff; fertilizer, pesticide, and cultural practices; chemical storage; fuel storage; animal waste; and water use for meeting environmental resource objectives.

3. Program Implementation

Program Definition: Program Implementation is the action component of the Coastal Rivers SWIM program, encompassing activities related to carrying out the policies and tasks identified in the plan. Included are analyses, presenting results of analyses and special studies, providing products of the monitoring or planning programs such as

maps and data reports, recommending or instituting rule changes based on special studies or analyses, undertaking specific enforcement activities, intergovernmental and interagency coordination, and providing ongoing technical assistance to other agencies or local government. Related implementation activities undertaken by the District include administering regulatory programs and land acquisition and management activities. These are not SWIM programs per se, but, through SWIM program assistance and coordination, fulfill SWIM program goals and objectives.

Project 3.1: Technical Assistance

Project Goal: Provide technical assistance and information to support local and regional land use planning and regulation in the Coastal Rivers watershed. Coordinate planning activities with local governments and regional planning councils to better integrate land and water planning.

The rural counties within the watershed generally have limited capability to interpret, administer, and enforce the complex requirements of the new planning and land development regulation processes. To protect water resources, it is essential that the technical information and technical expertise of the SRWMD's SWIM program be made available to and be utilized by local governments within the watershed. This effort, in order to be successful, must initiate with the planning process and be continued on an ongoing basis, including revising the SWIM program to adapt to changes in the region.

Local government comprehensive plans within the watershed were developed and adopted from 1989 to 1991. Much of the water resources information to support proper land use planning--such as resource availability, identification of sensitive areas, and development suitability--was not available. Local plans are required to be evaluated in 1998 and 1999, followed by plan revisions. The Coastal River SWIM program will work toward providing adequate water resources information prior to the plan revision schedule to better integrate land and water planning in the watershed.

Regional planning councils are required to prepare and adopt Strategic Regional Policy Plans by 1997, including a section on land use and natural resource protection. Part of the effort is to identify natural resources of regional significance and to adopt policies that will protect these resources, while allowing for appropriate use. The SWIM program is coordinated with the NCFRPC's planning efforts.

Task 3.1.1: Land and Water Planning Technical Assistance 1997- 1998

Develop a water resources map series with resource descriptions for each local government within the Coastal Rivers watershed. Included will be information on watershed hydrology, identification of subwatersheds, water quality information, land acquisition and management plans, watersheds with special criteria, land

cover, and significant natural resources. The water resources atlas will be part of the County Water Management Plans developed in conjunction with the District Water Management Plan. This document provides a basis for coordinated land and water planning at the county level.

Task 3.1.2: Land and Water Planning Coordination 1997-1999

Provide location-specific technical assistance to local units of government relating to land use planning, impact analyses, development review, facility development or siting, water quality problems or issues, ecological analyses, or other issues or problems as requested by the local government.

Task 3.1.3: Strategic Regional Policy Plan Assistance 1997

Assist the NCFRPC in the development and implementation of the Strategic Regional Policy Plan required by Chapter 27E-5, F.A.C. as it relates to the Coastal Rivers watershed.

Project 3.2: Local Government Comprehensive Plan and Plan Amendment Review

Project Goal: Ensure that local comprehensive plans within the Coastal Rivers watershed provide adequate protection for the system including water quality, water quantity, fish and wildlife habitat, and consistent economic and recreational values.

As previously discussed, there is a critical link between land use/land development and surfacewater quality and the quality of natural systems. Within the current framework of regulatory and management programs affecting the river, that link is land use planning.

Local units of government within the watershed are required to submit new or revised comprehensive plans pursuant to Chapter 9J-5, F.A.C., and Chapter 163, Part II, F.S. The SRWMD is a designated review agency pursuant to Chapter 163.3184, F.S., and reviews local plans and amendments for water resources issues. Local governments within the watershed have all submitted and adopted plans that can be amended up to twice yearly.

Task 3.2.1: Local Government Comprehensive Plan Amendment Review 1997-1999

Review local comprehensive plan amendments for issues relating to the waters of the Coastal Rivers watershed. Provide review comments, objections, and recommendations to affected local governments, DCA, and other state agencies. All counties and municipalities within the watershed are included for the duration of the planning period.

Project 3.3: Interagency Coordination (Technical Coordination)

Project Goal: To provide for increased interagency coordination for matters involving the system, including research and special studies, resource monitoring, rule and regulation enforcement, and resource planning and management.

Many agencies share responsibilities related to the watershed. Resource management efforts can be enhanced through regular coordination, including water quality and biological monitoring, hydrologic monitoring, research efforts, mapping, and related studies. Regulatory coordination has been facilitated by the District's new Environmental Resources Permitting program, which combines surfacewater management, wetlands dredge and fill, and dock construction activities (among others) into a single permitting process. Larger projects, such as point source discharges, pipelines, and landfills, are regulated by DEP with input from District staff. Both agencies have an adopted, contractual Operating Agreement that specifies the duties and responsibilities of each agency.

Task 3.3.1: Technical Assistance 1997-1999

Provide technical assistance to other agencies in regulatory, research, acquisition and management, and other programs affecting the Coastal Rivers watershed. Primary emphasis will be placed on the regulatory process for relocating the pulp mill's discharge location on the Fenholloway River and with wetlands restoration projects (see Project 4.1).

Task 3.3.2: Aquatic Preserve Coordination 1995 - 1998

Coordinate with DEP's Aquatic Preserve program to develop and implement a management plan for the Big Bend Seagrasses Aquatic Preserve.

Task 3.3.3: Enforcement Coordination 1997-1999

Coordination in enforcement actions will be increased and facilitated where possible through interagency meetings, workshops, and projects between regulatory agencies with jurisdiction on the system.

Project 3.4: Policy and Program Coordination

Project Goal: Provide for increased coordination among governmental entities and programs within the Coastal Rivers watershed to help assure that such programs are consistent with SWIM goals and programs, and to broaden the base of support for SWIM Plan implementation.

Task 3.4.1: Land acquisition and management technical support and coordination 1995 - 1998

Provide technical support to the Land Acquisition and Management Department and DEP in land acquisition planning, the evaluation of individual tracts proposed for acquisition, and land management practices to enhance surfacewater quality and the restoration and/or maintenance of native habitat and vegetative cover.

Provide technical support and assistance to the Land Acquisition Department, the CARL Committee, and other entities involved in public lands acquisition.

Task 3.4.2: Regulatory technical support and coordination 1995 - 1998

Provide technical support to District regulatory programs in the protection of surfacewater quality and fish and wildlife habitat. Provide assistance as requested by DEP and other state agencies in the implementation of water quality and habitat-related regulations.

