DUPLICATE

Surface Water Improvement and Management Plan

SWIM

Preserving Water Quality

Suwannee River System
1991

Suwannee River Water Management District

Suwannee River Water Management District
Surface Water Improvement and Management Plan

Suwannee River System

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I. Executive Summary

The Suwannee River Water Management District's (SRWMD) Surface Water Improvement and Management (SWIM) program for the Suwannee River has been in place since 1988. Originally the two top priority water bodies in the SRWMD, the upper and lower Suwannee River were combined to form the highest priority water body in the SRWMD SWIM Priority List in March 1990. Preliminary SWIM management plans for the upper and lower sections of the river were approved by the SRWMD's Governing Board and the Florida Department of Environmental Regulation (DER) in September 1988. These plans outlined the SRWMD's strategy for protecting the generally good water quality and high fish and wildlife values of the river system. An initial priority need was recognized as the establishment of an ongoing monitoring network for land cover, water quality, and the river system's biota.

This management plan reflects the changes made to the SRWMD's SWIM program since the original plans were adopted. It also charts the course for the SWIM program for the next three fiscal years, 1991-92 through 1993-94. Goals, objectives, and policies for the implementation of the SWIM program for the Suwannee River system are detailed in this plan. These guidelines provide the direction for the SWIM program, the projects undertaken to implement the program, and the overall framework within which the program will be administered. This management plan is an approach toward managing the activities that impact the myriad components of the river system and the institutional framework within which different management activities are conducted.

Management strategies have been identified for protecting and maintaining the water quality, hydrology, and habitat values of the Suwannee River system. These strategies compose the four programs developed for plan implementation: Waterbody Planning, Resource Monitoring, Resource Planning, and Program Implementation.

> **Waterbody Planning** is the program which encompasses the ongoing planning aspects of the SWIM program, including projects which address priority list and plan revisions and the annual review and evaluation of plan implementation. This program essentially provides for the administration and ongoing planning of the Suwannee River SWIM program.
>
> **Resource Monitoring** is the cornerstone program of the overall SWIM program for the Suwannee River. Included are projects which periodically monitor three interrelated components of the river system--water quality, riverine biota, and regional land cover. By regularly monitoring these components over the long term and analyzing the data collected, two critical issues can be addressed: more immediate impacts can be assessed throughout the basin, and long-term trends can be discerned.

Resource Planning encompasses activities related to the development of strategies and plans for basin management. This program includes the procurement and development of requisite data bases (apart from monitoring data), area-specific studies and planning activities, data analyses, and the further identification and refinement of management issues and needs.

Program Implementation carries forward the products and accomplishments of the other programs into action. This program involves the accomplishment of the overall basin management goals and objectives through intergovernmental coordination, the provision of technical assistance based on materials and products of the SWIM program to the SRWMD's land acquisition program, local government planning, and other agencies, and the involvement and education of the public in the wise use and management of the Suwannee River system.

Resource monitoring, technical assistance, intergovernmental coordination, data base maintenance, and public involvement and education are the most important components of the SWIM management program for the Suwannee River system. These five components are envisioned as the ultimate evolution of the SRWMD's management approach for the management of the Suwannee River. As the Suwannee River SWIM program progresses and the projects identified within this plan are successfully accomplished, the management efforts will be focused on these key areas.

The management program encompassed in this plan is dependent upon adequate funding from the SWIM Trust Fund. In turn, the Fund is dependent upon annual appropriations from the Florida Legislature. While the programs, projects, and tasks identified and described within this plan represent what SWIM staff believe to meet the needs of protecting the outstanding values of the Suwannee River System, little can be accomplished without the financial resources and commitment to implement this plan.

Recognizing this fact, the issues affecting the management of the river system have been prioritized by the SRWMD Governing Board. Programs, projects, and tasks to address these priority issues are then flagged within the Management Strategies section, corresponding to each of the priority issues. It is the intent of this process to address those issues deemed most important to fulfilling the goals of the SWIM program first, and address subsequent issues as funding and staff resources allow.

The priority issues involved in the management of the river system are all predicated on the preventive approach taken by the Suwannee River SWIM program. Since the overall quality of the river system is good, including water quality, fish and wildlife, habitat, economic, and recreational values, the major issues all involve maintaining that quality and addressing the existing impacts and problem areas. The priority issues are described in detail in Section III and summarized here:

1. Identification, analysis, and more complete definition of **point and nonpoint sources of pollution.**

2. Continuing the ongoing **resource monitoring** program for water quality, biology, and land cover.

3. Providing **technical assistance** to local governments in land use planning.

4. **Interagency, intergovernmental cooperation and coordination** in river system management.

5. Better definition of the **interaction of surface and ground waters** in the Suwannee River Basin.

6. Continued **land acquisition** of environmentally sensitive areas within the Suwannee River Basin.

7. Including **estuarine management** concerns in the overall management of the system.

8. **Permit tracking, coordination, and database management** for all regulatory activities within the Suwannee River Basin.

9. Increasing **public education, information, and involvement** efforts to support management initiatives within the Suwannee River Basin.

Figure 1 illustrates the SWIM planning process and organizational framework within which the SRWMD's Suwannee River SWIM program is implemented.

Tables 1 through 3, following, summarize: the interaction of SWIM goals, objectives, and policies; programs, projects, and tasks; program and project timeline estimates; and budget estimates and projections.

Figure 1. SRWMD SWIM Organizational Framework

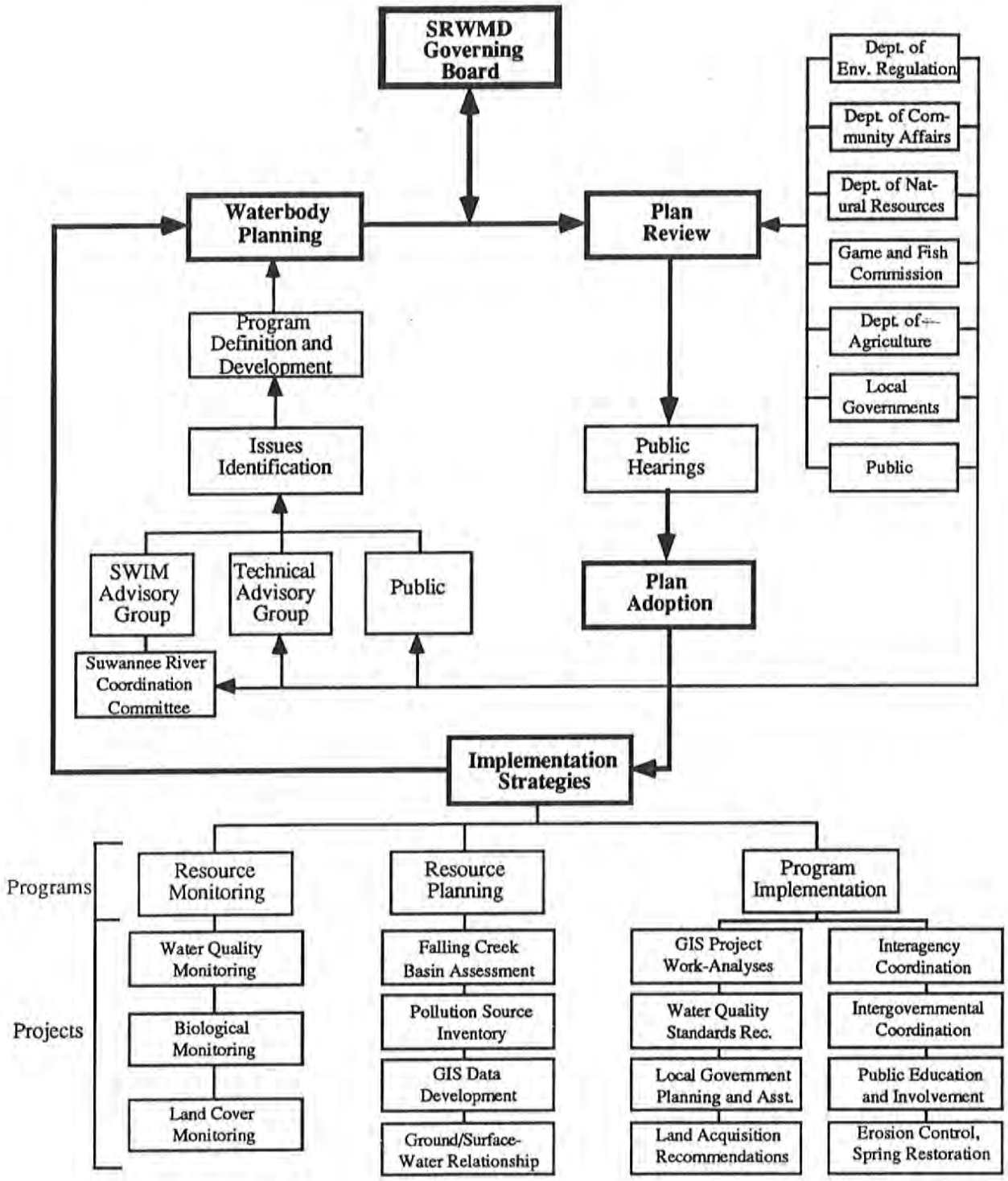


Table 1. Suwannee River SWIM Goal, Objective, and Policy Interaction and Management Strategy Summary

SWIM GOAL	SWIM OBJECTIVE	SWIM POLICIES
1. Protect ecological integrity, natural system values	2. Comprehensive, long-term monitoring	1. Monitor surfacewater qual. 2. Monitor aquatic biota 3. Monitor regional land cover 5. Special studies 14. Permit review /coordination
	4. Identify sensitive areas for acquisition	6. Geographic info. sys. 7. Local comp. plan assist. 8. Local plan amdmt. review 9. Stormwater planning assist. 10. 100-yr floodplain plan. 11. Surfacewater mgmt. perm. 12. Rule enforcement, assistance 13. Rule review and coord. 14. Permit review and coord. 20. Nonstruct. floodplain mgmt. 23. Land acq., restoration
	5. Identify, reduce impacts of pollution	3. Monitor regional land cover 6. Geographic info. system
	7. Technical Assistance	6. Geographic info. system 7. Local comp. plan assist. 8. Local plan amdmt. review 9. Stormwater planning assist. 10. 100-yr floodplain plan.
2. Conduct, promote scientific research	1. Studies for factors affecting river	5. Special studies 14. Permit review, coordination 21. Initiate, support scientific study
	2. Comprehensive, long-term monitoring	1. Monitor surfacewater quality 2. Monitor aquatic biota 3. Monitor regional land cover 5. Special studies 14. Permit review, coordination
	3. Maintain data, provide assistance	1. Monitor surfacewater quality 2. Monitor aquatic biota 3. Monitor regional land cover 4. Maintain, report data 6. Geographic info. system 14. Permit review, coordination

	6.	Suwannee-Santa Fe management plan requests	16.	Annual SWIM funding
	7.	Technical Assistance	6.	Geographic info. system
			7.	Local comp. plan assist.
			8.	Local plan amdmt. review
			9.	Stormwater planning assist.
			10.	100-yr floodplain plan.
			18.	Land use compatibility
			19.	Physical determ.-land uses
			23.	Land acquisition, restor.
	8.	Interagency, intergov. coordination	9.	Stormwater planning assist.
			10.	100-yr floodplain special plan.
			13.	Rule review, coordination
			17.	Santa Fe River SWIM plan
			19.	Physical determ.-land uses
			21.	Initiate, support sci. study
			22.	Interagency, intergov. coop.
			23.	Land acq., restoration
	9.	Ongoing SWIM planning	15.	SWIM plan rev./eval.
			21.	Initiate, support scientific study
			23.	Land acq., restoration
3. Reduce pollution source impacts	1.	Studies for factors affecting river	5.	Special studies
			14.	Permit review, coordination
			21.	Initiate, support scientific study
	4.	Identify areas for acquisition	6.	Geographic info. system
			7.	Local comp. plan assist.
			8.	Local plan amdmt. review
			9.	Stormwater planning assist.
			10.	100-yr floodplain plan.
			11.	Surfacewater mgmt. perm.
			12.	Rule enforcement, assistance
			13.	Rule review, coordination
			14.	Permit review, coordination
			20.	Nonstructural floodplain mgmt.
			23.	Land acq., restoration
	8.	Interagency, intergov. coordination	9.	Stormwater planning assist.
			10.	100-yr floodplain plan.
			13.	Rule review, coordination
			17.	Santa Fe River SWIM plan
			19.	Physical determ.-land uses
			21.	Initiate, support sci. study
			22.	Interagency, intergov. co-op.
			23.	Land acq., restoration

4. Preserve habitat	5.	Identify, reduce impacts of pollution	3. Monitor regional land cover 6. Geographic info. system
	7.	Technical Assistance	6. Geographic info. system 7. Local comp. plan assist. 8. Local plan amdmt review 9. Stormwater planning assistance 10. 100-yr floodplain plan
5. Promote wise use of the river	3.	Maintain data, provide assistance	1. Monitor surfacewater quality 2. Monitor aquatic biota 3. Monitor regional land cover 4. Maintain, report data 6. Geographic info. system 14. Permit review, coordination
	5.	Identify, reduce impacts of pollution	3. Monitor regional land cover 6. Geographic info. system
	6.	Suwannee-Santa Fe management plan	16. Annual SWIM funding requests
	7.	Technical Assistance	6. Geographic info. system 7. Local comp. plan assist. 8. Local plan amdmt review 9. Stormwater planning assist. 10. 100-yr floodplain plan. 18. Land use compatibility 19. Physical determ.-land uses 23. Land acq., restoration
	8.	Interagency, intergov. coordination	9. Stormwater planning assist. 10. 100-yr floodplain special plan 13. Rule review, coordination 17. Santa Fe River SWIM plan 19. Physical determ.-land uses 21. Initiate, support scientific study 22. Interagency, intergov. coop. 23. Land acq., restoration
6. Efficient, effective planning and management	8.	Interagency, intergov. coord.	9. Stormwater planning assist. 10. 100-yr floodplain plan 13. Rule review, coordination 17. Santa Fe River SWIM plan 19. Physical determ.-land uses 21. Initiate, support scientific study 22. Interag., intergov. cooper. 23. Land acq., restoration

9.	Ongoing SWIM planning	15.	SWIM plan rev./eval.
		21.	Initiate, support scientific
		23.	Land acq., restoration

Table 2. Suwannee River SWIM Programs, Elements, and Tasks

SWIM PROGRAM	PROJECT	TASK
1. Resource Monitoring	1. Water Quality Monitoring	1. Conduct monthly sampling 2. Analyses of samples 3. Modify existing network 4. Data management 5. Statistical documentation 6. Data reporting-annual, 1/4ly 7. Public information/education 8. Special event monitoring 9. Salinity regime monitoring
	2. Biological Monitoring	1. Establish, maintain network 2. Data management 3. Data reporting
	3. Land Cover Monitoring	1. Refine GIS coverage - LC 2. Plan for new imagery 1992,3 3. New aerial photography 4. Summary report, maps of LC
2. Resource Planning	1. GIS Database development	1. Soils coverage completion 2. Topography coverage completion 3. Census coverage 4. Floodplain parcel mapping 5. FNAI database 6. GFC habitat mapping
	2. Identify Pollution Sources	1. OSDS inventory 2. Field surveys 3. Point source coordination 4. Georgia coordination 5. GIS analyses
	3. Falling Creek Basin	1. Basin assessment 2. Iden. mgmt/restoration needs 3. Basin management plan
	4. Ground/Surfacewater relationship	1. Data inventory, compilation 2. Review of computer modelling 3. Computer model selection 4. Low-flow methodologies
3. Program Implementation	1. GIS analyses	1. OSDS suitability study 2. Development determinants 3. Nonpoint source modeling 4. Growth projections, analyses 5. Identify sensitive areas for acq.

	2.	Water Quality Standards	1. Database assembly 2. Methodology review 3. Database analysis 4. Distribution analyses 5. Monitoring network dev. 6. Standards recommendation
	3.	Nutrient Reduction Goal	1. Criteria determination 2. Load reduction goal 3. Nutrient monitoring 4. Goal implem. strategy
	4.	Local Government technical assistance	1. Data, map provision 2. Development review
	5.	Local Government comprehensive plan review	1. Plan amendment review and comment
	6.	Interagency coordination	1. SR Tech. Assistance Group 2. Enforcement coordination 3. Cooperative studies 4. Sub-group projects, coordination 5. Permit coordination, tracking
	7.	Intergovernmental coordination	1. Suwannee River Coordination Committee 2. Sub-group projects, coordination
	8.	Land Acquisition	1. LAMP review, assistance 2. LAM technical support
	9.	Public Involvement	1. Techniques research, review 2. Environmental education 3. Educational brochures, publication 4. River Watch groups 5. River Day, special events
	10.	Erosion Evaluation, Control	1. Erosion survey 2. Erosion manual 3. Spring restoration
4. Waterbody Planning	1.	Santa Fe River SWIM plan revision	1. Santa Fe River plan evaluation and review 2. Santa Fe River plan revision
	2.	Annual plan review and evaluation	1. Suwannee River plan review and evaluation
	3.	Annual priority list review	1. Yearly review for possible revisions

Table 3. Suwannee River SWIM Program Project Timeline

Suwannee,River SWIM Resource Monitoring Program Task Timeline 1991-1994

SWIM TASK NO.		1991			1992												1993												1994								
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
1.1 Water Quality Monitoring																																					
1.1.1	Monthly sampling	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.2	Sample analysis	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
1.1.3	Network modification	–	–	–	0																																
1.1.4	Data mgmt.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1.1.5	Statistical analyses	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1.1.6	Water qual. reports				X	X			X			X			X			X			X			X			X			X			X			X	
1.1.7	Public information	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1.1.8	Special event mon.						S-	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1.1.9	Salinity regime mon.	S-	–	–	–	–	–	–	–	–	–	–	–	–	–	0																					
1.2 Biological Monitoring																																					
1.2.1	Quarterly sampling					X			X			X			X			X			X			X			X			X			X			X	
1.2.2	Data reporting							X						X						X						X						X					
1.2.3	Annual report												X												X												X
1.3 Land Cover Monitoring																																					
1.3.1	Database refinemt.							S-	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1.3.2	Database update																						S-	–	–	–	–	–	–	–	–	–	–	C			
1.3.3	Aerial photography														S-	–	–	–	–	–	–	–	C														
1.3.4	Land cover report						S-	–	–	–	–	C																									

S = Start Date
C = Completion Date
X = Specific Occurrence

Table 3 continued

Suwannee River SWIM Resource Planning Program Task Timeline 1991-1994

SWIM TASK NO.		1991			1992												1993												1994								
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
2.1 GIS Database Development																																					
2.1.1	Soils coverages	–	–	–	–	–	-X																														
2.1.2	Topography coverages	–	–	–	-C																																
2.1.3	Census/population								S-	–	–	–	–	–	-C																						
2.1.4	Floodplain parcels	–	–	–	–	–	–	–	–	-C																											
2.1.5	FNAI database							S-	–	–	-C																										
2.1.6	GFC habitat mapping									S-	–	–	-C																								
2.2 Pollution Source ID																																					
2.2.1	OSDS Inventory	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	-C												
2.2.2	Field surveys	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2.2.3	Point source coord.	S-	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2.2.4	Georgia coord.		X					X							X					X							X					X					
2.2.5	GIS analyses				S-	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2.3 Falling Creek Basin																																					
2.3.1	Basin Assessment	–	-C																																		
2.3.2	Mgmt. needs			S-	–	–	–	–	–	–	–	–	-C																								
2.3.3	Mgmt. plan dev.												S-	–	–	–	–	-C																			
2.4 Ground/Surfacewater																																					
2.4.1	Data inventory										S-	–	–	–	–	–	–	–	–	–	-C																
2.4.2	Modeling review																		S-	–	–	–	–	-C													
2.4.3	Model selection																									S-	–	–	–	-C							
2.4.4	Low-flow study							S-	–	–	–	–	–	–	–	–	–	–	–	-C																	

S = Start Date
C = Completion Date
X = Specific Occurrence

Table 3 continued

Suwannee River SWIM Program Implementation Task Timeline 1991-1994

SWIM TASK NO.		1991			1992												1993												1994								
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
3.1 GIS Analyses																																					
3.1.1	OSDS suitability	S	–	–	–	C																															
3.1.2	Composite mapping	S	–	–	–	–	–	–	C																												
3.1.3	Nonpoint source mod.														S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.1.4	Growth projections														S	–	–	–	–	–	–	–	C														
3.1.5	Land acq. asstce.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.2 Water Qual. Standards																																					
3.2.1	Database Assembly	–	–	–	–	–	–	–	–	–	–	–	–	C																							
3.2.2	Methodology review	–	–	–	–	–	–	–	–	–	–	–	–	C																							
3.2.3	Data analysis	–	–	–	–	–	–	–	–	–	–	–	–	C																							
3.2.4	Standards distrib.	–	–	–	–	–	–	–	–	–	–	–	–	C																							
3.2.5	Mon. network devel.	–	–	–	–	–	–	–	–	–	–	–	–	C																							
3.2.6	ERC recomm.												S	C																							
3.3 Nutrient Loading Goal																																					
3.3.1	Criteria Determ.					X																															
3.3.2	Load Reduction Goal						X			X																											
3.3.3	Nutrient Monitoring							S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.3.4	Implem. Strategy						S	–	–	X	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.4 Technical Assistance																																					
3.4.1	Data, maps, reports									X												X												X			
3.4.2	Development review	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.5 Comp. Plan Review																																					
3.5.2	Plan amendment rev.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.6 Interag. Coordination																																					
3.6.1	Tech. Advisory Group	X								X						X						X						X						X			
3.6.2	Enforcement coord.	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.6.3	Coop. studies	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.6.4	Special adv. groups	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.6.5	Permit coord.										S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.7 Intergov't. Coordination																																					
3.7.1	SRCC	X			X		X			X			X			X			X			X			X			X			X			X			X
3.7.2	Spec. coord. issues									S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.8 Land Acq. Coordination																																					
3.8.1	Land Acq. Plan	–	C								X		S	–	–	C							X		S	–	–	C							X		S
3.8.2	Technical support	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.9 Public Involv./Education																																					
3.9.1	Techniques research						S	–	–	–	–	–	–	–	–	C																					
3.9.2	Env. education	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.9.3	Brochures, publ.												S	–	–	–	–	–	–	–	–	–	–	–	C												
3.9.4	River watch				S	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
3.9.5	River Day activities													X												X											
3.10 Erosion Eval., Control																																					
3.10.1	Erosion survey	–	–	–	–	–	–	–	–	–	–	–	–	–	–	C																					
3.10.2	Erosion manual												S	–	–	C																					
3.10.3	Spring restoration	S	–	–	–	–	–	–	–	–	–	–	C																								

S = Start Date
C = Completion Date
X = Specific Occurrence

Table 3 continued

Suwannee River SWIM Waterbody Planning Program Task Timeline 1991-1994

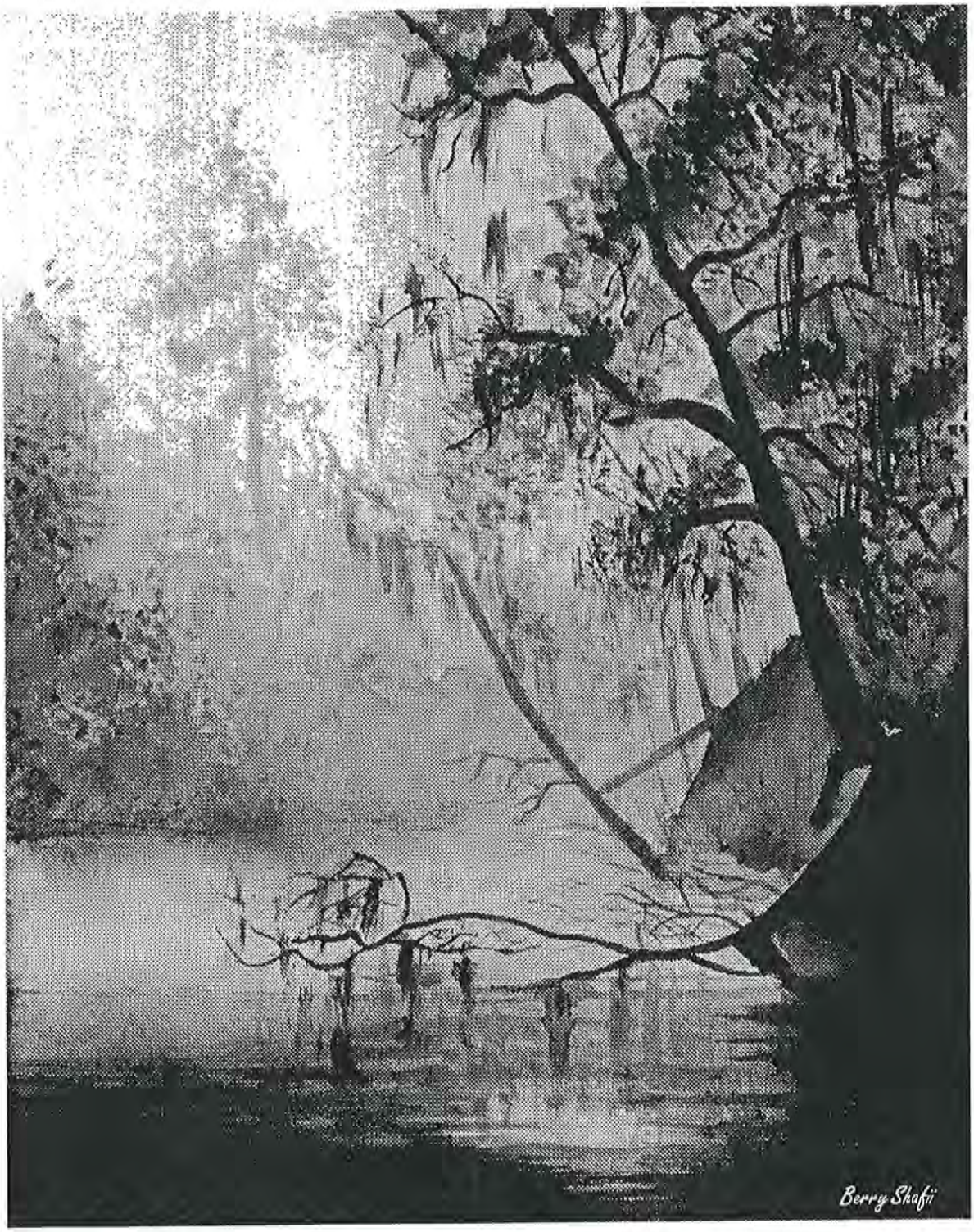
SWIM TASK NO.		1991	1992											1993												1994					
		O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S
4.1 Santa Fe R. Plan Rev.																									
4.1.1	Plan Review	S-	-	-C																					
4.1.2	Plan Revision									S-	-	-	-	-	-C										
4.2 Annual Plan Rev. /Eval.																									
4.2.1	Plan review/eval.												S-	-C											
4.3 Annual Priority List Rev.																									
4.3.1	Priority list review	S-	-	-C												S-	-	-C							

S = Start Date
C = Completion Date
X = Specific Occurrence

Table 4. Suwannee River SWIM Program Budget Estimates and Projections

SUWANNEE RIVER SWIM PLAN BUDGET ESTIMATES, 1991 - 1994

PROGRAM	Fiscal Year 1991-1992	1992-1993	1993-1994
Resource Monitoring			
Salaries and Benefits	$100,000.00	$125,000.00	$100,000.00
Operating Expenses	$5,000.00	$2,500.00	$2,500.00
Travel	$2,500.00	$2,500.00	$2,500.00
Capital Outlay	$1,500.00	$1,000.00	$1,000.00
Contracts	$375,000.00	$375,000.00	$450,000.00
Program Subtotal	$484,000.00	$506,000.00	$556,000.00
Resource Planning			
Salaries and Benefits	$100,000.00	$125,000.00	$95,000.00
Operating Expenses	$2,500.00	$2,500.00	$1,500.00
Travel	$2,500.00	$2,500.00	$2,500.00
Capital Outlay	$1,000.00	$1,000.00	$1,000.00
Contracts	$100,000.00	$100,000.00	$150,000.00
Program Subtotal	$206,000.00	$231,000.00	$250,000.00
Program Implementation			
Salaries and Benefits	$75,000.00	$100,000.00	$100,000.00
Operating Expenses	$2,500.00	$10,000.00	$1,500.00
Travel	$2,500.00	$2,500.00	$2,500.00
Capital Outlay	$1,000.00	$10,000.00	$2,500.00
Contracts	$100,000.00	$150,000.00	$100,000.00
Program Subtotal	$181,000.00	$272,500.00	$206,500.00
Waterbody Planning			
Salaries and Benefits	$25,000.00	$10,000.00	$10,000.00
Operating Expenses	$2,500.00	$500.00	$500.00
Travel	$1,500.00	$1,500.00	$500.00
Capital Outlay	$0.00	$500.00	$250.00
Contracts	$0.00	$0.00	$0.00
Program Subtotal	$29,000.00	$12,500.00	$11,250.00
Total Budget Estimate	$900,000.00	$1,022,000.00	$1,023,750.00
SWIM Trust Fund (60%)	$540,000.00	$613,200.00	$614,250.00
SRWMD Match (40%)	$360,000.00	$408,800.00	$409,500.00


Berry Shafii

II. Background Information

SWIM Act Background

The SWIM Act (Sections 373.451-373.4595, Florida Statutes [F.S.]) was passed into law by the Florida Legislature effective July 1, 1987. The general purpose of the Act is to restore or protect the quality of surface waters in the State of Florida and to provide an on-going planning and coordination mechanism to maintain surfacewater quality. The Legislature delegated the responsibility of evaluating, prioritizing, and developing management plans for surface waters to the state's five water management districts, in cooperation with other state agencies and local governments.

Two principle factors are recognized within the Act as contributing to the decline in the surfacewater systems of the state: point and nonpoint sources of pollution, and the destruction of the natural systems which protect and purify surface waters and provide habitat for fish and wildlife. In particular, the ecological, aesthetic, recreational, and economic values of the state's surface waters are impacted or threatened by these two factors.

SWIM Principles and Concepts

The SRWMD advocates a regional approach to water management. The need for a regional approach to water quality issues is based on a simple fact: surfacewater bodies, groundwater aquifers, and their related natural systems are not confined to political jurisdictions. The lands that drain into a water body, defined as the watershed or basin, are often comprised of the jurisdictions of many levels of government. Unless all the levels of government within a basin are in close cooperation, the overall quality of a water body cannot be assured. Therefore, the management of these systems must extend beyond political jurisdictions.

Two factors are important to consider when discussing surfacewater systems and water quality. First, land use is an important determinant of water quality. Substances either intentionally or inadvertently put on the surface of the land get rinsed into receiving water bodies following storm events and normal overland surfacewater flow. More intensive land uses usually introduce greater quantities of contaminants such as fertilizers, pesticides, oil and gasoline residues, and other toxic substances than less intensively developed land.

Second, the authority to regulate land uses, including land use allocation, density, and intensity controls through land use planning, lies principally with local units of government. Since land use is a key determinant in the quality of a basin's water bodies, a considerable portion of the responsibility for surfacewater protection lies directly and indirectly with local governments. Local units of government have a limited geographic area within the scope of their authority, and often they have a more acute awareness of local conditions and are more able to respond to the

particular needs of their jurisdictions. This awareness and response, however, rarely extends beyond the local government's boundaries. Since there may be a number of local jurisdictions within a basin, regional and state agencies should influence local land use decisions that could affect the regional water bodies. Through the assistance and oversight of regional and state agencies, the regional protection of natural resources can be addressed.

However, even at the state and regional level, management responsibilities can overlap; and inconsistent management objectives may exist. Agencies which share similar responsibilities, for example, can be inconsistent in permitting and enforcement procedures. To compound this situation further, their jurisdictional boundaries often overlap. The result may be a complex regulatory framework whereby natural resource protection efforts are less effective due to ineffective or nonexistent interagency coordination.

Interagency coordination, local government assistance, and public information are the most important components of the SWIM process. To develop and assist in the implementation of SWIM management plans, the SRWMD established a SWIM Technical Advisory Group (TAG) to identify regional management issues, exchange data and information, and review management proposals. The TAG is comprised of representatives from the SRWMD, DER, Game and Fresh Water Fish Commission (FGFWFC), Department of Natural Resources (DNR), the North Central Florida Regional Planning Council (NCFRPC), the Department of Agriculture and Consumer Services, Division of Forestry (DOF), the US Department of Agriculture, Soil Conservation Service (SCS), the United States Geological Survey (USGS), the Army Corps of Engineers (COE), and the University of Florida (UF).

The local units of government within the SRWMD region historically have not had an active land use planning mechanism. Most of the local governments have no planning staff or planning agency and only limited land use controls. This situation is rapidly changing within the basin. Mandates of the 1985 Local Government Comprehensive Planning and Land Development Regulation Act (Ch. 163, Part II, F.S.) now require a more integrated planning approach at the state, regional, and local level. Local government comprehensive plans and land development regulations are required to provide for, among other issues, the protection of ground and surface waters and their related natural systems. It is essential that the SRWMD SWIM plans provide resource protection guidance and directives for local and regional plans and regional programs, and that coordination be maximized to increase the efficiency and effectiveness with which the planning efforts are implemented.

The combination of the above factors--the need for a regional approach to resource management, land use demands and impacts, and the overall planning needs of the region--emphasize the relevance and importance of the SWIM planning process.

SWIM Planning Process

Planning for district surface waters is a three step process. First, an evaluation of the district's surface waters is conducted to develop a **priority list** of those systems most in need of restoration or protection. Second, once this list has been developed, **management plans** are written for priority waters that will guide the restoration and/or protection of water quality. Third, the **implementation and monitoring** of management plans are conducted, including annual evaluations and modifications as needed.