Task 3.4.3: Nonregulatory program support and coordination 1995 - 1998

Provide support and assistance to nonregulatory programs such as the District's Forestry and Agricultural Resources Management program, which will develop comprehensive, site-specific management plans in cooperation with private landowners to reduce water quality and habitat impacts from farming and forestry operations.

Project 3.5: Public Involvement and Education

Project Goal: To increase public involvement and educational efforts about the natural resources, functioning, and values of the Coastal Rivers system in order to allow residents and visitors to better manage their personal activities and impacts to the river system.

Task 3.5.1: Environmental Education 1997-1999

SWIM brochures and documents, and especially the WaterWays curriculum developed for elementary and secondary students, provide information about the basic functioning of the Coastal Rivers system and outline activities that can bring about a more complete understanding of the river. Field trips to SRWMD Save-Our-River lands, science projects, and classroom projects and presentations are examples of components of an environmental education program. These programs need to continue and an environmental educational effort for adults needs to be pursued.

Task 3.5.2: Public Involvement and Assistance 1995 - 1998

Provide financial and technical assistance to groups involving the public in water quality and habitat protection. Assistance should be provided to groups involved with river clean-up activities, educational and awareness efforts, and general public participation in waterbody protection.

Task 3.5.3: Environmental Awareness and Education 1998 - 1999

Place signs and interpretive information at all public boat ramps and marinas that advise boaters and anglers about the need to protect water quality and habitat values, control the spread of aquatic plants, and to conserve fish and wildlife resources. An example is a sign/poster at coastal boat ramps advising boaters to steps they can take to avoid damaging seagrasses, sandbars, and oyster bars (as well as their boats).

4. Restoration Implementation

Program Definition: This program includes activities aimed at restoring water bodies with degraded water quality and impacted areas such as wetlands and areas subject to erosion and sedimentation. The process for identifying nonpoint source loadings, either existing or projected, has been identified earlier and includes water quality monitoring, field surveys, and GIS-based watershed assessments. Problem areas identified as in need of water quality restoration, apart from regulatory compliance efforts, are addressed in this program. Since Project 2.2 will culminate in a priority list of subwatersheds in 1997, the next revision to this plan in 1998 will address any identified (water quality) restoration needs.

Wetlands restoration is also addressed through this program, but will not specifically address certain site-specific restoration activities associated with District or DEP regulatory programs. Rather, the SWIM program will act to coordinate restoration projects on a regional watershed level. Restoration needs identified but not associated with regulatory compliance or permit conditions may be examined and addressed through the SWIM program.

Restoration activities undertaken through this program may also include assisting local governments in planning and designing stormwater utilities and retrofitting stormwater management facilities to improve water quality treatment. Other restoration activities are aimed at reducing and managing the impacts from heavily used areas like publicly-owned springs and boat ramps.

<u>Project 4.1: Restoration Planning</u>

Project Goal: Coordinate wetlands restoration projects to restore natural hydrologic fluctuations to altered wetlands and watercourses within the watershed. Where restoration needs are identified but are not addressed through regulatory requirements, develop a watershed restoration plan that will include regulatory and nonregulatory governmental programs, landowners, and affected/interested parties.

Task 4.1.1: Current Wetlands Restoration Projects 1997

Develop a detailed listing of past and planned wetlands restoration projects in the watershed, including maps and associated GIS coverages of control structures, restored areas, and monitoring sites.

Task 4.1.2: Identify Future Restoration Needs 1998 - 1999

Based on Projects 1.3, 2.2, 3.1, and 3.3, develop a prioritized listing of future restoration needs (not addressed in Task 4.1.1 above) within the watershed for hydrologic, water quality, or fish and wildlife habitat concerns. This task will provide a basis for the 1998 SWIM Plan update.

Task 4.1.3: Compliance Assistance 1997 - 1999

Provide technical assistance and support to District and DEP regulatory programs' compliance and enforcement efforts within the watershed.

Project 4.2: Stormwater Management Improvements

Project Goal: Improve the quality of stormwater discharges to surface waters in the Coastal Rivers system by increasing the level of stormwater treatment within the watershed.

Task 4.2.1: Stormwater Problem Area Survey 1997

In conjunction with other related tasks, survey local officials to identify stormwater problem areas and local stormwater management needs.

Task 4.2.2: Stormwater Management Improvements 1997 - 1999

Coordinate the application of District land acquisition, permitting, and assistance programs to resolve identified stormwater management needs in accordance with the priority list developed in Task 2.2.4. Two areas within the watershed have already been identified and will be supported through the SWIM program. These areas are around Perry, in the Fenholloway basin, and Madison, in the uppermost part of the Coastal Rivers watershed.

5. Waterbody Planning

Program Definition: Waterbody planning encompasses those activities involved with the ongoing SWIM planning process as it affects the Coastal Rivers system. Specifically, such plan administration tasks as annual plan review and evaluation of implementation progress, minor revisions, and ongoing planning fall within this category.

Recognizing that the SWIM planning and management process for the watershed is an ongoing process, this program provides for the periodic review and analysis of the overall program, the projects conducted to accomplish management objectives, and the individual tasks that comprise the projects. As tasks and projects are implemented and the SWIM program progresses, it becomes necessary to redefine aspects of the SWIM program in order to further refine the program to meet the management needs of the river system and the agencies involved.

Project 5.1: Annual SWIM Plan Review and Evaluation 1997 - 1999

Project Goal: To annually review and evaluate the Coastal Rivers SWIM plan and the implementation of programs, projects, and tasks for the purposes of project and task refinement, problem identification, and resolution of identified problems.

The SWIM program is an ongoing program. The Coastal Rivers SWIM plan and the overall program cannot be static and respond adequately to the changing needs of the river system and the management issues associated with it. In order for the SWIM program to be effective, the SWIM plans must be periodically reviewed, appraised, and modified as needed. The periodic, systematic evaluation of the plan and the overall program by SRWMD SWIM staff will help ensure that the program can respond to changing conditions and needs.

Task 5.1.1: SWIM Plan Review and Evaluation 1997 - 1999

An annual review and evaluation of the Coastal Rivers SWIM plan and the implementation of programs, projects, and tasks will be conducted. Annual evaluation reports will be prepared for the SRWMD Governing Board, DEP, involved agencies, and local governments.

Task 5.1.2: SWIM Plan Revision 1999

Update or revise this SWIM Plan according to the degree of successful implementation of the projects and tasks identified in this plan. This task may result in a substantially revised plan or a minor update of SWIM management strategies.

Project 5.2: Annual Priority List Review

Project Goal: To keep the SRWMD's SWIM Priority List updated to reflect the need for restoration and protection measures for the area's surface waters.

The SWIM priority list should be reviewed and evaluated each year to ascertain the priority ranking of the Coastal Rivers system or the need for additional priority waters within the system.

Task 5.2.1: Annual Priority List Review 1997-1999

The SRWMD's SWIM Priority List will be reviewed annually and evaluated for the need for revisions to the Coastal Rivers priority ranking.

V. Appendices

Appendix A. Water Quality Data

The following tables present water quality data collected by the SWIM program since 1989. Some of the stations below have been discontinued as the monitoring networks have evolved, so not all stations correspond to those listed in Table 5. The parameter abbreviations are explained below. The tables list the parameter sampled, number of samples (N), minimum and maximum observed values, the mean observed value, and the standard deviation about the mean.

Parameter	Description
SECCHI	Secchi depth in meters
TEMP	Water temperature
CONDF	Field measured conductivity
CONDL	Conductivity at 25° C
PHF	Field measured pH
PHL	Laboratory measured pH
DO	Dissolved oxygen concentration
SAL	Salinity
COLORAP	Apparent color
TURB	Turbidity
BOD	Biochemical oxygen demand
RESFIXED	Total fixed residue
RESFIXNF	Fixed suspended residue
RESNFLT	Total suspended residue
RESDISS	Total dissolved residue
RESVOLDS	Volatile fixed residue
RESVOLNF	Volatile suspended residue
RESVOL	Total volatile residue
RESTOT	Total residue
ALKTOT	Total alkalinity as $CaCO_3$
CHLA	Chlorophyll a
TOC	Total organic carbon
DOC	Dissolved organic carbon
KTOT	Total potassium
NATOT	Total sodium
MGTOT	Total magnesium
CATOT	Total calcium
CLTOT	Total chloride
FTOT	Total fluoride
SO4TOT	Total sulfate
TKN	Total kjeldahl nitrogen
NOXNTOT	Nitrate plus nitrite nitrogen
NO3NTOT	Total nitrate nitrogen
NO2NTOT	Total nitrite nitrogen
NH3NTOT	Total ammonia nitrogen
PTOT	Total phosphorus
OPO4DISS	Dissolved orthophosphate
COLITOT	Total coliform bacteria
COLIFEC	Fecal coliform bacteria

STREPFEC	Fecal streptococci

STATID=ECN010C1 Econfina River at County Grade Road, above U.S. 98 (Note: This station was discontinued in 1993. Stations were established in 1994 at US27 and US98)

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	21	0.250	1.200	0.691	0.292
TEMP	22	12.500	25.600	20.250	3.835
CONDF	22	40.000	425.000	241.727	142.510
CONDL	22	40.000	469.000	264.818	152.967
PHF	21	4.910	8.410	6.996	0.846
PHL	1	7.100	7.100	7.100	.
DO	22	3.400	7.700	5.555	1.051
SAL	9	0.000	0.000	0.000	0.000
COLORAP	22	40.000	1000.000	358.182	317.151
TURB	22	0.400	6.300	2.607	1.796
BOD	16	1.000	4.000	2.019	0.966
RESFIXNF	12	4.000	12.000	5.417	2.234
RESDISS	16	92.000	410.000	194.250	84.519
RESVOLDS	0	.	.	.	.
RESVOLNF	12	4.000	10.000	5.083	1.676
RESVOL	6	30.000	95.000	51.167	23.481
RESTOT	12	110.000	410.000	220.833	82.842
ALKTOT	22	5.800	240.000	127.495	87.172
CHLA	16	0.070	5.500	0.781	1.332
TOC	22	6.800	56.000	29.586	18.200
DOC	0	.	.	.	.
KTOT	20	0.500	2.900	1.035	0.558
NATOT	20	1.900	7.000	3.160	1.246
MGTOT	20	1.200	16.800	8.475	5.169
CATOT	20	5.200	77.600	37.660	23.507
CLTOT	20	3.700	11.000	6.260	1.628
FTOT	20	0.100	0.200	0.183	0.035
SO4TOT	20	3.000	16.000	8.225	4.211
TKN	21	0.100	1.900	0.772	0.528
NOXNTOT	22	0.050	0.280	0.060	0.049
NO3NTOT	16	0.050	0.280	0.064	0.058
NO2NTOT	16	0.050	0.050	0.050	0.000
NH3NTOT	21	0.010	0.430	0.053	0.089
PTOT	22	0.065	0.270	0.122	0.055
OPO4DISS	22	0.000	0.140	0.061	0.031
COLITOT	12	9.000	800.000	179.417	227.898
COLIFEC	12	1.000	170.000	42.750	48.929
STREPFEC	0	.	.	.	.

STATID=FEN010C1 Fenholloway River at U.S. 27

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	34	0.100	1.000	0.369	0.225
TEMP	34	10.500	26.000	19.638	4.633
CONDF	34	58.000	397.000	163.029	108.106
CONDL	34	67.000	403.000	180.118	115.553
PHF	33	3.460	7.450	5.452	1.540
PHL	1	7.000	7.000	7.000	.
DO	34	1.000	8.500	4.515	1.851
SAL	21	0.000	0.000	0.000	0.000
COLORAP	34	40.000	2200.000	724.706	571.351
TURB	34	0.400	13.000	2.940	2.939
BOD	27	1.000	3.600	1.652	0.701
RESFIXNF	12	4.000	8.000	4.917	1.084
RESDISS	28	101.000	520.000	216.750	91.442
RESVOLDS	12	24.000	224.000	140.750	70.393
RESVOLNF	24	4.000	7.000	4.375	0.711
RESVOL	6	21.000	160.000	76.667	51.899
RESTOT	12	110.000	520.000	226.667	133.507
ALKTOT	34	1.000	204.000	65.412	73.678
CHLA	16	0.120	5.300	1.124	1.321
TOC	34	7.600	121.000	62.679	38.562
DOC	0	.	.	.	.
KTOT	32	0.500	1.400	0.731	0.275
NATOT	32	2.100	4.500	2.909	0.425
MGTOT	32	1.000	15.100	5.613	4.628
CATOT	32	2.200	62.900	20.831	19.907
CLTOT	32	4.600	13.700	8.678	2.591
FTOT	32	0.100	1.050	0.176	0.167
SO4TOT	32	3.000	23.000	7.709	6.385
TKN	33	0.130	2.760	1.413	0.837
NOXNTOT	34	0.050	0.120	0.054	0.013
NO3NTOT	16	0.050	0.070	0.052	0.006
NO2NTOT	16	0.050	0.050	0.050	0.000
NH3NTOT	33	0.010	0.590	0.102	0.113
PTOT	34	0.020	2.500	0.169	0.416
OPO4DISS	34	0.010	2.300	0.129	0.385
COLITOT	19	37.000	480.000	184.579	127.006
COLIFEC	20	10.000	152.000	44.900	38.960
STREPFEC	2	96.000	108.000	102.000	8.485