SWIM Priority List

The development of a priority water body list was first undertaken by the SRWMD in the fall of 1987. Using the criteria promulgated by the Florida DER, water bodies were prioritized by the SRWMD in cooperation with DER, DNR, FGFWFC, local units of government, and other interested parties. In order of priority, the first six SWIM priority waters were the upper Suwannee, lower Suwannee, Santa Fe, Steinhatchee, Alligator Lake, and Falling Creek. In 1990, the priority list was revised to reflect progress made in implementing the SWIM plans and the evolution of the SWIM program during its first two years. The principle changes were the inclusion of the upper and lower Suwannee and Falling Creek into an overall Suwannee River System, the expansion of the Steinhatchee plan to include the entire Coastal Rivers basin, and the addition of the Aucilla and Waccasassa rivers. In order of priority, the SWIM priority list is as follows:

Priority Water 1: *Suwannee River System* (including the Alapaha and Withlacoochee rivers and Falling Creek), selected because of the high quality of the system and the threat of pollution from point and nonpoint sources of pollution;

Priority Water 2: *Santa Fe River System*(including the headwater lakes Santa Fe, Little Santa Fe, Sampson, Crosby, and Rowell) , selected because of the high quality of the system and threats from urban and agricultural activities;

Priority Water 3: *Coastal Rivers Basin* (including the Econfina, Fenholloway, and Steinhatchee rivers, and Spring Warrior and Sanders creeks), selected because of the overall quality of the system, the contribution to coastal waters, and concerns for potential impact of forestry activities and point source discharges;

Priority Water 4: *Alligator Lake,* selected because of degraded water quality, concern over possible connection to the groundwater system, recreational demands, and urbanization of the basin;

Priority Water 5: *Aucilla River System* (including the Wacissa River), selected because of the high quality of the system, with high fish and wildlife values and recreational use of the system;

Priority Water 6: *Waccasassa River and Waccasassa Bay*, selected because of the generally undisturbed state of the river basin and the concomitant high fish and wildlife values of the river and bay.

SWIM Plans

Management plans were developed for the upper and lower sections of the Suwannee River by SRWMD staff and reviewed by other agencies and individuals, adopted by the SRWMD governing board, and approved by DER in 1988. These plans outlined a two-year strategy for developing a comprehensive monitoring network for water quality, biology, and land cover throughout the priority basins, as well as the development of computerized data bases culminating in geographic information system (GIS) coverages. Other programs included the establishment of special studies to better understand certain aspects of the river and the establishment of a technical assistance program to tie into the local government comprehensive planning process.

The initial SWIM plans for the Suwannee were in essence strategic management plans for the SRWMD in developing the SWIM program for the river. The revised Suwannee River SWIM plan contained herein is aimed at managing the SRWMD's and other agencies' and local governments' activities in the basin. Thus, this revised plan is intended to provide guidance for basin management. This is accomplished by the four linked, interactive components of this plan which address the central river system management issues. These four components are:

1) Goal, objective, and policy statements that provide guidance for the overall implementation of the SWIM program,

2) A discussion and prioritization of issues affecting the river system and the SWIM program for the river,

3) An evaluation and revision of work programs and tasks outlined in the previous management plans, and

4) The revised work programs and tasks that comprise the management action strategies for the Suwannee River SWIM program.

The initial plans also include the foundation for developing long-range management plans and strategies for the priority waters by including goal and objective statements for the SRWMD's SWIM plans. Those goal and objective statements are revised, updated, and expanded in the following section, which outlines the management strategy of the Suwannee River SWIM Plan. The specific

programs and projects which will implement the goal, objective, and policy statements are described in the Strategies section.

Goals

In recognition of the importance of natural systems in protecting surfacewater quality, the following goals have been established for the SRWMD SWIM program for the Suwannee River:

1. To protect the ecological integrity of natural surfacewater systems of the Suwannee River, and to enhance their environmental, aesthetic, scenic, and recreational values;

2. To conduct and promote scientific research aimed at better understanding the natural processes that influence the river system, and to ensure that management efforts are as compatible with those systems as possible;

3. To reduce the impact of point and nonpoint sources of pollution on water quality, fish, and wildlife;

4. To preserve habitat for native plants, fish, and wildlife, including threatened and endangered species;

5. To promote the wise public use of the river system and the accrual of economic benefits consistent with protection and restoration objectives; and

6. To streamline the management process and increase the efficiency and effectiveness of river management through SWIM planning and management for the Suwannee River system.

Objectives

The objectives of the Suwannee River SWIM program are intended to provide measurable guidance in achieving the overall goals of the program. These objectives are:

1. To develop and implement studies to evaluate the natural and anthropogenic factors that affect the surfacewater systems of the Suwannee River Basin;

2. To implement a comprehensive, long-term monitoring program that can detect changes in the water quality, ecological communities, and land cover of the Suwannee River Basin;

3. To develop and maintain regional databases for the Suwannee River Basin and to provide data, maps, and technical assistance to other governmental

units and interest groups in order to better manage our impacts to the natural systems of the basin;

4. To identify the most ecologically sensitive and valuable areas in the Suwannee River Basin for potential acquisition, and to ensure that the public use of these lands promotes the purposes for which they are acquired;

5. To identify and map all potential nonpoint sources of pollution to the Suwannee River and to reduce the impact of these sources on surface waters, fish and wildlife, and habitat values, including restoration of degraded areas;

6. To combine the individual SWIM management plans of the Suwannee and Santa Fe rivers into one collective, comprehensive management plan based on a fuller understanding of the dynamics governing the natural and man-induced functioning of the river systems;

7. To provide technical assistance to local governments, other agencies, and the public in the formulation, revision, or preparation of land use and management plan, site and development plans, scientific research or special studies, or other programs relating to the Suwannee River Basin;

8. To facilitate intergovernmental cooperation and coordination through interagency meetings, workshops, and seminars, providing technical assistance, and acting as a clearinghouse for information regarding the Suwannee River Basin;

9. To continue the SWIM planning and management process for the Suwannee River Basin by periodically reviewing, evaluating, and revising SWIM plans, strategies, programs, and projects for effectiveness and accomplishment of goals and objectives for the SWIM program. Public comment and interagency review and coordination are important components of this objective;

10. To periodically review the rules and regulations that affect the various components of the Suwannee River Basin to ensure that the spectrum of institutional controls are effective, efficient, and equitable, and can respond to the changing needs of the river system and the people who use the system or reside within the basin.

Policies

Resource Monitoring

1. The SRWMD will monitor surfacewater quality throughout the Suwannee River System in order to determine seasonal and long-term trends in water quality.

2. The SRWMD will monitor aquatic biota, in conjunction with water quality, in order to determine seasonal and long-term trends in species composition and diversity.

3. The SRWMD will monitor regional land cover in order to define trends in vegetative cover and general land use.

4. The SRWMD shall make all data collected through the SWIM program available to other governmental units and interested parties, and shall prepare quarterly and annual reports and presentations summarizing data collected and analyses conducted on that data.

5. The SRWMD shall conduct special studies to investigate specific impact areas or particular needs of subbasins, limited geographic areas, or for parameters of special interest.

Land Use and Resource Planning

6. The SRWMD shall continue to use, and expand the use of, geographic information system (GIS) technology in the management and use of data to provide data, analyses, maps, and reports to assist in the management and resource protection of the Suwannee River Basin.

7. The SRWMD shall provide technical assistance to local units of government in the preparation and implementation of local comprehensive plans as related to priority surface waters. This assistance shall take the form of data, analyses, maps, and, upon request, in the application and interpretation and use of such data, analyses, and maps.

8. The SRWMD shall review and make comment on local comprehensive plans and plan amendments as related to the plan's potential impact on priority surface waters and consistency with the objectives of the Suwannee River SWIM plan.

9. The SRWMD shall provide assistance to local units of government in the development of stormwater management plans and facilities within the Suwannee River Basin with priority given to those areas in direct proximity to the river and its tributaries. Areas of higher density development along the river system will be identified and evaluated as to the feasibility of developing regional stormwater management facilities or treatment systems.

10. Local units of government should designate the 100-year floodplain of the Suwannee River and its major tributaries as a special planning area in local comprehensive plans and should recognize the environmentally sensitive nature of the river system in land use planning and the preparation and application of land development regulations.

Resource Management

11. The SRWMD shall continue to permit surfacewater management systems within all priority waters and shall ensure that such systems have no adverse impacts on the surfacewater resources of any priority water basin.

12. The SRWMD shall continue to enforce rules and regulations regarding the use and disposition of surface waters and related ground waters of the Suwannee River Basin, and shall assist any agency in the protection of the natural resources of the basin.

13. The SRWMD shall periodically review its rules relating to the use, management, or disposition of surface and ground waters within the Suwannee River Basin to ensure their effectiveness in protecting the water resources of the basin. Where other agency or local government rules and regulations are not consistent with SRWMD rules, the SRWMD shall seek to maximize efficiency and effectiveness by encouraging or requiring the application of the rules or regulations that provide the greater degree of protection to the basin's water resources.

14. The SRWMD shall, as part of the SWIM management plan for the Suwannee River, develop a permit tracking system for periodic review of permitted activities which could potentially impact the Suwannee River system.

General SWIM Policies for the Suwannee River System

15. The SRWMD shall, no less than annually, review and evaluate the implementation of SWIM management plans and strategies for the Suwannee River system. SWIM plans for the Suwannee River System shall be thoroughly reviewed and evaluated and accordingly revised on a triennial basis.

16. The SRWMD shall submit annual SWIM funding requests to DER based on the expected costs of continuing programs and projects and the estimated costs of initiating new projects or studies in support of SWIM programs.

17. The SRWMD shall review and revise, as required, the SWIM Plan for the Santa Fe River system consistent with and in close coordination with the projects and programs of the Suwannee River SWIM Plan.

18. Intensive land uses such as commercial, industrial, and high density residential should be directed away from the surface waters and directly related groundwater systems of the Suwannee River system. Those land uses which are compatible with the conservation and protection of the river and

its ecosystems may be allowed in closer proximity to the system, but should be controlled to minimize any impacts to the system.

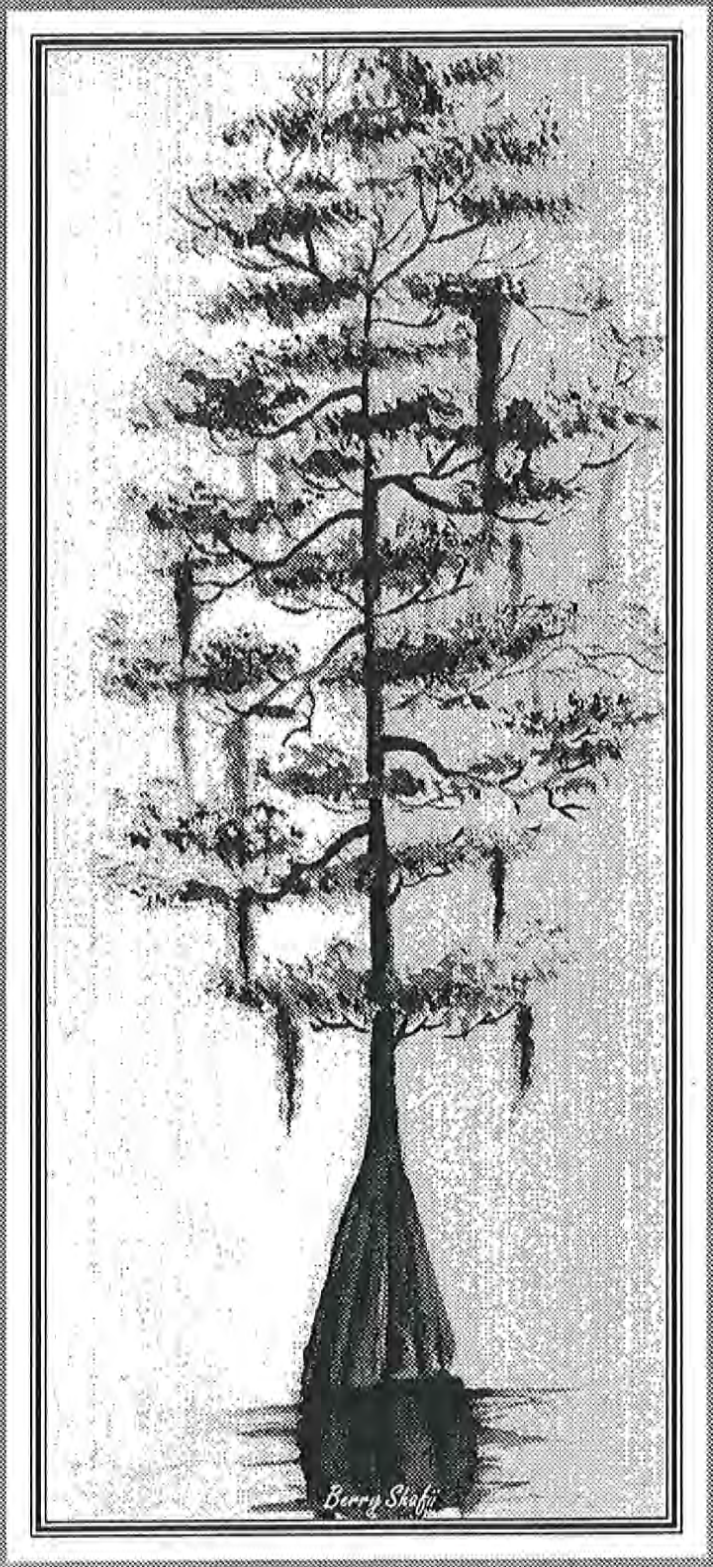
19. Land use allocation and distribution should be based on the physical capacity of the land to accommodate such uses. Site plans, development activities, and land management should be undertaken in accordance with the natural physical features of the land and should not rely on alterations of those features. Development proposals should be reviewed in a coordinated and cooperative manner by all regulatory agencies and affected local governments.

20. The SRWMD shall continue to use nonstructural floodplain management as the management method of choice for the Suwannee River Basin.

21. The SRWMD shall initiate, support, or encourage the establishment of scientific studies aimed at better understanding the natural functioning of the Suwannee River system and the impact of man-induced change upon the river's functioning.

22. All governmental agencies and units of government should work cooperatively and in a coordinated manner in all activities conducted within the Suwannee River Basin which could impact or lead to a better understanding of the river system, including land, water, flora, and fauna.

23. The SRWMD's SWIM program for the Suwannee River will continue to support the acquisition of lands for water management purposes, habitat restoration, resource-based recreation, and resource protection.


Berry Shaffer

Basin Description

Physiography and Topography

The Suwannee River Basin drains a total area of approximately 9,950 square miles, of which 4,230 (42.5%) are in Florida and 5,720 (57.5%) in Georgia (Figure 2). Excluding the Santa Fe River basin, the Suwannee basin in Florida encompasses 2,846 square miles. The Suwannee River Basin lies entirely within the Southeast Coastal Plain. The upper basin lies predominantly in the Northern Highlands physiographic region, the lower basin entirely within the Coastal Lowlands physiographic region. The river and floodplain portions of the upper basin are within the River Valley Lowlands, considered to be an extension of the Coastal Lowlands. The Northern Highlands are separated from the Coastal Lowlands by a feature known as the Cody Scarp, the crest of which in the upper Suwannee basin correlates approximately with the 110-foot topographic contour. This pronounced physiographic feature marks the transition in geologic formations as the river progresses downstream.

Elevations within the Suwannee basin range from over 150 feet above the National Geodetic Vertical Datum (NGVD) in the north to sea level at the mouth of the river (the stream bed near the mouth of the river lies at about 10 to 15 feet below mean sea level). The bottom of the river bed near the state line (river mile 208) lies at approximately 77 feet NGVD, giving an average gradient of the streambed of about 0.4 feet per mile (COE, 1989). The topography of the upper river basin is predominantly flat to gently rolling hills, with moderate to steeply sloping hills along the streambeds. Mature karst topography is present throughout the basin and is prevalent along the river's floodplain between White Springs and Ellaville and extending into northern Suwannee County. Numerous limestone solution sinks are found in the area. This karst topography is responsible for the capture of many streams in the area, most notably the Alapaha and Santa Fe rivers, the former often disappears underground during periods of low flow, the latter flows overland only during periods of extremely high flow. The lower basin is predominantly flat lowlands, with many areas of karst topography. Extensive lowlands and coastal marshes extend around the lower reaches of the river.

Climate

The Suwannee basin is characterized by humid, subtropical summers with winters more typical of a southern temperate climate. The average year-round temperature is 67°F. The warmest temperatures are generally recorded during the summer months of June through August with average maximum temperatures near 90°F. The average minimum temperatures are in the mid-forties during the coldest months of December and January. Freezing temperatures associated with frontal activity during the winter months are not uncommon, and are usually of short duration. Temperatures are somewhat moderated closer to the coast, due to the

Figure 2. Location Map of the Suwannee River Basin

influence of onshore winds, but usually do not vary significantly throughout the basin.

Precipitation within the Suwannee basin averages 54 to 56 inches per year, with the highest rates of rainfall occurring during the summer months of June through August. Rainfall during these months is associated with highly localized convectional thunderstorms; approximately 50% of the annual precipitation within the basin occurs during the summer. Tropical storms and hurricanes during the summer and early fall can often bring inclement weather and heavy precipitation into the area. During the winter, rainfall is associated with frontal activity, generally of longer duration, and more evenly distributed. The period with the lowest precipitation is usually during October and November. The annual average evapotranspiration rate for the area is estimated to be 42 inches per year--about three-fourths of the annual precipitation (SRWMD, 1983).

Hydrogeology

The composition and stratigraphy of topographic and physical features within a basin exert a significant influence on the hydrology of that basin--both on the land's surface as well as below it. Physical features predominant in karst topography dictate the complex interaction of surface and ground waters, such as occurs in the Suwannee River Basin. In the upper river basin, perched surficial aquifers provide base flow to the river; in the middle sections, artesian springs provide a high proportion of the river's base flow. These groundwater inflows to the river system carry constituents of the rainfall and runoff from inland areas as well as the geologic formations they pass through. Following is a brief discussion of the hydrogeologic features of the basin.

A perched, unconfined surficial aquifer exists in much of the upper basin, generally above the Cody Scarp. This aquifer consists of Miocene and younger sands and clayey sands that blanket the area and range in thickness from 20 to 150 feet. At the base of this aquifer is a bed of impermeable clays which separates the surficial aquifer from an intermediate artesian aquifer.

The intermediate artesian aquifer is comprised of phosphatic sands, clays, and carbonates of the Middle Miocene Hawthorn Formation. Permeable beds within this artesian aquifer system vary in depth and thickness throughout its extent, with the water-bearing sediments varying in thickness from 80 to 234 feet, thickening considerably from the west to the northeast. These sediments are underlain by a semi-permeable confining unit which separates the intermediate artesian aquifer from the Floridan Aquifer.

The Floridan Aquifer is generally broken down into two types of hydrologic conditions: the artesian (confined) and the nonartesian (unconfined) areas. Artesian conditions prevail in the Northern Highlands where the aquifer is confined under pressure by overlying impermeable strata. This area covers most of

the upper river basin above White Springs, Jasper, and where the Withlacoochee crosses the state line. Nonartesian conditions prevail in the Coastal Lowlands where the Floridan Aquifer is not confined on top by the Hawthorn Formation and the saturated zone of the aquifer is at atmospheric pressure. The potentiometric surface of the Floridan is higher where the aquifer is artesian; therefore, groundwater flow in the Floridan Aquifer is from the artesian to the nonartesian portions of the aquifer (Ceryak, et al., 1983).

Surfacewater Characteristics

The Suwannee originates in the Okefenokee Swamp in southern Georgia, exiting the swamp through an earthen sill constructed in 1960 to provide fire protection for the Okefenokee National Wildlife Refuge. The Alapaha and Withlacoochee rivers originate in south-central Georgia and flow in a southerly direction until merging with the Suwannee within several miles of each other upstream of Ellaville. They contribute an average of 15% and 24%, respectively, to the average annual flow of the Suwannee. The Alapaha River is completely captured during low flows by solution sinks, leaving a dry river bed for much of its course in Florida. During these periods, the river flows underground and joins the Suwannee at Alapaha Rise and possibly Holton Springs.

From the river's origin in the Okefenokee Swamp to the area around White Springs its flow is heavily dependent upon surface drainage from the river's tributaries and seepage from the surficial aquifer. Just upstream from White Springs, the Hawthorn Formation thins; and the river enters the River Valley Lowlands, cutting into the Suwannee Limestone of the Floridan Aquifer. From this area downstream, the river flow is augmented by numerous springs and groundwater seepage, changing the chemistry and appearance of the waters. Water quality data collected beginning in February 1989, as a component of the initial SWIM Plan strategy for the Suwannee River, provides an illustration of these water composition responses to the watershed geology.

One of the responses is ionic dominance. The ion balance in the Suwannee River generally improves downstream as inputs of ground water, the composition of which is usually consistent, overcomes the influences of surface drainage, which varies in response to precipitation and seasonality. The cationic composition of the river is dominated by calcium and magnesium, which is characteristic in karst regions. In the upper reaches, however, the system contains a cation contribution up to 50% by sodium derived from the swamp headwaters. Potassium is not significant to the cationic composition throughout the river system. The anionic composition displays an even more distinct change in response to geologic changes. The upper reaches are dominated by a chloride and sulfate system with little to no contribution from bicarbonate associated the karstic geology. Downstream, as Floridan Aquifer waters enter the system, the anionic composition is dominated by bicarbonate, or, very frequently, a bicarbonate/sulfate system.

Surface drainage from swampy headwaters results in waters colored by tannins, with lower pH levels from organic acids derived from detrital decomposition and lower conductivities due to the absence of spring waters saturated with dissolved limestone components. Color, measured in PCU during the period from February 1989 to July 1990 at stations near the Georgia border to White Springs ranged from 45 to 660 PCU. Stations in the reach between Branford and Wilcox, over the same time period, exhibited color measurements in a range of 15 to 320 PCU. Similarly, minimum pH in the upper reaches of the river was 3.2, compared to a minimum pH of 6.7 in the lower reach. Minimum conductivities were 53 and 116, respectively. Oxygen is depleted in groundwater reservoirs, and spring discharge is characteristically low in oxygen saturation. Interestingly, the minimum dissolved oxygen measurements collected between February 1989 to July 1990 were at the reach just above the Withlacoochee River confluence, where the Suwannee River receives discharges from Alapaha Rise and Holton Springs. The maximum dissolved oxygen measurements were made at stations associated with Hunter Creek and Swift Creek confluences.

Occidental Agricultural Chemical Products Co. (OXY) has two wastewater outfalls which discharge to Hunter Creek and Swift Creek. Phosphate, fluoride, sulfate, and ammonium by-products of OXY industrial processes are discharged in the wastewater at one or both of these outfalls. Resulting impacts to the Suwannee River due to these discharges are most notable for orthophosphate - the reactive ionic form - and fluoride. Figures 3 and 4 show mean values of these two variables from SWIM data collected between February 1989 and July 1990. Sulfates are common anions in the composition of spring water inputs to the river. In December 1989, the river was experiencing low flow conditions. Data during this time display spring water sulfate contributions to the river water composition. The sulfate contribution from OXY wastewater is readily discernible at the monitoring station just below Swift Creek (Figure 5). There is a small spring in this reach, Louisa Spring, but it is unlikely that it is the source of the sharp increase in sulfate noted in the SWIM data. The mean values over the period of record show a similar pattern (Figure 6).

Nitrogen behavior in the Suwannee River is also a product of both natural and human influences. Relatively high organic nitrogen and ammonia nitrogen derived from swamp headwaters are typical byproducts where detrital and wildlife sources are present. As the river flows downstream, these nitrogen species undergo nitrification. Their measures decrease as nitrate nitrogen correspondingly increases. This pattern is apparent in plots of average values of twelve data points of TKN (Total Kjeldahl Nitrogen, which is a measure of organic nitrogen plus ammonia nitrogen) and nitrate nitrogen (Figure 7). The plot shows increases in nitrate-N and a corresponding decrease in TKN in the Upper Suwannee, and again at the Branford station, which is above the confluence with the Santa Fe River. This pattern does not appear to hold beginning at the monitoring station below the confluence with the Withlacoochee River and downstream at the station below the Gold Kist