STATID=FEN020C1 Fenholloway River at U.S. 98

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	29	0.020	0.250	0.097	0.070
TEMP	34	15.500	32.300	25.929	4.785
CONDF	34	88.000	4000.000	1981.412	933.400
CONDL	34	100.000	4020.000	1920.500	879.995
PHF	33	3.850	7.590	6.966	0.675
PHL	1	7.200	7.200	7.200	.
DO	34	1.100	8.000	4.032	2.069
SAL	25	0.000	2.000	0.648	0.533
COLORAP	34	200.000	3000.000	1488.824	611.063
TURB	34	0.400	22.000	6.407	6.576
BOD	27	1.000	41.000	16.230	10.413
RESFIXNF	12	4.000	24.000	8.417	6.067
RESDISS	28	270.000	2300.000	1309.893	539.550
RESVOLDS	12	122.000	314.000	242.167	48.433
RESVOLNF	24	4.000	22.000	7.875	4.721
RESVOL	6	190.000	310.000	240.000	46.904
RESTOT	12	420.000	2300.000	1635.000	442.893
ALKTOT	34	2.900	280.000	144.615	67.031
CHLA	16	0.100	280.000	28.149	76.722
TOC	34	51.000	213.000	134.621	38.199
DOC	0	.	.	.	.
KTOT	32	0.500	13.700	6.238	3.291
NATOT	32	31.000	630.000	336.594	161.557
MGTOT	32	3.200	20.000	15.319	4.707
CATOT	32	9.300	72.700	46.700	15.889
CLTOT	31	34.000	620.000	340.516	171.423
FTOT	32	0.100	0.410	0.168	0.059
SO4TOT	32	5.000	460.000	225.578	139.540
TKN	33	2.700	26.000	7.325	4.488
NOXNTOT	34	0.050	0.480	0.101	0.102
NO3NTOT	16	0.050	0.410	0.105	0.102
NO2NTOT	16	0.050	0.230	0.065	0.046
NH3NTOT	33	0.680	17.000	4.098	3.143
PTOT	34	0.086	9.600	2.368	2.131
OPO4DISS	34	0.050	4.000	1.257	0.958
COLITOT	18	10.000	6800.000	685.556	1557.359
COLIFEC	18	1.000	372.000	50.611	92.682
STREPFEC	2	50.000	143.000	96.500	65.761

STATID=FEN030C1 Fenholloway River off C.R. 326

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	12	0.100	0.250	0.169	0.061
TEMP	12	15.800	26.300	21.350	3.731
CONDF	12	413.000	1440.000	848.167	330.723
CONDL	12	438.000	1404.000	895.000	310.541
PHF	12	6.950	7.390	7.160	0.138
PHL	0	.	.	.	.
DO	12	1.000	4.600	2.375	1.237
SAL	12	0.000	0.600	0.225	0.230
COLORAP	12	400.000	1800.000	806.250	422.402
TURB	12	0.400	7.000	2.008	2.085
BOD	11	2.600	7.800	4.427	1.899
RESFIXNF	0	.	.	.	.
RESDISS	12	180.000	1000.000	602.500	225.943
RESVOLDS	12	55.000	207.000	135.083	39.486
RESVOLNF	12	4.000	7.000	4.333	0.888
RESVOL	0	.	.	.	.
RESTOT	0	.	.	.	.
ALKTOT	12	98.000	224.000	169.167	39.411
CHLA	0	.	.	.	.
TOC	12	48.600	83.100	59.400	10.467
DOC	0	.	.	.	.
KTOT	12	1.200	5.000	2.933	1.184
NATOT	12	42.500	190.000	113.150	46.760
MGTOT	12	10.200	19.400	16.408	2.821
CATOT	12	26.500	63.600	47.342	9.187
CLTOT	12	52.900	243.000	121.500	59.322
FTOT	12	0.100	0.190	0.138	0.028
SO4TOT	12	3.000	215.000	96.292	60.425
TKN	12	1.340	3.470	1.915	0.635
NOXNTOT	12	0.270	0.580	0.395	0.101
NO3NTOT	0	.	.	.	.
NO2NTOT	0	.	.	.	.
NH3NTOT	12	0.194	1.840	0.838	0.522
PTOT	12	0.334	1.700	0.891	0.345
OPO4DISS	12	0.262	1.420	0.740	0.302
COLITOT	8	100.000	1700.000	616.250	502.591
COLIFEC	8	10.000	371.000	101.750	114.419
STREPFEC	2	48.000	189.000	118.500	99.702

STATID=STN010C1 Steinhatchee River at SR 51 (Discontinued)

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	32	0.200	0.850	0.575	0.172
TEMP	32	6.800	26.800	19.475	5.447
CONDF	32	39.000	500.000	224.719	147.068
CONDL	32	46.000	540.000	254.656	168.754
PHF	31	4.600	7.830	6.823	0.876
PHL	1	7.500	7.500	7.500	.
DO	32	0.500	7.600	4.253	1.655
SAL	5	0.000	0.000	0.000	0.000
COLORAP	32	50.000	1000.000	403.281	329.231
TURB	32	0.400	4.000	2.340	0.975
BOD	20	1.000	6.000	2.435	1.506
RESFIXNF	12	4.000	21.000	8.333	5.614
RESDISS	20	120.000	300.000	181.500	60.722
RESVOLDS	0	.	.	.	.
RESVOLNF	12	4.000	9.000	4.750	1.485
RESVOL	0	.	.	.	.
RESTOT	12	140.000	300.000	212.500	60.321
ALKTOT	32	1.000	260.000	116.641	94.445
CHLA	20	0.100	3.640	0.638	0.909
TOC	32	6.900	71.000	36.669	21.228
DOC	0	.	.	.	.
KTOT	24	0.500	1.200	0.817	0.243
NATOT	24	2.100	4.300	3.129	0.586
MGTOT	24	1.200	12.600	5.208	3.842
CATOT	24	5.000	86.500	33.367	27.039
CLTOT	24	5.800	10.000	7.700	1.321
FTOT	23	0.100	0.240	0.177	0.043
SO4TOT	24	3.000	21.000	8.150	5.425
TKN	32	0.100	1.700	0.886	0.459
NOXNTOT	32	0.050	0.210	0.056	0.028
NO3NTOT	20	0.050	0.066	0.051	0.004
NO2NTOT	20	0.050	0.050	0.050	0.000
NH3NTOT	32	0.010	0.456	0.072	0.101
PTOT	32	0.029	0.280	0.097	0.054
OPO4DISS	32	0.010	0.080	0.044	0.018
COLITOT	12	22.000	690.000	338.833	237.442
COLIFEC	12	1.000	130.000	71.250	39.032
STREPFEC	0	.	.	.	.

STATID=STN015C1 Steinhatchee River at (discontinued)

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	8	0.100	1.000	0.406	0.331
TEMP	8	10.500	23.000	18.438	4.625
CONDF	8	212.000	720.000	580.250	225.237
CONDL	8	263.000	771.000	639.000	218.246
PHF	8	6.810	7.340	6.988	0.207
PHL	0	.	.	.	.
DO	8	0.300	8.700	2.913	3.504
SAL	8	0.000	0.300	0.125	0.116
COLORAP	8	20.000	400.000	89.375	131.541
TURB	8	0.400	2.700	1.263	0.857
BOD	0	.	.	.	.
RESFIXNF	0	.	.	.	.
RESDISS	8	233.000	504.000	418.625	97.993
RESVOLDS	0	.	.	.	.
RESVOLNF	0	.	.	.	.
RESVOL	0	.	.	.	.
RESTOT	0	.	.	.	.
ALKTOT	8	120.000	324.000	271.625	88.808
CHLA	0	.	.	.	.
TOC	1	8.100	8.100	8.100	.
DOC	0	.	.	.	.
KTOT	8	0.500	0.600	0.513	0.035
NATOT	8	4.200	7.400	5.625	0.947
MGTOT	8	5.900	17.300	14.038	4.646
CATOT	8	42.900	132.000	103.588	35.068
CLTOT	8	10.900	15.100	13.100	1.551
FTOT	0	.	.	.	.
SO4TOT	8	3.000	71.200	46.500	25.880
TKN	8	0.370	0.820	0.554	0.150
NOXNTOT	8	0.050	0.060	0.051	0.004
NO3NTOT	0	.	.	.	.
NO2NTOT	0	.	.	.	.
NH3NTOT	8	0.010	0.216	0.136	0.081
PTOT	8	0.055	0.128	0.078	0.022
OPO4DISS	8	0.037	0.076	0.057	0.013
COLITOT	0	.	.	.	.
COLIFEC	0	.	.	.	.
STREPFEC	0	.	.	.	.

STATID=STN020C1 Steinhatchee River near Steinhatchee Springs

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	55	0.100	1.200	0.544	0.215
TEMP	56	6.200	28.800	19.905	5.266
CONDF	56	42.000	780.000	287.839	172.539
CONDL	56	49.000	756.000	314.107	172.630
PHF	55	6.230	7.890	7.237	0.358
PHL	1	7.300	7.300	7.300	.
DO	56	3.600	10.400	6.573	1.499
SAL	31	0.000	0.900	0.039	0.165
COLORAP	56	20.000	1000.000	315.268	264.600
TURB	56	0.400	38.000	2.724	5.207
BOD	20	1.000	3.000	1.680	0.525
RESFIXNF	12	4.000	30.000	9.083	8.118
RESDISS	44	120.000	429.000	223.227	66.658
RESVOLDS	24	10.000	148.000	79.167	36.463
RESVOLNF	36	4.000	14.000	4.583	1.933
RESVOL	0	.	.	.	.
RESTOT	12	150.000	320.000	247.500	57.386
ALKTOT	56	25.000	300.000	132.714	76.716
CHLA	20	0.110	6.000	0.671	1.342
TOC	56	6.700	75.300	33.250	17.670
DOC	0	.	.	.	.
KTOT	48	0.500	1.000	0.629	0.217
NATOT	48	2.200	5.800	4.065	0.843
MGTOT	48	1.800	17.700	6.433	4.088
CATOT	48	14.000	124.000	49.844	28.635
CLTOT	48	5.900	14.200	9.942	1.985
FTOT	48	0.100	0.310	0.162	0.062
SO4TOT	48	3.000	78.400	14.977	18.360
TKN	56	0.100	1.910	0.914	0.517
NOXNTOT	56	0.050	0.550	0.067	0.068
NO3NTOT	20	0.050	0.130	0.061	0.021
NO2NTOT	20	0.050	0.050	0.050	0.000
NH3NTOT	56	0.010	0.078	0.031	0.019
PTOT	56	0.028	0.560	0.109	0.081
OPO4DISS	56	0.017	0.130	0.057	0.027
COLITOT	12	1.000	550.000	294.417	168.548
COLIFEC	12	1.000	130.000	83.500	40.831
STREPFEC	0	.	.	.	.

STATID=STN030C1 Steinhatchee River at U.S. 19/98 (Discontinued)

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	12	0.400	1.000	0.700	0.216
TEMP	12	15.200	28.000	22.125	4.780
CONDF	12	323.000	550.000	399.000	73.559
CONDL	12	347.000	528.000	423.833	52.226
PHF	10	7.260	7.880	7.589	0.208
PHL	1	7.200	7.200	7.200	.
DO	12	0.900	6.900	3.992	1.480
SAL	3	0.000	0.000	0.000	0.000
COLORAP	12	32.000	120.000	57.250	23.293
TURB	12	0.670	2.700	1.133	0.653
BOD	12	1.000	3.100	1.617	0.646
RESFIXNF	0	.	.	.	.
RESDISS	12	200.000	300.000	240.000	28.604
RESVOLDS	0	.	.	.	.
RESVOLNF	0	.	.	.	.
RESVOL	0	.	.	.	.
RESTOT	12	210.000	310.000	241.667	29.491
ALKTOT	12	160.000	260.000	216.667	26.742
CHLA	12	0.980	22.000	5.833	5.886
TOC	12	6.700	26.000	11.742	5.516
DOC	0	.	.	.	.
KTOT	4	1.000	1.000	1.000	0.000
NATOT	4	3.100	3.900	3.500	0.337
MGTOT	4	9.300	13.000	10.700	1.711
CATOT	4	64.000	75.000	69.750	4.500
CLTOT	4	4.900	12.000	8.375	3.643
FTOT	4	0.200	0.200	0.200	0.000
SO4TOT	4	5.000	6.200	5.300	0.600
TKN	12	0.100	2.500	0.672	0.625
NOXNTOT	12	0.050	0.050	0.050	0.000
NO3NTOT	12	0.050	0.050	0.050	0.000
NO2NTOT	12	0.050	0.050	0.050	0.000
NH3NTOT	12	0.030	0.099	0.044	0.023
PTOT	12	0.050	0.300	0.106	0.065
OPO4DISS	12	0.050	0.100	0.054	0.014
COLITOT	12	1.000	1300.000	224.083	353.335
COLIFEC	12	1.000	110.000	32.833	31.648
STREPFEC	0	.	.	.	.