Figure 3. Mean Orthophosphate, Suwannee River, February 1989 - July 1990

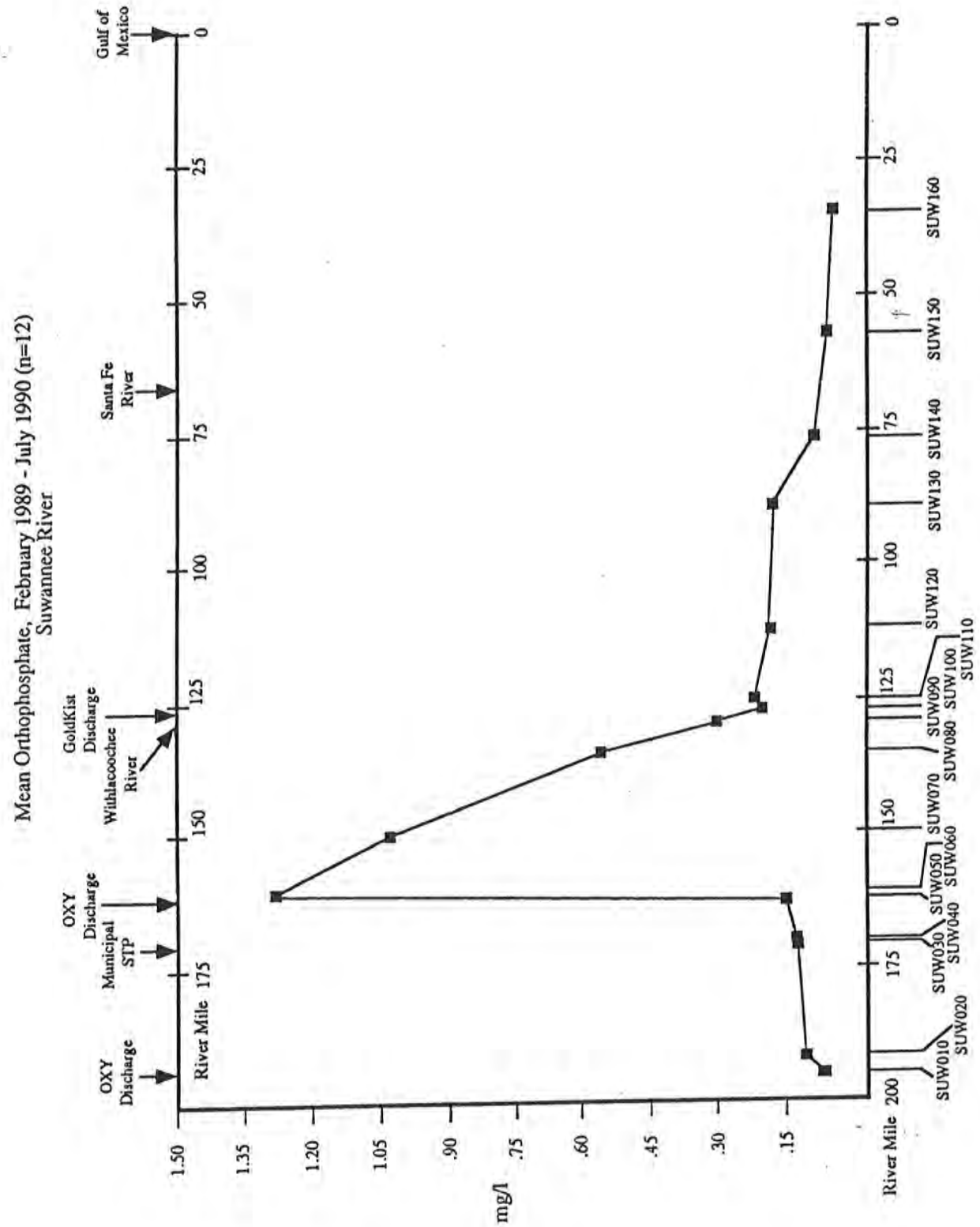


Figure 4. Mean Fluoride, Suwannee River, February 1989 - July 1990

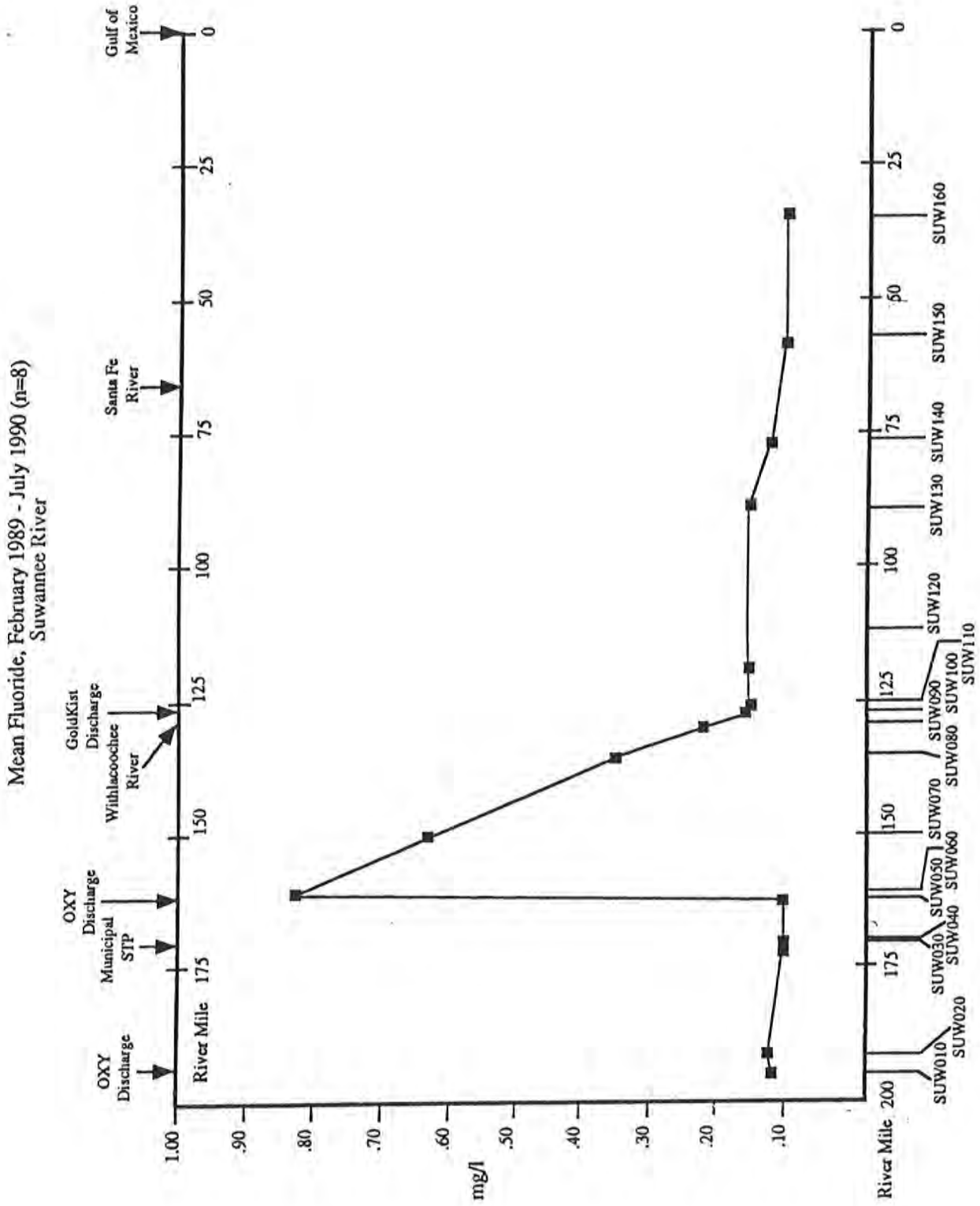


Figure 5. Sulfate, Suwannee River, December 1989

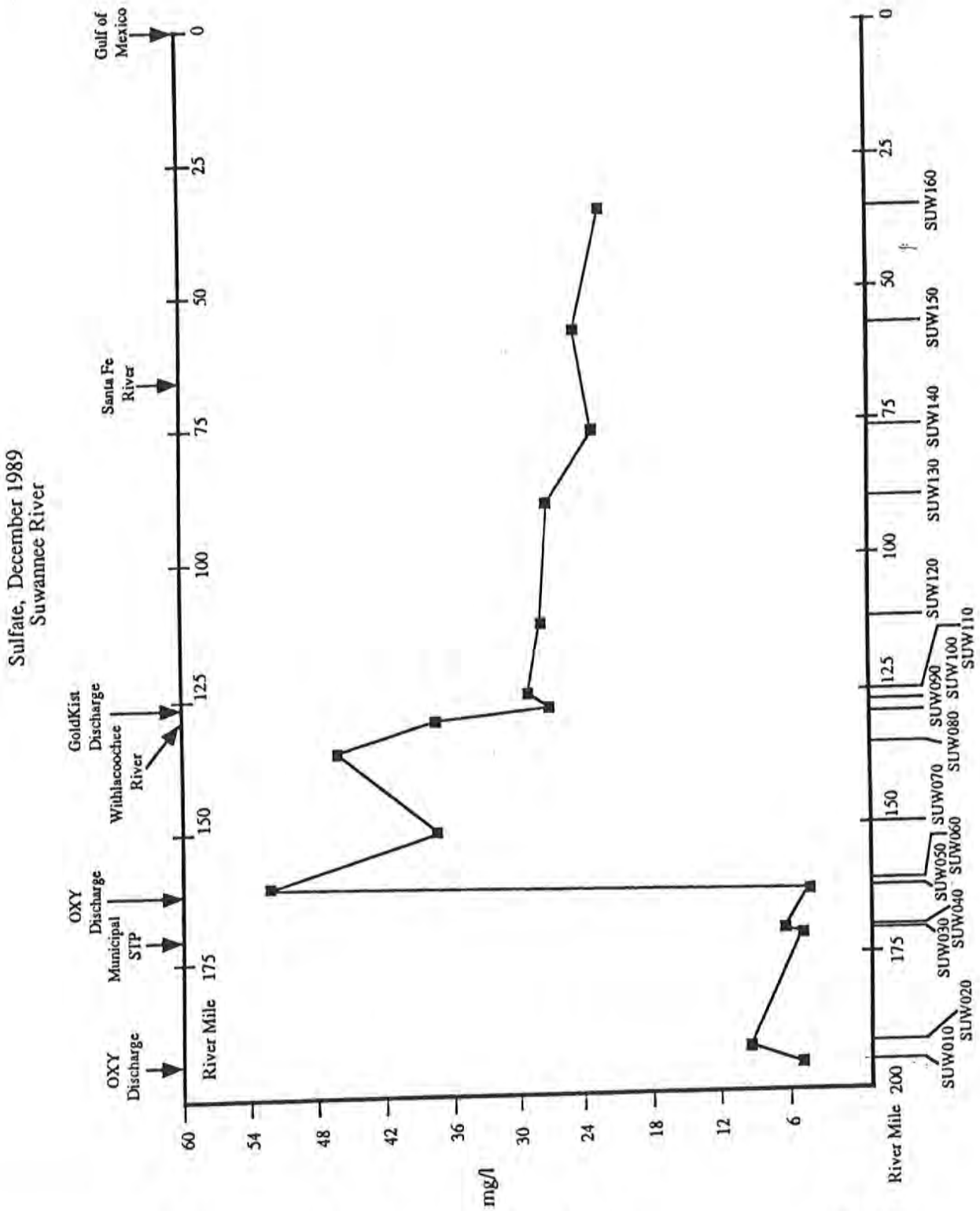


Figure 6. Mean sulfate, Suwannee River, February 1989 - July 1990

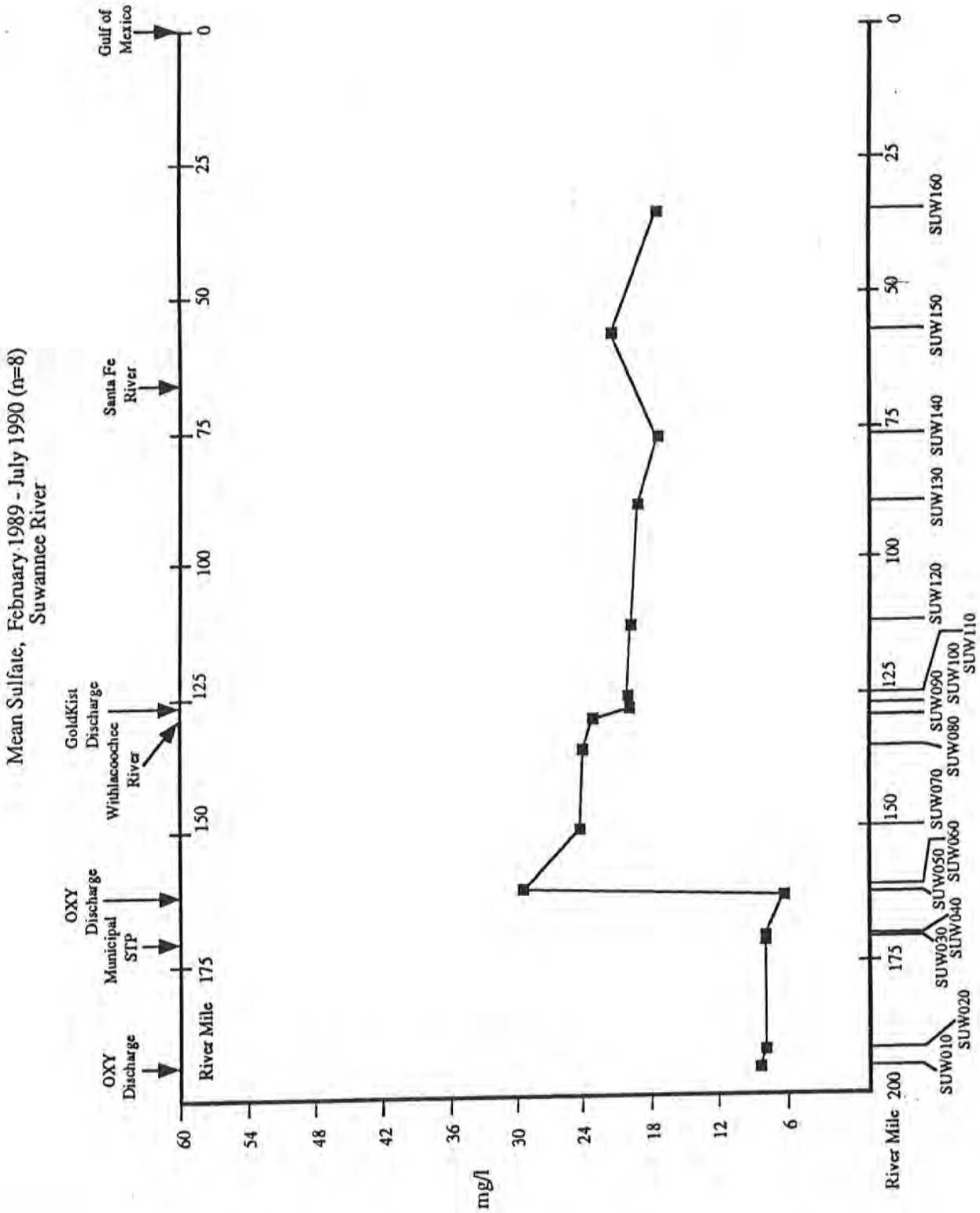
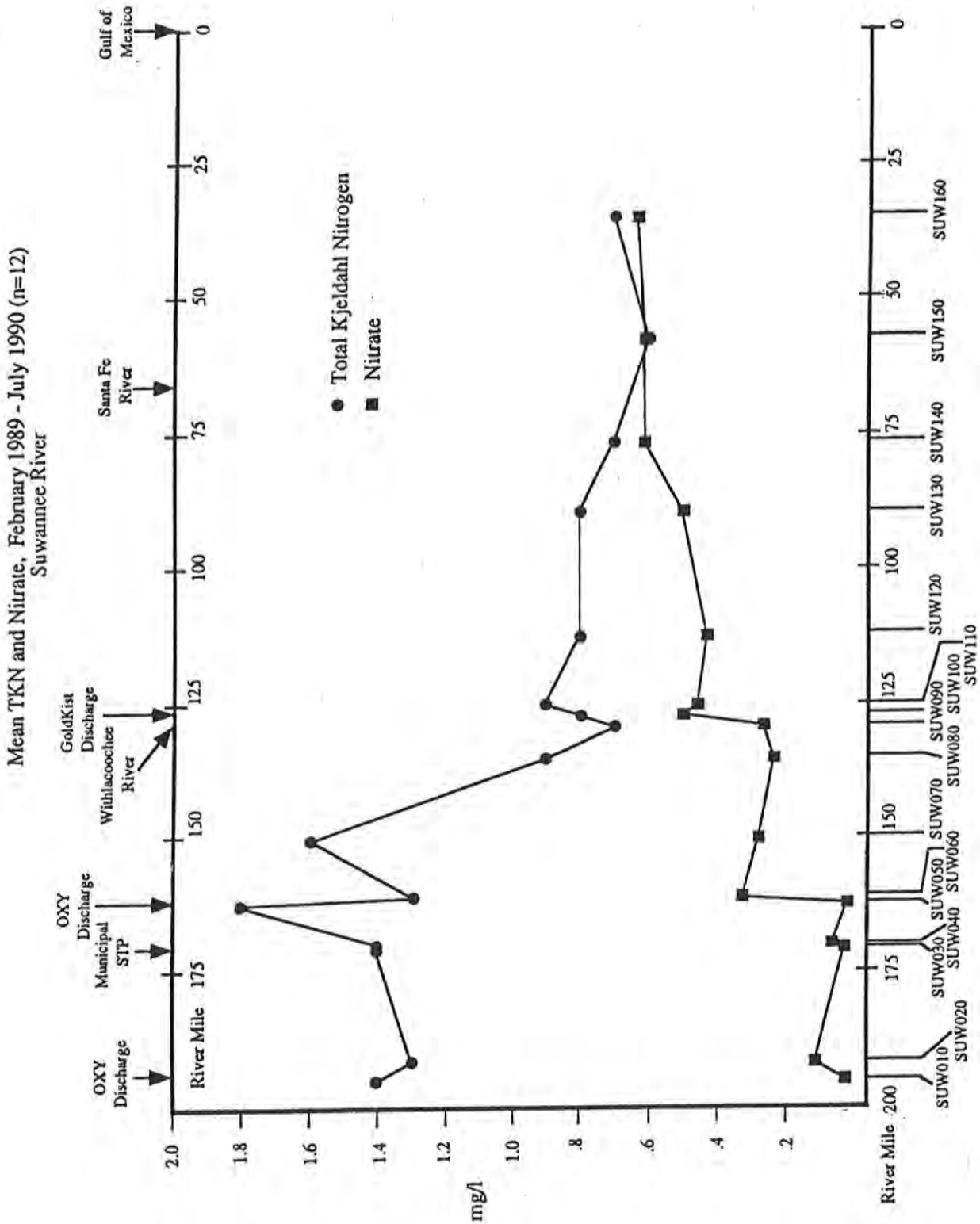


Figure 7. Mean TKN and Nitrate (N), Suwannee River, February 1989 - July 1990



Poultry Plant discharge, nor downstream of the Branford station, which is downstream of the Santa Fe River confluence.

Coliform bacteria counts are often used in water quality assessments. A review of the SWIM data reveals that this analysis contains substantial variation which limits its quantitative application. Qualitative interpretations can be made, however, to determine where the presence of the bacteria tend to be , and their approximate abundance. Coliform bacteria populations are typically higher in swampy waters where flow is slow and nutrient sources are abundant. Upper Suwannee tributaries Rocky Creek, Roaring Creek, Robinson Branch, and Camp Branch had total coliform bacteria counts of greater than or equal to 2,900 colonies per 100 ml in the SWIM data, denoting a relatively abundant bacterial population. Camp Branch and Roaring Creek also had relatively high fecal coliform counts, which were generally not abundant in the Rocky Creek and Robinson Branch tributaries. This suggests that some other factor or factors could be affecting these two systems. No other inference can be made on the coliform data from the remaining Suwannee River stations with a significant level of confidence.

Water quality variations due to point and nonpoint pollution sources are difficult to define in a system which demonstrates high natural variability. Natural variability results from factors inherent in the distinct geologic phenomena discussed above, and also from the long length of the river where the discharge volume variation is influenced by precipitation and evapotranspiration patterns, and the extraordinarily large number of springs of karstic origin feeding the river.

Variation is also influenced by the substantial flows received from the Withlacoochee, Alapaha, and Santa Fe rivers. The variations inherent in their respective watersheds is then reflected in the Suwannee. These effects will become more apparent as the SWIM monitoring program continues and trend analyses are applied to the SWIM water quality data.

The upper Suwannee River has been rated as having fair water quality in the DER's 1990 305(b) Report. The reason is twofold. Both the natural composition of swamp headwater chemistry, and the impacts from the OXY industrial discharges influence the Water Quality Index (WQI) used in the report. The Lower Suwannee River is rated as good in the 305(b)WQI, but is also influenced by low dissolved oxygen characteristic of spring discharges. The Suwannee River is classified as Class III waters, the designated uses of which are recreation and the propagation and maintenance of a healthy, well-balanced population of fish and wildlife. Class III water quality standards set forth in rule 17-302.560, Florida Administrative Code (FAC), state standard criteria for many constituents that have not been monitored through the SWIM monitoring program. Of the variables measured in the network with rule 17-302, FAC, criteria, the fecal coliform standard was exceeded in two tributaries in the upper basin; Camp Branch and Roaring Creek. The total coliform standard was exceeded in the four tributaries mentioned above, containing the two with high fecal counts and also located in the upper basin. Alkalinity

criteria is set at greater than or equal to 20 mg/l as $CaCO_3$, yet the water composition in the upper reaches of the river are frequently well below this as a result of the natural conditions there. The rule recognizes this condition in the pH criteria. No other exceedance of Class III standards is apparent, or cannot be determined, from the SWIM data collected between February 1989 and July 1990.

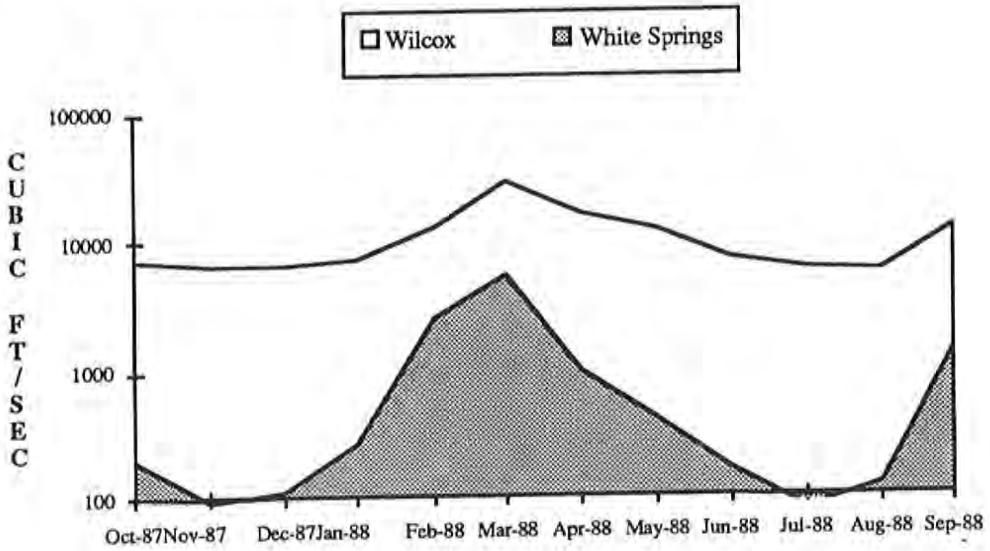
River flows in the upper Suwannee and its two major tributaries fluctuate throughout the year, with the peak flows generally occurring during March and April. The monthly mean discharge for the Suwannee at Ellaville during these two months is 10,760 and 11,380 CFS, respectively. This includes the discharge of both the Withlacoochee and the Alapaha rivers. This figure is the monthly mean average computed for a 52-year period ending in 1978. The lowest flow periods for the Suwannee at Ellaville are during the late fall and early winter, with average monthly discharges of 3,695 CFS for November and 4,279 for December (Ceryak, et al., 1983). Table 5 shows the average discharge, maximum discharge, and minimum discharge at six gaging stations on the Suwannee River for various periods of record as measured by the USGS. Figure 8 illustrates the magnitude and seasonal variability of discharge at two stations along the river, White Springs and Wilcox, representative of the upper and lower reaches of the river.

In addition to the stream bodies, the surfacewater system of the basin includes lakes, ponds, springs and spring runs, and wetlands areas. There are few lakes or ponds immediately adjacent to the river or in the general vicinity; many lakes are within the total basin of the river. Wetlands areas are present within the floodway of the three major streams, as well as in large swamp areas that feed the lesser tributary streams. Most of the floodway of the river is dominated by bottomland hardwood swamp forests.

Table 5. Discharge for Selected Suwannee River Gauging Stations. Discharge is shown in cubic feet per second (CFS) for the period of record (POR) for each station (expressed in years). USGS data.

Station Name	Avg. CFS (POR)	Max. CFS (Date)	Min. CFS (Date)
Benton	1,427 (14)	18,300 (27,700) (4/6/84) (4/6/73)	5.0 (8/9/77)
White Springs	1,836 (64)	38,100 (4/10/73)	4.8 (11/15/31)
Suwannee Springs	1,804 (15)	30,100 (4/12/73)	69 (12/10/83)
Ellaville	6,477 (62)	95,300 (4/8/48)	882 (7/17/55)
Branford	6,984 (58)	83,900 (4/11/48)	1,530 (7/1/55)
Wilcox	10,580 (49)	84,700 (4/14/48)	2,960 (10/25/81)

Figure 8. Suwannee River Discharge, USGS Water Year 1988



Ecological Communities and Fish and Wildlife Resources

The various natural communities present in the basin contribute to both its natural resource and cultural values. 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; marsh and swamp habitats may be important nursery areas for species of fish with recreational and commercial value and the riparian forests of the river add to its scenic beauty. An understanding of the natural systems/ecological resources of the basin is an integral part of the SWIM program for this river system.

Aquatic Ecosystems and Habitats

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

- fish and wildlife habitat;
- floodwater storage and attenuation;
- protection and maintenance of water quality; and
- cultural benefits (commercial and recreational fisheries, aesthetic benefits, other recreational attributes, etc.)

Each of these aquatic ecosystems requires a somewhat different approach for monitoring and study strategies (see Management Strategies section).