STATID=STN031C1 Steinhatchee River above Steinhatchee Falls

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	44	0.200	1.500	0.455	0.272
TEMP	44	12.100	27.000	20.386	3.682
CONDF	44	85.000	549.000	325.614	135.618
CONDL	44	99.000	573.000	354.023	142.833
PHF	44	6.730	7.380	7.090	0.160
PHL	0	.	.	.	.
DO	44	0.300	8.200	3.557	2.084
SAL	26	0.000	0.000	0.000	0.000
COLORAP	44	20.000	1000.000	280.909	238.267
TURB	44	0.400	21.000	2.341	3.256
BOD	8	2.000	3.000	2.125	0.354
RESFIXNF	12	4.000	20.000	7.333	4.830
RESDISS	32	120.000	398.000	239.906	63.424
RESVOLDS	24	10.000	136.000	70.667	35.967
RESVOLNF	36	4.000	8.000	4.500	1.134
RESVOL	0	.	.	.	.
RESTOT	0	.	.	.	.
ALKTOT	44	39.000	270.000	164.159	73.815
CHLA	8	0.110	0.710	0.266	0.198
TOC	44	6.500	62.000	29.409	15.152
DOC	0	.	.	.	.
KTOT	44	0.500	1.000	0.598	0.197
NATOT	44	2.200	5.900	3.700	0.676
MGTOT	44	2.000	9.000	5.643	2.105
CATOT	44	19.000	99.200	62.877	24.825
CLTOT	44	5.400	15.000	9.061	1.750
FTOT	44	0.100	0.230	0.127	0.041
SO4TOT	44	3.000	17.500	8.095	3.917
TKN	44	0.180	1.600	0.821	0.401
NOXNTOT	44	0.050	0.220	0.055	0.026
NO3NTOT	8	0.050	0.220	0.074	0.059
NO2NTOT	8	0.050	0.050	0.050	0.000
NH3NTOT	44	0.010	1.300	0.079	0.191
PTOT	44	0.033	0.580	0.080	0.081
OPO4DISS	44	0.010	0.090	0.036	0.018
COLITOT	0	.	.	.	.
COLIFEC	0	.	.	.	.
STREPFEC	0	.	.	.	.

STATID=STN040C1 Steinhatchee River at Steinhatchee

Variable	N	Minimum	Maximum	Mean	Std Dev
SECCHI	32	0.400	2.400	1.257	0.567
TEMP	32	11.500	31.700	22.944	5.239
CONDF	32	120.000	43000.000	19502.469	13571.246
CONDL	32	137.000	40843.000	20412.531	14214.554
PHF	31	6.850	7.940	7.450	0.264
PHL	1	7.600	7.600	7.600	.
DO	32	2.200	8.900	4.769	1.542
SAL	24	0.000	25.500	14.167	8.903
COLORAP	32	5.000	750.000	195.938	210.665
TURB	32	0.150	3.800	1.933	0.890
BOD	20	1.000	2.300	1.690	0.452
RESFIXNF	12	7.000	104.000	47.583	33.983
RESDISS	20	150.000	20000.000	6688.000	6289.860
RESVOLDS	0	.	.	.	.
RESVOLNF	12	4.000	34.000	8.833	9.074
RESVOL	0	.	.	.	.
RESTOT	12	1900.000	20000.000	10375.000	5556.834
ALKTOT	32	49.000	200.000	134.328	42.443
CHLA	31	0.120	53.400	6.266	11.299
TOC	32	6.400	196.000	26.384	33.993
DOC	0	.	.	.	.
KTOT	24	1.000	369.000	129.583	126.623
NATOT	24	5.500	7670.000	2899.754	2599.168
MGTOT	24	3.000	957.000	359.300	331.453
CATOT	24	23.000	344.000	157.492	103.677
CLTOT	24	10.000	15600.000	5847.417	5334.095
FTOT	24	0.180	0.830	0.416	0.221
SO4TOT	24	11.000	2090.000	763.458	708.265
TKN	32	0.100	1.400	0.758	0.412
NOXNTOT	32	0.050	0.100	0.054	0.012
NO3NTOT	20	0.050	0.099	0.056	0.013
NO2NTOT	20	0.050	0.050	0.050	0.000
NH3NTOT	32	0.010	0.130	0.047	0.034
PTOT	32	0.010	0.330	0.087	0.071
OPO4DISS	32	0.010	0.110	0.043	0.024
COLITOT	13	31.000	1300.000	451.231	444.022
COLIFEC	13	1.000	110.000	47.846	36.014
STREPFEC	0	.	.	.	.

Appendix B. Governmental Units with Jurisdiction in the Coastal Rivers Watershed

FEDERAL AGENCIES
U. S. Army Corps of Engineers
Responsibilities include wetlands dredge and fill permitting and navigation channels.

U. S. Environmental Protection Agency
Responsibilities include permitting point sources of pollution and overseeing state water quality programs consistent with the Clean Water Act.

U. S. Fish and Wildlife Service
Responsibilities include National Wildlife Refuge management and Endangered Species Act administration and enforcement.

STATE AGENCIES
Department of Environmental Protection
Responsibilities include permitting point sources of pollution, landfills, and linear transmission facilities, water quality classifications and monitoring, State land acquisition and management, SWIM program administration, and oversight of water management districts.

Department of Transportation
Responsibilities include state roads and associated stormwater management systems.

Department of Agriculture and Consumer Services, and Division of Forestry
Responsibilities include pesticide and herbicide management, consumer affairs, State Forest management, and biennial review of forestry Best Management Practices compliance.

Department of Community Affairs
Responsibilities include local comprehensive plan review administration, Developments of Regional Impact, and the State Land Development Plan.

Department of Health and Rehabilitative Services
Responsibilities include administration of onsite sewage treatment and disposal systems regulations in conjunction with county public health units.