River Ecosystems and Habitats

The riverine ecosystems constitute the major type of freshwater aquatic system in the Suwannee River Basin. "River ecosystems" are defined as all streams in the basin, ranging from the Suwannee River to its small tributary streams. Major habitats associated with these stream systems which contribute to their ecological value include floodplain habitats, which mainly consist of various forested wetland communities, and the various habitats associated with the river channel.

The floodplain of the Suwannee River and its tributaries is dominated by a variety of forested systems, primarily various types of forested wetland communities or swamps. In the upper portions of the river, riparian areas along the riverbank are vegetated with cypress and Ogeechee tupelo. Floodplain areas adjoining the upper river tend to be dominated by mixed hardwood and pine forests which are infrequently flooded. Proceeding downstream, various types of bottomland hardwood swamp and floodplain swamp communities predominate in the floodplain. Riparian areas tend to be vegetated with cypress, planer elm or ash.

More frequently flooded swamps ("Floodplain Swamps" according to the Florida Natural Areas Inventory description) are dominated by bald and pond cypress, water tupelo, swamp tupelo, ash, and other tree species adapted to frequent flooding. Areas flooded less frequently exhibit a more mixed canopy which includes various oak species (live oak, laurel oak, swamp chestnut oak, black oak), water and mockernut hickory, sweet gum, black gum, american elm, iron wood (blue beech), hop hornbeam, hackberry and other species. The composition of the floodplain forest at a particular site is determined by a complex array of environmental factors, including topography, frequency, depth, and duration of flooding, and soil types.

These floodplain forest areas fulfill a variety of ecological roles. When flooded, they are believed to constitute important nursery habitat areas for riverine fishes (Wharton and others, 1982; Crance and Ischinger, 1989). These areas also serve as massive flood detention areas, storing floodwaters and "buffering" river flood peaks downstream (Wharton and others, 1982). The floodplain forests contribute leaf litter and other plant detritus which forms a basic food source in river food webs. Elder and Cairns (1982) measured an annual litter production of 800 g/m2/year in floodplain wetland forests of the Apalachicola River. This translates to 8 metric tons per hectare per year or 7,137 pounds per acre per year of food material. Some of this is transported to the river and some is utilized in place on the forest floor. Tree composition of many of the Apalachicola forests was similar to Suwannee River floodplain forests, suggesting that these litter fall estimates may be applicable to the Suwannee. It is significant to note that this value is higher than litter fall measured in comparable river systems in the southeastern U.S. (Elder and Cairns, 1982).

River channel habitats include:

a. The **littoral** (submerged bank) **areas**, which may provide important fisheries habitat, particularly if vegetated with species of emergent or submergent aquatic plants or covered by tree roots and trunks.

b. **Snag areas**, submerged logs and brush, which have been shown to be important habitat areas for riverine invertebrates; Benke and others (1984) showed that much of the invertebrate production in the Satilla River, Georgia, occurred on snags.

c. **Shoal areas**, which are known to support abundant and diverse populations of benthic invertebrates. The FGFWFC; see Bass and Cox, 1985) showed that biomass and density of benthic invertebrates was considerably higher on limestone shoal areas in the Suwannee, compared to sand-bottom areas of the river channel.

An additional important habitat in the river system is the small tributary streams. It appears that these areas fulfill important roles as nursery areas for riverine fishes. The FGFWFC (1989) documented that most of the redbreast sunfish using Roaring Creek were juveniles, suggesting the nursery role of the creek.

Sampling of benthic invertebrate populations in the Suwannee River was begun as part of the SWIM program in 1989. Use of this group of animals as general indicators of water quality and the "health" of the aquatic system is a well established tool in water quality management. Taxa richness (the number of different invertebrates) at nine biological sampling sites sampled in 1989 is shown in Figure 9. Generally, the invertebrate community is "richer" downstream (more different types of invertebrates are present). This relates to a number of environmental factors, including the more variable hydrologic conditions in the upper river (Figure 8) and the more alkaline, higher conductivity and more nutrient rich water quality conditions found in the lower river. A summary of 1989 benthic macroinvertebrate data collected on the Suwannee is found in SRWMD (1990); a technical report summarizing the data. The proportion of different types of invertebrate "feeding guilds" in the river are quite instructive in indicating the dominant basic food sources in the river; Table 6 shows these proportions. The dominance of "filterer", "collector/gatherer" and "shredder" groups indicates the importance of the particulate organic material produced in the riparian and floodplain forests to the river food web.

Lake Ecosystems and Habitats

Lakes are not a major component of the surfacewater resources of this basin. Those lakes which are present, however, have a variety of ecological and cultural values. A statewide study of lakes in the late 1970's (Canfield, 1981) found that basic lake chemistry, and thus lake ecology, was closely related to regional geology in a particular physiographic region. In the northern highlands physiographic region (which includes most of the upper Suwannee basin), three major groupings of lakes were identified based on water quality characteristics:

1. Clear, acidic, softwater lakes of low mineral content and oligotrophic nutrient status (these were all located outside of the Suwannee River Basin).

2. Mesotrophic lakes which tended to exhibit colored, acidic, soft-water characteristics. These include Lake Louise, Low Lake, and Lake Octahatchee.

Figure 9. Mean taxa richness at each sampling station during each sampling interval.

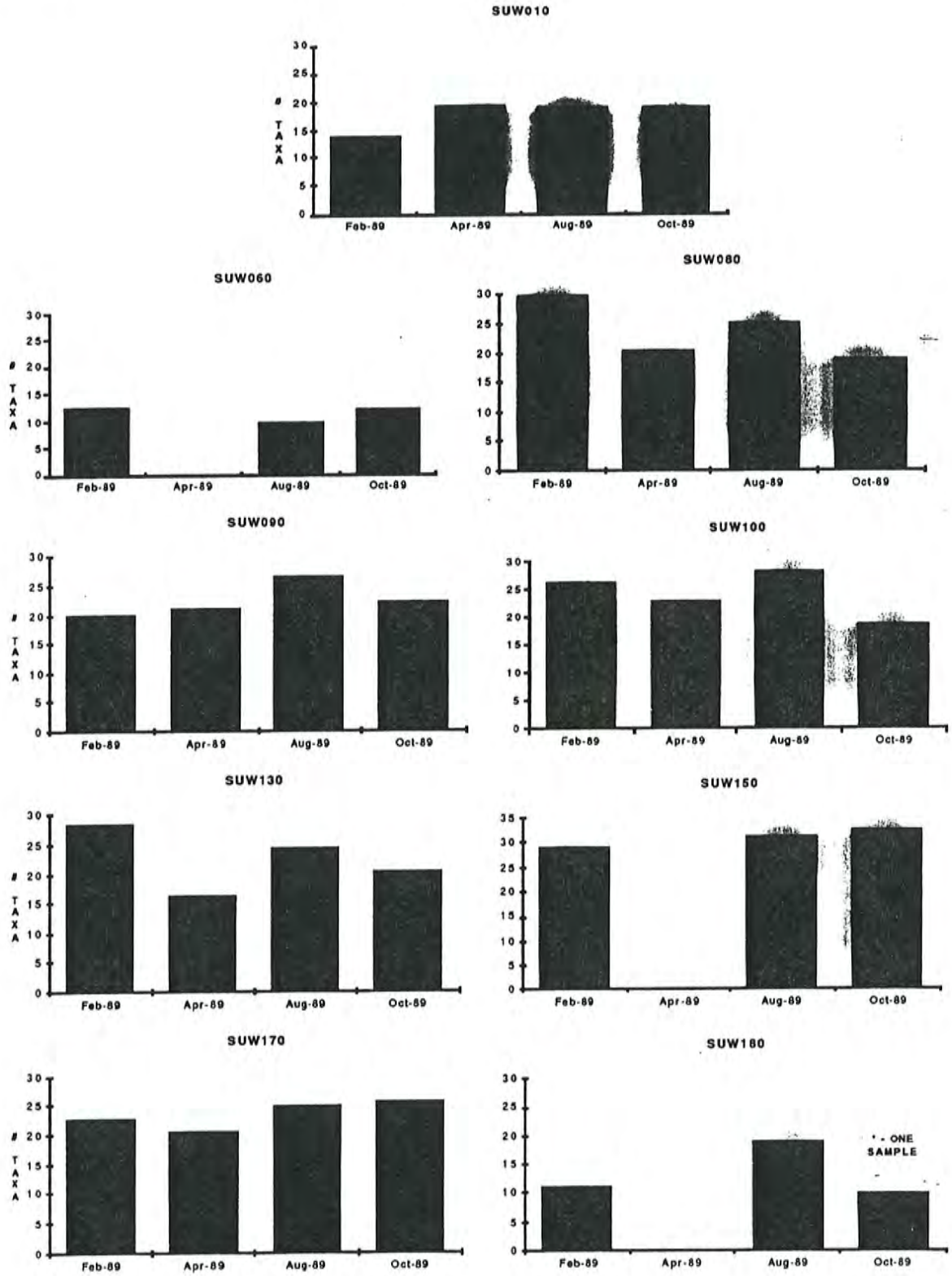


Table 6. Invertebrate feeding guild composition at the Suwannee River sampling stations (determined for all invertebrates collected at each site).

	FEEDING GUILD (% COMPOSITION)				
STATION	Filtering Collectors	Gathering Collectors	Shredders	Scrapers	Predators/Piercers
SUW010	61.7	7.6	11.5	8.8	8.8/1.6
SUW060	80.1	3.6	8.9	6.4	0.9/0.1
SUW080	58.4	7.4	17.5	8.3	6.6/1.9
SUW090	51.2	13.2	8.3	12.1	6.9/8.2
SUW100	46.2	14.2	15.2	6.1	11.2/7.0
SUW130	58.0	14.0	3.1	12.1	4.0/8.9
SUW150	20.8	45.8	10.3	9.4	5.9/7.8
SUW170	7.7	53.6	23.5	9.3	2.1/3.8

3. Colored, acidic, soft-water lakes of low mineral content which exhibit a eutrophic nutrient status (Suwannee Lake being a good example, although aberrant in that it is an artificially created lake).

Lakes in the Coastal Lowlands physiographic region generally exhibited a similar trophic status, being oligotrophic to oligo-mesotrophic lakes, but the basic water chemistry was rather variable, depending mostly upon the water source of the lake and the proximity to limestone. Lake water chemistry ranged from acidic, soft-water lakes of low mineral content (Townsend Pond in Lafayette County) to alkaline, hard-water lakes of higher mineral content (Governor Hill Lake in Dixie County).

Lakes in the Tallahassee Hills physiographic region (which includes a portion of the upper Suwannee basin in Madison County) were characterized as acidic, soft-water lakes of low mineral content and generally mesotrophic nutrient status.

Some aspects of the biology of lakes of the basin are known. The regional office of the FGFWFC has conducted some fisheries assessments in selected lakes in the basin to generally characterize fish populations. The DNR Bureau of Aquatic Plant

management conducts biennial aquatic plant surveys in publicly accessible lakes in the basin. Some of the lakes of the basin are surrounded by forested swamp systems. Littoral marshes are present on some lakes, absent on others. A more comprehensive assessment and overview of basin lake resources would be beneficial.

Wetland Ecosystems and Habitats

The two main types of wetland ecosystems present in the basin are marshes, vegetated with herbaceous aquatic vegetation, and swamps, vegetated with woody plants. Herbaceous marshes are found primarily in the lowest reaches of the river and include both fresh and salt water marshes. Some small areas of marsh and wet prairie habitat are found in the upper Suwannee basin. Forested wetlands cover large areas of the river floodplain and adjacent areas. Isolated wetland systems (those present in the basin but not hydrologically connected with the river or its tributaries) are also an important component of the wetland resources of the basin. The array of wetland types in the basin may be summarized as:

a) forested wetlands dominated by needle-leaved deciduous trees; bald or pond cypress (*Taxodium distichum* or *T. ascendens*, respectively), and/or needle-leaved evergreen trees; slash pine, loblolly pine, pond pine or spruce pine,

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 broadleaved deciduous hardwoods (oaks, various gums, hickory, river birch, red maple),

d) herbaceous marshes ranging from sedgebogs, 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*).

Estuarine Ecosystems and Habitats

Extensive areas of estuarine habitat are present in the extreme lower portion of the Suwannee River and Suwannee Sound, the estuary of the Suwannee River. An estuary, broadly defined, is a "region of mixing of fresh and salt water." Estuaries as distinct surfacewater systems are among the most productive biological systems in

the world (Comp and Seaman, 1985). Over 90% of the total commercial fisheries catch in the Gulf of Mexico is comprised of species that depend upon Gulf estuaries during some part of their life cycle (Snedaker and deSylva, 1977; Comp and Seaman, 1985). Overviews and characterizations of the Suwannee estuary are provided in Wolfe and Wolfe (1985) and Mattson and Rowan (1989). The estuary of the Suwannee is perhaps the most undisturbed major river estuary in Florida.

The flow of freshwater into an estuary creates a gradient of different salinity zones, each of which supports distinct and fairly characteristic communities of plants and animals:

Tidal Freshwater Zone: Salinites in this zone never rise above about 0.5 o/oo. The dominant plant communities in the tidal freshwater zone of the Suwannee estuary are forested swamp systems. These are hardwood swamps dominated by cypress, swamp tupelo, ash, bay, cabbage palm, red cedar, maple, and mixed oaks. Although dominated by what appears to be a freshwater wetland community, these swamps include a number of estuarine species; including invertebrates such as red-jointed fiddler crabs, olive nerite snails, blue crabs and grass shrimp; marine red algae on the tree trunks, and estuarine fish such as mojarra, sheepshead, atlantic needlefish, gray snapper, and mullet.

Oligohaline Zone: Salinities in this zone range from 0.5 to 5 o/oo. The dominant habitat of the oligohaline zone in the Suwannee estuary is the brackish marsh, dominated by sawgrass, black rush, giant reed and bulrushes. Also important habitats in this zone are beds of submerged plants such as eelgrass, widgeon grass, and other submerged aquatics. These support animals such as estuarine grass shrimp, mud crabs, needlefish, menhaden (an important baitfish) and birds such as clapper rail, wading birds, and osprey. The importance of oligohaline habitat areas in estuaries is now beginning to be widely recognized. Rozas and Hackney (1983) identified 25 species of finfish and 3 species of shellfish which were economically important and which heavily used oligohaline habitat areas in estuaries.

Mesohaline Zone: Salinities in this zone range from 5 to 18 o/oo. These areas also support brackish marshes and submerged grass beds and have habitat values similar to those of oligohaline areas. An additional important habitat in mesohaline areas are oyster reefs and bars. These are areas composed of and dominated by the eastern oyster; a bivalve mollusc. Other animals of the reefs include mussels, snails, crabs, snapping shrimp, other crustaceans and reef dwelling fish such as gobies and blennies. Oyster reef fauna also includes birds such as american oystercatcher ruddy turnstone and other shorebirds which use the reefs when they are exposed at low tide. In addition to being an important estuarine habitat, oyster areas are a valuable economic resource.

Polyhaline Habitats: Salinities in this zone range from 18 to 30 o/oo. Habitats in these areas include salt marshes, dominated by smooth cordgrass and black rush; seagrass beds (usually vegetated with widgeon grass, shoal grass and turtle grass,

and/or pinwheel grass); and unvegetated sand and mud flats, which can be immensely productive habitat areas for shrimp and other estuarine animals (Peterson and Peterson, 1979).

Euhaline Habitats: These are the "true marine" habitat areas generally averaging 30 o/oo in salinity or greater. They include salt marshes, seagrass beds (vegetated with shoal grass, turtle grass, manatee grass, and benthic algae), intertidal and subtidal flats, and oyster reefs. The value of these areas for fisheries and other aquatic organisms has been well studied in many estuaries on the east coast of the U.S. Summaries may be found in Weinstein (1979), Durako and others (1985), Lewis and others (1985) and Day and others (1989).

A critical need for management of the Suwannee estuary is a better understanding of the relationship between freshwater flow and the distribution of these different salinity zones.

Transitional and Terrestrial Ecosystems and Habitats

Transitional Habitats

The transitional habitats (those ecotone areas between wetland and upland communities) and the terrestral 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 bakeri*, 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.

Low pine flatwoods. These are areas dominated by a sparse overstory of pine (slash or loblolly pine) with an understory of fetterbush, gallberry, mixed sedges, and rushes.

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

Terrestrial Habitats

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. The importance of these

upland resources to the basin is involved with their role in recharging the groundwater resources of the basin which feed the springs emptying into the Suwannee River.

Fish and Wildlife Resources and Protected Species

The Florida Rivers Assessment, issued by DNR in 1989 (DNR, 1989), provides a good overview of the biological resources of the basin. Four biological communities recognized as critically imperiled by the Florida Natural Areas Inventory are known to occur in the river basin. These are: aquatic cave habitats, sandhill, spring-run stream habitats, and xeric hammock. These communities support a number of species with protected or designated status (see below).

The Suwannee River Basin appears to represent a zone of biogeographic transition in Florida in that a number of species reach the southern limits of their distribution in the river's basin. Roughly half of the native fishes of Florida reach the southern and eastern limits of their distribution in the Suwannee basin (Bass and Cox, 1985). Riverine invertebrates include a number of species more characteristic of mountain streams, such as stoneflies (Cox, undated report). The cedar elm, a tree found in bottomland hardwood swamps along the river, represents a disjunct population found only in the Suwannee basin (its typical range is in the Mississippi basin). Other trees, overcup oak and white oak for instance, appear to reach their southern and eastern limits in the Suwannee basin (Kurz and Godfrey, 1962). The Suwannee basin thus has a number of unique biological attributes about which more needs to be learned in order to afford protection to these resources.

DNR (1989), citing other studies, lists 54 species of fishes as occurring in the Suwannee basin. Riverine fish communities are dominated by redbreast sunfish (Bass and Cox, 1989). Principle sportfishes are various bream species (bluegill, red breast, shellcracker, and stumpknocker), catfish, largemouth bass, and Suwannee bass. The river supports what appears to be the only remaining naturally functioning population of the threatened Gulf Sturgeon in the eastern Gulf of Mexico (Barkuloo, 1988). These fish are anadromous, living their adult lives in the Gulf but traveling upriver to spawn. During these spawning runs, the spring habitats and outflows in the river appear to provide areas where the gravid cows rest to allow their eggs to mature (Barkuloo, 1988 and S. Carr, pers comm.). The young sturgeon initially live in the upper Suwannee River (R. A. Mattson, pers. observation), but gradually migrate to the Gulf as they grow.

A number of species of wildlife use the river basin; 39 species of amphibians, 73 reptile species, 232 bird species, and 42 mammal species have been listed as occurring in the basin (DNR, 1989). Wildlife use of the resources of the basin is considered to be high, due to the relatively undeveloped nature of the area. A number of species 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 U.S. Fish and Wildlife Service; those

Table 7. List of protected species and their status which have been observed or reported to occur in the Suwannee River Basin. English names only are used. (E = endangered; T = threatened; UR = under review; SSC = species of special concern.)

SPECIES	STATUS (federal	state)
Hobb's Cave Amphipod	UR	-
Atlantic Sturgeon (Gulf subspecies)	UR	SSC
Suwannee Bass	-	SSC
American alligator	T	SSC
Atlantic loggerhead turtle	T	T
Atlantic green turtle	E	E
Suwannee Cooter	UR	SSC
Alligator snapping turtle	UR	SSC
Gopher Tortoise	UR	SSC
Eastern Indigo Snake	T	T
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
Limpkin	-	SSC
Florida Sandhill Crane	-	T
Brown pelican	-	SSC
Florida mouse	UR	SSC
Florida black bear	UR	T
West Indian manatee	E	E

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; species listed by the Florida Natural Areas Inventory as element occurrences G1-G3 or S1-S3; 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 DNR (1989). A listing of selected vertebrate species which have been observed or reported from the basin is provided in Table 7. Note that this list is not intended to be exhaustive but simply to point out some of the more familiar species.

Population Profile

A discussion of the demographic changes both in the basin and in the state serves to illustrate the existing and potential impact of population growth on the Suwannee River. Currently, the State of Florida is experiencing significant population growth; it is estimated that about 800 persons move to the state per day. By the year 2000, Florida is expected to become the third most populous state in the nation with a projected population of 14.7 million (BEBR, 1986). Most of Florida's new residents settle in the more heavily urbanized south and central portions of the state, particularly near coastal areas. With these trends expected to continue, the more rural areas of North Florida are not expected to experience growth as rapidly in actual population numbers.

Migration patterns, however, suggest that residents within the state are now finding the less urbanized areas more attractive. Lower land prices, reduced crime, and natural amenities (rivers, streams, lakes, and forests) continue to attract new development to the North Florida area. The environmentally sensitive nature of these areas (groundwater recharge, tendency to flood), however, often makes these areas the least suited for development. Thus, population increase can be equated to an increased threat to water resources and the natural systems of the Suwannee River. Fortunately, many of the impacts can be avoided or mitigated with proper planning and land use controls.

An examination of population trends and projections is relevant for water resource planning since the changes in natural systems caused by human activities affect surfacewater systems to a large degree. Analyzing the trends in population change allow general correlations to be drawn between population characteristics and change and the quality of natural systems such as the Suwannee system. Likewise, by projecting future populations, potential impacts of growth on water quality can be estimated. This allows for the development of policy alternatives to offset the negative impacts of growth and development.

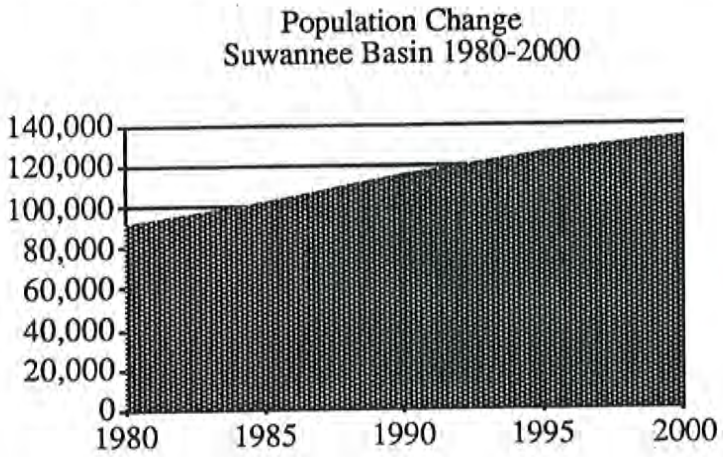
Population change in the Florida counties of the Suwannee basin for the period from 1970 to 1987 was 60%, compared to the statewide figure of 77.3% during the same period (BEBR, 1988). The smaller rural counties have high percentage

increases in population both in the recent past as well as for projections, even though the actual numbers are smaller. Table 8 and Figure 10 illustrate the population change projected for the population residing in the Suwannee basin. The 1980 population figures represent the proportion of each county's total population residing within the Suwannee Basin. The projections are based on the assumption that the proportion of total county population living in the basin will remain the same in each county from 1980 through 2000.

Table 8. Suwannee Basin Population Estimates and Projections*

	1980	1985	1990	1995	2000
Columbia	35,399	39,358	44,531	48,877	52,299
Dixie	2,775	3,296	3,978	4,447	4,828
Gilchrist	5,445	6,617	7,445	8,149	8,718
Hamilton	8,761	9,221	10,515	10,953	11,249
Lafayette	3,191	3,558	4,348	4,724	5,024
Levy	5,780	6,533	7,565	8,402	9,074
Madison	7,342	7,702	8,243	8,619	8,883
Suwannee	22,287	25,355	28,316	31,093	33,280
Total	90,980	101,640	114,941	125,264	133,355

Figure 10. Suwannee Basin Population Estimates and Projections*



Source: Governor's Office Projections, 1990 SRWMD Projections, 1988

* - based on proportion of 1980 population within the Suwannee River Basin

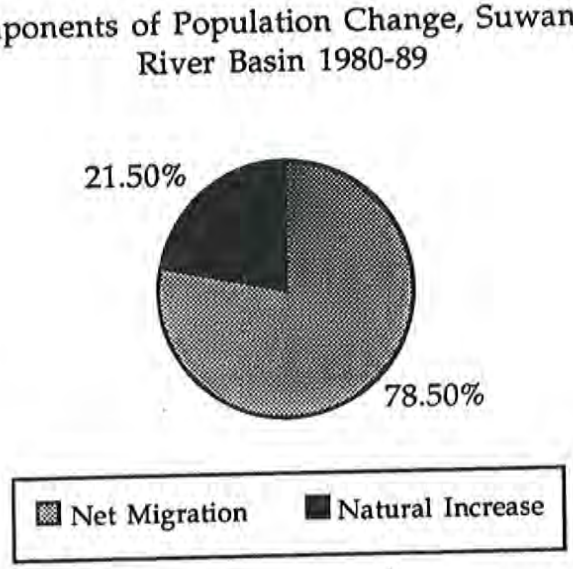
Collectively, the factor most influencing population change within the counties of the basin was net migration--the number of new residents within the basin, less those moving out. As Figure 11 illustrates, over 78% of the population growth in the basin from 1980 to 1989 is attributable to people moving into the area. This means that natural increase--births minus deaths--is less a factor influencing population growth than the influx of new residents. The percentages of population change accounted for by either natural increase or net migration between counties within the basin varies considerably as shown in Table 9. A correlation can be drawn between the components of change in the counties with higher populations and larger urban centers than the more rural counties. The counties with larger populations and cities generally increased population more from net migration than from natural increase.

Table 9. Components of Population Change, Suwannee River Basin 1980-87

	1980	1989	Change	Natural Increase	%	Net Migration	%
Columbia	35,399	43,553	8,154	2,578	31.6%	5,576	68.4%
Dixie	7,751	9,866	3,081	451	14.6%	2,630	85.4%
Gilchrist	5,767	7,098	1,942	334	17.2%	1,608	82.8%
Hamilton	8,761	10,372	1,611	598	37.1%	1,013	62.9%
Lafayette	4,035	5,404	1,369	142	10.4%	1,227	89.6%
Levy	19,870	25,182	5,312	508	9.6%	4,808	90.4%
Madison	14,894	16,500	1,606	884	55.0%	722	45.0%
Suwannee	22,287	27,688	5,401	626	11.6%	4,775	88.4%
TOTAL	118,764	145,663	28,476	6,121	21.5%	22,359	78.5%

Source: BEBR, 1988

Figure 11. Components of Population Change, Suwannee River Basin 1980-87

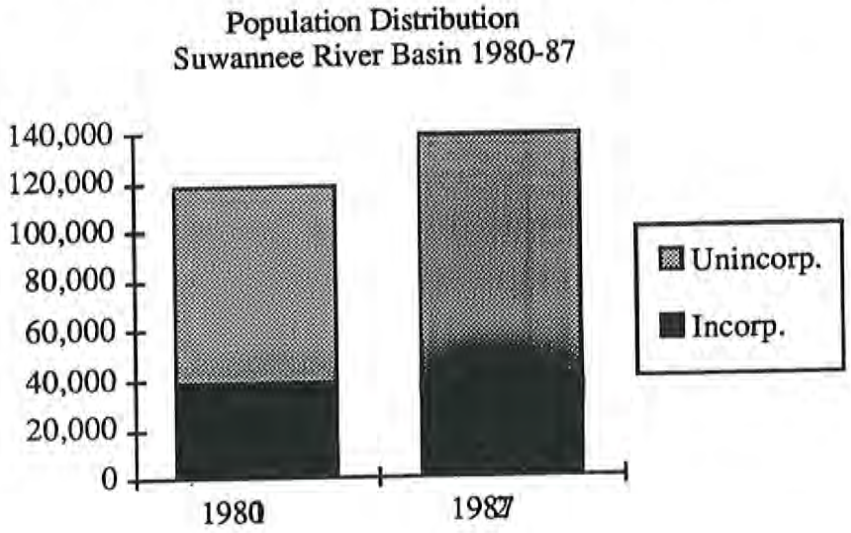


Source: BEBR, 1990

The significance of net migration as a cause for most of the basin's population increase is the increased demand for land to accommodate the influx of residents. Previously undeveloped and lesser-developed land, either natural forest, pine plantations, or farmland is increasingly being converted to more intensive uses--residential and to a lesser degree commercial lands to support the increased population. This land conversion will have an impact on the water resources of the Suwannee River system, primarily because trends indicate that the population growth is being focused on the rural, unincorporated areas of the basin.

The distribution of each county's population has changed during the 1970-1985 period as illustrated in Figure 12. The incorporated areas in each county have either lost population or maintained approximately the same number, while the majority of the county-wide population increase has been absorbed into the unincorporated areas. The implications of this decentralizing trend in the upper Suwannee counties for water quality are marked--more undeveloped and agricultural land is being converted to residential, commercial, and other urban uses. The unincorporated areas of the counties have very limited service areas for public facilities such as central sewage treatment plants, increasing the reliance on septic tanks. A high density of septic tank systems, particularly in marginal quality soils (poor percolation, susceptible to flooding) or along river floodplains, poses a significant nonpoint source threat.

Figure 12. Population Distribution in the Suwannee River Basin, 1980-1987.



Source: BEBR, 1988

This combination of factors illustrates the potential for increased threats to the Suwannee River system. Steadily increasing population growth, higher proportions of population growth attributable to in-migration, a continuing decentralizing "move to the countryside" trend, and the demand for waterfront property exhibited throughout the state, all indicate that the projections for the basin illustrated above will very likely be focused toward the river system. These projections should be considered to be conservative estimates. It is likely that the proportion of each county's total population residing within the Suwannee basin will increase, with all other factors held constant.

Economic Profile

The changes in the economy of the region, like population changes, can also illustrate relationships between human activities and water quality. Primary (extractive) activities can have different impacts on water quality than manufacturing or service-oriented activities. For example, agricultural activities can impact water quality through erosion and sedimentation, leaching of pesticides and herbicides, or animal waste runoff. Industrial manufacturing, heavy commercial, and retail/wholesale activities can impact water quality through stormwater runoff, the use, storage, and disposal of toxic and hazardous wastes and materials, and water withdrawal and discharge.

Agriculture has been declining as an economic mainstay of the predominantly rural counties of the Suwannee basin, mirroring a national trend. The share of the region's economy in the combined primary activities of farming, forestry, and mining has declined during the last half-century from 53% of the workforce in 1930 to just 12% in 1980 (Bell, 1986). The shift to manufacturing and service sectors of the basin's economy mirrors national trends.

The commercial and recreational fisheries associated with the Suwannee River represent the single greatest economic sector directly associated with the river system--and the sector most dependent on the continuing health of the river system. The single greatest threat to this sector is declining water quality over time as well as the occurrence of particular periods of poor water quality. As indicated in Table 10, the coastal area around the Suwannee estuary is an important commercial fishery, with landings in 1986 totalling nearly 6 million pounds. Commercial boat registrations for 1988 total 912, indicating a relatively large number of residents involved in the commercial fisheries sector of the local economy. Oysters are an important component of the commercial fisheries of the region, as most of the oysters are harvested within the Suwannee estuary. Since oysters are particularly sensitive to pollutants (i.e., bacteria), the oystering operations are shut down during periods of heavy rainfall due to the influx of contaminated water from upstream. Considerable areas of the Suwannee estuary are now closed or restricted for harvest of oysters.

Table 10. Fisheries Landings and Commercial Boat Registration, 1988

Landings, in pounds		Commercial		
County	Fish	Shellfish	Total	Boats
Dixie	2,124,964	1,699,948	3,824,912	545
Levy	392,806	1,484,170	1,880,976	367
TOTAL	2,517,770	3,184,118	5,705,888	912

Source: BEBR, 1990

The recreational fisheries of the Suwannee River system are not insignificant, although quantifying the economic gain from this sector is made difficult due to the lack of consistent reporting of landings and income derived from the activities. Both the Suwannee River (and its tributaries) and the estuary and coastal area are heavily used by recreational anglers, particularly on weekends and holidays. Based on creel surveys conducted by the FGFWFC, the Suwannee River has one of the highest quality freshwater sport fisheries in the state. Largemouth bass, various species of bream, and catfish are among the most sought-after freshwater gamefish

species; speckled sea-trout, redfish, mackerel, and flounder are among the more popular saltwater species. Numerous small commercial operations catering to the sport fishery industry exist through out the basin, including small bait and tackle shops, boat ramps and marinas, guide services, boat rental operations, and other related businesses. Although difficult to quantify, the economic value of a healthy sport fishery, both fresh and saltwater, is a significant component of the economy of rural, largely undeveloped areas such as the Suwannee River Basin.

Land Cover and Land Use

From a general perspective, the predominant land use in the Suwannee basin in Florida is agriculture, including silviculture, traditional row crops, and pasture. Almost half the land area in the counties within the basin is devoted to developed uses--primarily agriculture. A significant portion of eastern Hamilton County in the upper river basin is devoted to phosphate mining. Urban areas along the river are limited to the municipalities of White Springs, Branford, Fanning Springs, and the town of Suwannee. Developed communities along the river include Dowling Park and Fowler's Bluff, as well as numerous residential subdivisions in varying stages of development throughout the river corridor.

The lower Suwannee basin is largely forested and undeveloped, interspersed with agricultural and silvicultural uses. Developed land uses adjacent to and within the basin of the lower Suwannee have historically been low-intensity and agricultural in nature. Early writings that describe human activity along the lower Suwannee in the 18th and 19th centuries portray a sparsely populated area of small communities subsisting on agriculture, fishing, and hunting. Towards the early 20th century, logging developed as an important activity within the basin as the once vast native forests were cut over and left bare.

Recognizing the important relationship between land use/land cover and water quality, the SWIM program for the Suwannee River identified land cover information as one of the top priority tasks (SRWMD, 1988). The SRWMD has obtained satellite imagery from April 1988 for the Suwannee River Basin in a digitized format for (GIS) mapping and analyses. Figure 13 shows the general land cover of the counties in the Suwannee River Basin and Table 9 lists the acreages in each of the land cover classifications. In Figure 13, developed land cover includes urban, agriculture, mining, and silviculture, while the upland and wetland categories include generally intact forested or vegetated areas.