Game and Fresh Water Fish Commission
Responsibilities include Wildlife Management Areas, fisheries research, and administering and enforcing game and fish regulations.

Department of Corrections

Responsibilities include the operation of state correctional facilities and prisons.

REGIONAL AGENCIES
Suwannee River Water Management District
Responsibilities include stormwater, water use, well construction, and wetlands regulations, SWIM plan development and implementation, water quality and quantity monitoring, land acquisition and management, and environmental education.

North Central Florida Regional Planning Council
Responsibilities include Strategic Regional Policy Plan development and implementation, Developments of Regional Impact, review of Federal projects (A-95 review), and providing technical planning assistance to local governments.

LOCAL GOVERNMENTS
Responsibilities include local comprehensive plan development and implementation, administering land development regulations, and the operation and maintenance of public facilities.

COUNTIES	CITIES
Dixie County	Cross City, Horseshoe Beach
Lafayette County	Mayo
Taylor County	Perry
Madison County	Madison

Appendix C. Proposed Coastal Rivers SWIM Budget

PROGRAM	1997	1998	1999
Resource Monitoring			
Salaries, Benefits, Expenses, Equipment	$2,500	$5,000	$5,000
Contracts	$25,000	$150,000	$30,000
SWIM Trust Fund (80%)	*$22,000*	*$44,000*	*$28,000*
SRWMD Match (20%)	*$5,500*	*$11,000*	*$7,000*
Total	$27,500	$155,000	$35,000
Resource Planning			
Salaries, Benefits, Expenses, Equipment	$5,200	$10,000	$15,000
Contracts	$0	$25,000	$40,000
SWIM Trust Fund (80%)	*$4,160*	*$28,000*	*$44,000*
SRWMD Match (20%)	*$1,040*	*$7,000*	*$11,000*
Total	$5,200	$35,000	$55,000
Program Implementation			
Salaries, Benefits, Expenses, Equipment	$6,500	$40,000	$50,000
Contracts	$0	$5,000	$5,000
SWIM Trust Fund (80%)	*$5,200*	*$36,000*	*$44,000*
SRWMD Match (20%)	*$1,300*	*$9,000*	*$11,000*
Total	$6,500	$45,000	$55,000
Restoration Implementation			
Salaries, Benefits, Expenses, Equipment	$5,600	$10,000	$20,000
Contracts	$20,000	$10,000	$5,000
SWIM Trust Fund (80%)	*$20,480*	*$16,000*	*$20,000*
SRWMD Match (20%)	*$5,120*	*$4,000*	*$5,000*
Total	$25,600	$20,000	$25,000
Waterbody Planning			
Salaries, Benefits, Expenses, Equipment	$3,400	$2,500	$5,000
Contracts	$0	$0	$0
SWIM Trust Fund (80%)	*$2,720*	*$2,000*	*$4,000*
SRWMD Match (20%)	*$680*	*$500*	*$1,000*
Total	$3,400	$2,500	$5,000
Annual Total Budget	$68,200	$257,500	$175,000

Appendix D. Glossary of Terms

Acidic--Waters which have a pH value less than 7.0 (neutral).

Alkaline--Waters which have a pH value greater than 7.0 (neutral).

Ambient--The natural background or surrounding conditions of surface or ground water.

Aquifer--A geologic formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield significant quantities of water to wells and springs.

Base flow--Sustained or fair-weather flow of a stream. In most places, base flow is derived from ground water in-flow to the stream channel.

Basin--See "Drainage Basin" and "Watershed".

Benthic organism- A form of aquatic life that lives on the bottom or near bottom of streams, lakes, or the oceans.

Carbonate--A salt or ester of carbonic acid; a compound containing the radical CO_3.

Cation- An atom that has a positive electrical charge- for example, sodium and calcium ions.

Color--The physical measurement of water's lightness or darkness as measured in platinum-cobalt units (PCU). Water color determines the amount of sunlight that penetrates the water column and, as a result, the amount of aquatic vegetation present.

Confined aquifer--An aquifer in which ground water is confined under pressure which is significantly greater than atmospheric pressure. Synonym: artesian aquifer.

Confining bed--A body of relatively impermeable materials (usually clay in this document) stratigraphically adjacent to one or more aquifers.

Consumptive use--Any use of water which reduces the supply from which it is withdrawn or diverted.

Cubic feet per second--The rate of discharge representing a volume of one cubic foot (7.48 gallons) passing a given point during one second.

Diatoms--Species of algae characterized by the presence of an outer layer or cell wall composed of silica.

Discharge area--Area in which subsurface water, including both ground water and vadose water, is discharged to the land surface, to bodies of surface water, or to the atmosphere.

Drainage basin--A subdivision of a watershed.

Effluent--Treated wastewater from municipal or industrial wastewater treatment plants.

Endemic--A species native to, and found exclusively within, a specific geographic area or ecological community.

Epibenthic (epifaunal or epifloral)--Living on the surface of the bottom.

Escarpment (scarp)--A steep slope of some extent along the margin of an elevated area.

Estuary--A semi-enclosed body of water that has a free connection with the open sea and within which seawater is diluted measurably with freshwater that is derived from land drainage.

Eutrophic--Water bodies or habitats with high concentrations of nutrients.

Eutrophic lake--A standing body of water containing an excessive concentration of plant nutrients, especially phosphorus and nitrogen, which results in excessive algal production, especially blue-green algae.

Eutrophication--The process by which waters become enriched with plant nutrients, especially phosphorus and nitrogen.

Evapotranspiration--A collective term that includes water lost through evaporation from the soil and surface-water bodies and by plant transpiration.

Flood Stage--The level at which flood waters cause damage to property.

Floodplain--The land area subject to inundation by flood waters from a river, watercourse, lake, or coastal waters. Floodplains are delineated according to their estimated frequency of flooding. A 100-year floodplain is the area with a one percent risk of inundation in any given year.

Floodprone area--Interior areas which are subject to inundation from storm events due to closed drainage, low permeability soils, high water table, or a combination of factors.

Freshwater--Water that generally contains 1-1,000 milligrams per liter of dissolved solids.

Ground water--In the broadest sense, all subsurface water, as distinct from surface water; as more commonly used, that part of the subsurface water in the saturated zone.

Groundwater availability--The potential quantity of water which can be withdrawn without resulting in significant harm to the water resources or associated natural systems.

Hydrogeology--The science that deals with subsurface waters and related geologic aspects of surface waters.

Hydrograph--A graph showing stage, flow, velocity, or other property of water with respect to time.

Hypoxia--Very low levels of dissolved oxygen in a water body.

Instream use--Water use taking place within the stream channel. Examples are hydroelectric power generation, navigation, water-quality improvement, fish propagation, recreation, and other uses. Also called nonwithdrawal use or inchannel use.

Karst--A type of topography that results from dissolution and collapse of limestone, dolomite, or gypsum beds, and characterized by closed depressions or sinkholes, caves, and underground drainage.

Land Development Regulations--Ordinances and regulations adopted by local governments pursuant to Chapter 163, Part II, Florida Statutes, to implement Local Comprehensive Plans. The regulations typically include stormwater management, floodplain management, zoning, subdivision, and the protection of environmentally sensitive areas.

Litter--Accumulations of dead leaves in various states of fragmentation and decomposition.

Littoral--The shoreline zone of a water body.

Local Comprehensive Plan--A county or city comprehensive plan prepared and adopted according to Chapter 163, Part II, Florida Statutes. The plan includes the adopted goals, objectives, and policies of the local government and supporting data and analyses.

Macrophyte--An individual plant large enough to be seen easily with the unaided eye.

Mean--The average of a range of values.

MSL/NGVD--Elevation or altitude in feet above or below mean sea level (MSL), or in feet above or below National Geodetic Vertical Datum (NGVD).

Nonpoint source of pollution--Pollution from sources that cannot be defined as originating from discrete points. Examples include areas of fertilizer and pesticide application and leaking sewer systems.

Nutrients--Those constituents required by plants.

Oligotrophic--Water bodies or habitats with low concentrations of nutrients.

Organic--Deriving from living organisms.

Parameter--A constituent sampled in a water body which has variable values, e.g., pH.

Periphyton--Species of microscopic algae which are attached to underwater surfaces.

Period of Record--The time period in which samples are taken or conditions measured at a given location. Longer periods of record more accurately account for variability at that location.

Permeability--The capacity of a porous rock, sediment, or soil for transmitting a fluid without altering its physical structure; a measure of the relative ease of fluid flow under pressure.

pH--The acidity or alkalinity of water ($-\log_{10}$ of the activity of hydronium ions in water).

Physiography (geomorphology)--The study of the genesis and evolution of land forms.

Phytoplankton--The photosynthesizing organisms residing in the plankton.

Plankton--Organisms living suspended in the water column and incapable of moving against water currents.

Point source of pollution--Pollution from any confined or discrete source, such as the outflow from a pipe, ditch, tunnel, well container, concentrated animal-feeding operation, or floating craft.

Population density--Number of individuals per unit area.

Porosity--The ratio of the aggregate volume of interstices in a rock or soil to its total volume. It is usually stated as a percentage.

Potable water--Water that is safe and palatable for human use and consumption.

Potentiometric surface--An imaginary surface representing the static head of ground water in tightly cased wells that tap a particular water bearing rock unit (aquifer), or, in the case of unconfined aquifers, the water table.

Recharge--The process of addition of water to the zone of saturation.

Reuse--The deliberate application of reclaimed water, in compliance with DEP and District rules, for a beneficial purpose.

River Stage--The height at which a river's water level is measured using a staff gage whose elevation above mean sea level is known.

Runoff--That part of precipitation or snow melt that appears in streams or surface-water bodies.

Sedimentary--A rock resulting from the consolidation of loose sediment that has accumulated in layers either mechanically, by precipitation from solution, or from the remains or secretions of plants and animals. Also applied to processes leading to, or resulting from, the formation of such rocks.

Semiconfined aquifer--An aquifer that is partially confined by a layer (or layers) of low permeability through which recharge and discharge occur.

Silviculture--A branch of forestry dealing with the development and care of forests.

Sinkhole--A general term for a closed depression in an area of karst topography that is formed either by solution of the surficial limestone or by collapse of underlying caves. Its form is generally basinlike or funnel-shaped.

Sinking stream (stream-to-sink watersheds)--A surface stream that disappears into an underground channel (e.g., a stream in a karst region that disappears into a sinkhole and follows a definite channel through limestone caves).

Spring--The resurgence of ground water at the land's surface or into a surfacewater body.

Stormwater Runoff--Rainfall that, due to saturated soil conditions or impervious surfaces, is carried by gravity over the land's surface to a receiving water body (including lakes, streams, rivers, wetlands, and aquifers).

Subwatershed--A geographic subunit of a watershed, also referred to as a basin or sub-basin.

Taxa--The classification and naming system for organisms used in biological science..

Topographic map--A map of a sufficiently large scale showing, in detail, selected man-made and natural features of a part of a land surface, including its relief (generally by means of contour lines) and certain physical and cultural features (vegetation, roads, drainage, etc.).

Transpiration--The process by which water in living organisms, primarily plants, passes into the atmosphere.

Tributary--A branch of a stream or river which provides additional surface waters.

Turbidity--The state, condition, or quality of opaqueness or reduced clarity of a fluid due to the presence of suspended matter.

Unconfined aquifer--An aquifer whose upper surface is a water table free to fluctuate up or down under atmospheric pressure.

Vadose zone--Zone of aeration; usually refers to unsaturated layers in soil or rock formations.

Water Quality Classifications--The Department of Environmental Protection, through Chapter 62-302, F.A.C., has classified surface waters according to present and future most beneficial uses as follows:

Class I	Potable Water Supplies
Class II	Shellfish propagation or harvesting
Class III	Recreation, propagation and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use

Watershed--The land area which contributes to the flow of water into a receiving body of water.

Watershed Assessment--A systematic process for evaluating trends and conditions within a watershed or subwatershed, especially for water quality, hydrologic, ecological, or other concerns.

Water table--The water surface in an unconfined aquifer at atmospheric pressure. It is the water level in wells that penetrate the uppermost part of an unconfined aquifer.

Wellhead protection area--An area designated by a local government to protect the groundwater source for a well intended for human consumption for a community water system and includes the surface and subsurface area surrounding a potable water well field. The wellhead protection area may include all or part of the zone of contribution. Within the protection area zones establishing differing levels of protection may be established based on an evaluation of the risk to human health and the environment.

Wetland--Those areas that are inundated or saturated by surface water or ground water at a frequency or duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soils.

Appendix E. Bibliography and Past and Current Studies Related to the Coastal Rivers Watershed

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Past and Current Studies Related to the Coastal Rivers Watershed

Note that this listing includes studies conducted in areas outside of the Coastal Rivers Basin area but within the Florida Big Bend physiographic region (e.g., Crystal River, the Cedar Keys area). The results of these studies are considered applicable to similar habitat types within the area defined in this SWIM plan.

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