Figure 13. General Land Cover in the Suwannee River Basin, 1988

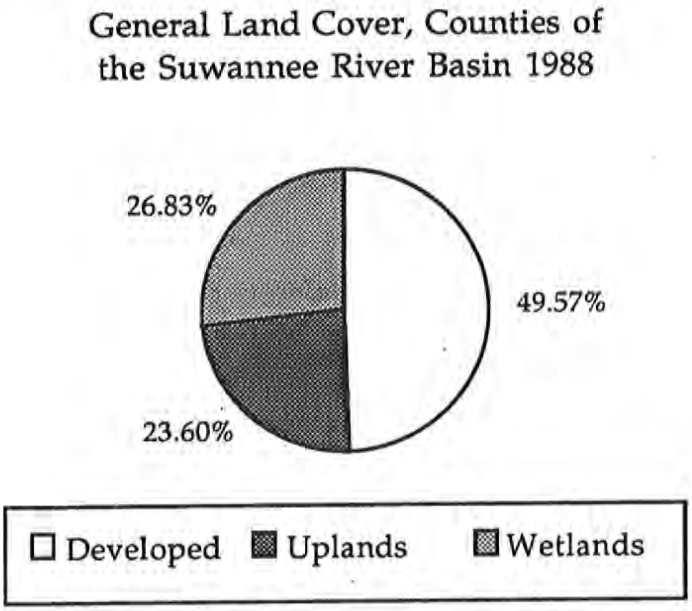


Table 11. Land Cover Classifications, Counties of the Suwannee River Basin. Florida Land Use, Cover, and Forms Classification System Codes.

FLUCFCS CODE		Basin Total
110	Residential	20,444.1
140	Commercial	7,343.1
150	Industrial	50.2
160	Extractive	27,506.7
210	Agricultural	645,106.0
320	Shrub/Bush	453,345.4
322	Coastal scrub	5,186.2
421	Xeric oak	84,339.8
425	Hardwood	130,657.4
427	Live Oak	10,130.1
432	Sand/live oak	6,503.5
434	Hard/Con mix	137,119.5
441	Pine plant.	971,252.5
510	Streams	6,785.2
520	Lakes	13,770.2
611	Bay swamps	2,870.7
613	Gum swamps	4,604.2
614	Titi swamps	13.2
615	Str/lk swamp	26,078.4
617	mix wetl. hard	158,947.5
618	willow wetl.	5,183.7
621	Cypress	101,577.4
624	Cypress mix	4,293.1
630	Wetl. for. mix	511,152.5
641	Fresh marsh	34,737.3
6411	Sawgrass	4,369.1
6421	Cordgrass	6,854.7
6422	Needlerush	48,626.6
6423	High marsh	5,448.4
644	Emerg. aquatic	20.9
6442	Spatterdock	2,952.7
646	Scrub wetland	559.3
651	Tidal flats	1,655.8
700	Disturbed	65,655.9
	Total	3,505,141.3

The impact of primary land uses on water quality has changed relative to the level of technological innovation. Early agricultural practices had little impact, if any, due to their small scale and farming practices. With the advent of mechanized, irrigated, fertilizer- and pesticide-dependent practices, however, the impact of agricultural land uses on the quality (and sometimes quantity) of adjacent waters is marked. Logging and timber production, however, probably have less direct impact on surface waters at the present time than in the past. During the later 19th and early 20th centuries, timbering activities increased until virtually all of the virgin timber had been rapaciously cut. Little attention was paid to controlling runoff, erosion, and siltation from clearcutting activities. It was only after the middle of this century that any large scale replanting or silvicultural activities developed, along with better managed forestry practices aimed at reducing these impacts.

Changes in land use within the basin have three major impacts to the river system:

- alterations of the river's hydroperiod,
- changes in water quality from point and nonpoint source discharges of pollutants, and
- the disruption or destruction of fish and wildlife habitat.

As land is converted to more intensive uses--from farm fields to shopping center parking lots--the pattern of rainfall drainage is altered. Increased impervious areas as well as topographical changes in the land's surface contribute to increases in the amount and intensity of rainfall runoff. Disruptions to natural vegetation and undisturbed land surfaces introduce contaminants to the hydrologic cycle of the river system. These pollutants have significant impacts on the entire food chain of the river system which has evolved on a dependence on the natural water quality of the system and the more gradual changes caused by natural alterations. More directly, point source discharges can adversely affect the water quality of the system significantly, and in localized areas. The impacts of point source discharges can reverberate throughout the biota of the system. Finally, changes in the river system's land cover and vegetation, hydrology, topography, and other features affect the quality and availability of habitat for fish and wildlife species. Many native species cannot tolerate disturbances to the natural systems they have evolved a dependence on and are extirpated when more intensive land uses are introduced.

Water Resource Use

The Suwannee River and its principal tributaries have been used historically as transportation corridors, limited sources of potable water and irrigation, and as sources of recreation and food (fisheries). Evidence indicates that the Suwannee River area was settled prior to the coming of European peoples by several native American tribes. The location and extent of such settlements in the river basin is only partially understood.

The lower Suwannee area has been settled by European peoples since this area of the southeastern U.S. was first settled in the late 18th century. William Bartram describes several small settlements of white and Indian families in his Travels, published in 1791. His descriptions of the river, which he calls the "little St. Juan" (thought to be one possible origin of the name Suwannee--the other being the Indian name "Sawani" meaning "echo river") are as follows:

> "The river Little St. Juan may, with singular propriety, be termed the pellucid river. The waters are the clearest and purest of any river I ever saw, transmitting distinctly the natural form and appearance of the objects moving in the transparent floods or reposing on the silvery bed, with the finny inhabitants sporting in its gently flowing stream.
>
> The river at the town [the Indian settlement of Talahasotche] is about two hundred yards over, and fifteen or twenty feet in depth. The great swamp and Lake Oaquaphenogaw is said to be its source, which is about one hundred miles by land North of this place; which would give the river a course of near two hundred miles from its source to the sea, to follow its meanders; as in general our rivers that run any considerable distance through the country to the sea, by their windings and roving about to find a passage through the ridges and heights, at least double their distance.
>
> The Indians and traders say that this river has no branches or collateral brooks or rivers tributary to it, but that it is fed or augmented by great springs which break out through the banks."

Bartram had traveled from Florida's east coast westward, passing what he called Alachua Savanna--likely what is known today as Payne's Prairie, southeast of Gainesville. He described the clarity of the river, probably in the vicinity of Manatee Springs, as being different from the typical darker-colored waters of the coastal plain. It is likely that he saw the river at a period of low flow conditions, during which spring flow from the springs of the Suwannee and Santa Fe make up virtually all of the river's flow--hence its clarity. Usually, the river is distinctly tannin-stained throughout its length and during periods of higher flow can appear more turbid than normal.

Historical use of the river was predominantly a transportation corridor, with regular steamer traffic being conducted to the early 20th century. Streamer traffic originating from Cedar Key to the limits of navigability at Ellaville (and Fort White on the Santa Fe) carried mail and trade goods up the river and lumber and other resources downstream. Facing a challenge in the mid-1800's, Captain James Tucker travelled all the way upstream to White Springs on the steamer Madison to prove it could be done--a feat previously thought impossible. The trip could only be taken during a period of high water, when enough water in the river allowed the boat to clear the shoals in this shallow section of the river. High water also meant the boat was closer to the overhanging trees--the steamer lost its pilot house and smokestacks along the way. The boat was later scuttled in Troy Springs during the Civil War to avoid capture by Federal forces, where its few remains still lie.

Currently, the primary human uses of the Suwannee Basin's water resources are as recipients of domestic and industrial effluent discharge, a source of cooling water for power generation, recreation in the form of fishing and boating, commercial fisheries in the estuary, and limited agricultural water supply. The Suwannee River's single most popular use appears to be recreation. This use, with proper controls, is the most compatible with the preservation of the river's water quality, the most sustainable, and at the same time economically beneficial to surrounding communities. With the projected increase in the State's population, particularly urban/suburban populations, the demand for quality outdoor recreation experiences will increase. Hence, the use of the Suwannee River's surface waters for recreational purposes can be expected to increase.

Projected uses of the surfacewater resources are likely to be a continuation of existing uses. The designation of the Suwannee as an Outstanding Florida Water (OFW), requiring that no discharge into the river may degrade the existing (at the time of designation) ambient water quality should serve to prevent future degradation from DER-permitted point sources. An integral component in the protection of the river's water quality is the establishment of an expanded water quality and biological monitoring network, which will help to detect any water quality degradation.

Land use designations for the river corridor by local units of government in their comprehensive plans are limited to recreation, low density residential, conservation, agricultural, and forestry. Existing urban areas described above are limited as to how close to the river they can extend largely by the requirements of the 1985 Growth Management Act and Rule 9J-5, FAC, as well as by local land development regulations intended to implement the local plans.

III. Priority Issues and Analyses

This section describes the major issue areas affecting the Suwannee River system. The purpose of presenting these issues and related analyses is to prioritize the issues within the plan and subsequently in implementation efforts. Recognizing that myriad factors influence the river system, and that there are limits to the resources which governmental agencies, industries, communities and individuals have at their disposal to address issues, it is necessary to prioritize the most critical issues. The priority issues which are identified within this section include:

- pollution source (point and nonpoint) identification and reduction, including improved water quality standards
- resource monitoring
- technical assistance
- coordinated intergovernmental management
- surfacewater/groundwater interaction, minimum flows
- land acquisition
- coastal/estuarine management

- permit tracking/database
- public education and information

Pollution Sources

Most of the Suwannee River Basin is relatively undeveloped and has a low population density (with localized exceptions) and there are few sources of pollution directly on the river. Most of the river corridor (including tributaries) is forested with scattered residential subdivisions that increase in number as one progresses downstream. Agricultural uses predominate among the developed land uses in the river basin in both Georgia and Florida. The Withlacoochee and Alapaha basins in Georgia have extensive areas of agricultural use, as well as many small towns and communities. This area of the southeast U.S. has been devoted to agriculture since the region was initially settled, with many communities and towns being located in direct proximity to the two rivers.

Reducing the impact of point and nonpoint sources of pollution is the main component of protecting the water quality and natural systems of the Suwannee River Basin. Permitted point sources are known--their effluent characteristics and estimated impacts are known, as are their locations. The key to controlling their impact is through the established permitting procedures of the U.S. Environmental Protection Agency, DER, and the Georgia Department of Natural Resources.

The priority issue regarding pollution sources impacting the Suwannee River is in identifying the location, type, magnitude of threat, and remedial actions available for nonpoint sources of pollution. Similarly, unpermitted point sources, if any, need to be located and brought into compliance with federal and state regulations or abated altogether. Following is a discussion of the known pollution sources within the basin.

Point Sources

A point source of pollution can be described as a discrete, definable source such as an outfall pipe from industry or sewage treatment plants. Of the twenty point sources discharging into the Suwannee and its tributaries (Figure 14), fifteen are sewage or wastewater treatment plants, five are industrial point sources. Usually, the approach to controlling point sources of pollution involves technical applications such as tertiary level treatment of sewage, reduced pollutant output, diversion, or treatment and/or dilution of the waste stream.

There are five point sources in Florida that discharge into the Suwannee: the City of White Springs, (domestic wastewater), the Florida Sheriffs Boys Ranch (domestic wastewater) Occidental Agricultural Chemical, Inc. (industrial), GoldKist (industrial), and Florida Power Corporation (industrial).

1. The *City of White Springs* operates a 0.15 MGD design flow sewage treatment plant located east of the city. The facility treats domestic waste from a population of approximately 800, treating the wastewater by contact stabilization, a polishing pond, and chlorination before discharge into a ditch which flows eastward to the Suwannee River.

2. The *Florida Sheriffs Boys Ranch* operates a 0.20 MGD design flow sewage treatment plant located ten miles northwest of Live Oak, on the Suwannee River. Treatment of the wastewater consists of contact stabilization, a polishing pond, and chlorination prior to discharge to the Suwannee River.

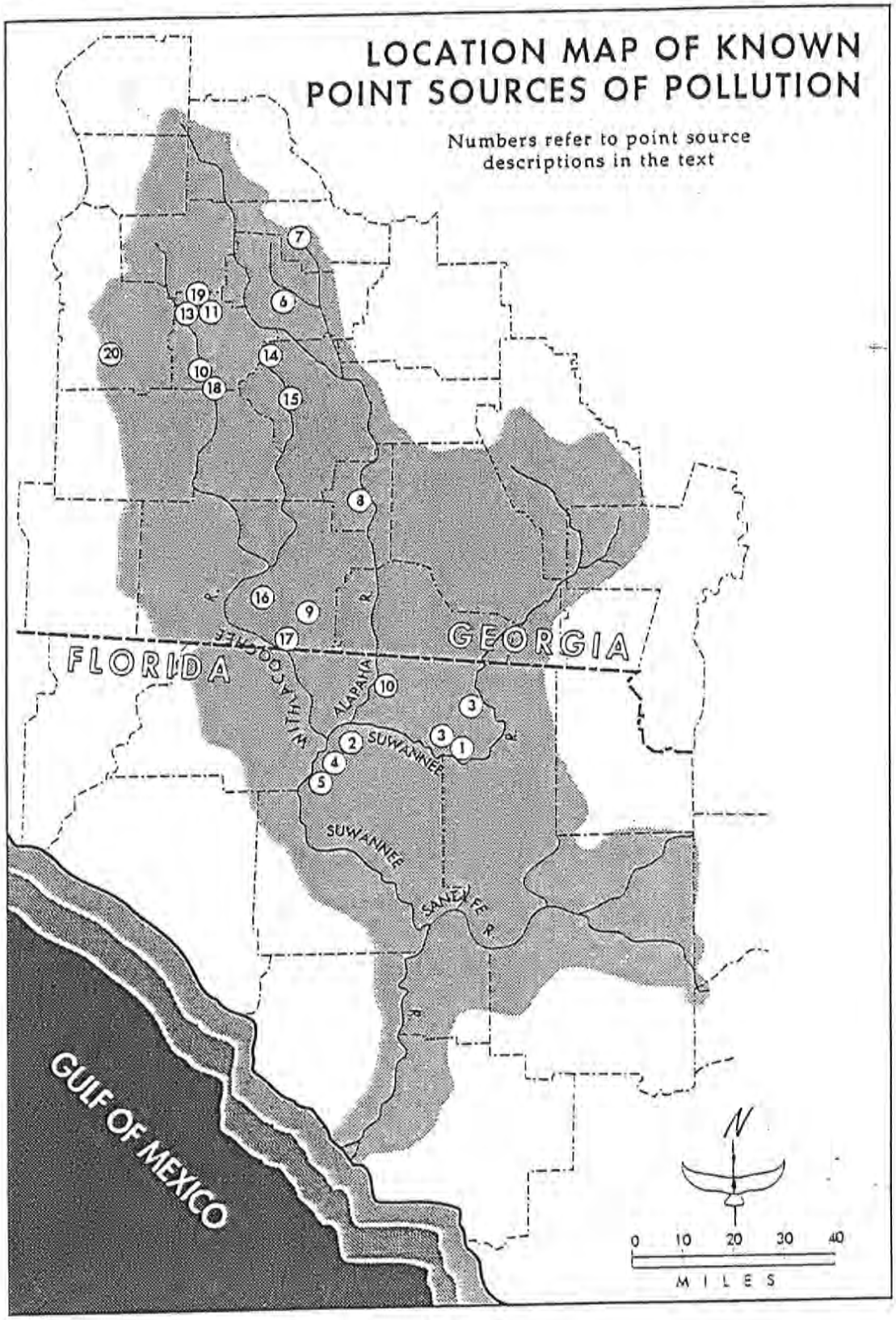
3. *Occidental Chemical Agricultural Products, Inc.* (OXY) produces phosphatic fertilizers, superphosphoric acid, and associated by-products at two chemical and mining complexes in Hamilton County near White Springs. The OXY facility includes two mines, two beneficiation plants, and two fertilizer and phosphoric acid processing plants. The processing plants produce acidic process wastewaters that undergo a neutralization treatment with lime in settling ponds. After this treatment, process wastewater is discharged to Swift Creek. Nonprocess water--consisting of vacuum pump seal water, filter vacuum scrubber water, evaporator condensate and filter skirt sprays--and rainfall runoff is discharged to Swift and Hunter Creeks and ultimately into the Suwannee. The Suwannee River Mine and Chemical Complex is permitted for a discharge of 4.32 MGD, and the Swift Creek Mine and Chemical Complex for 1.4 MGD. Treated process water is not discharged in a continuous flow, but infrequently. The effluent discharged contains phosphorus, fluoride, sulfate, nitrate, ammonia, radium, and suspended solids.

Recent improvements in water management and recirculation at Suwannee River Chemical will result in a reduction or possible elimination in normal rainfall years of the need for treatment and discharge of process water (Oxy, 1988).

4. *Florida Power Corporation* operates three oil and gas fueled power generation units southwest of Ellaville. The plant's condensor cooling system obtains approximately 176 MGD of cooling water from the Suwannee River and returns the same amount via a discharge canal to the river. Effluent in the form of heated water is the only major constituent discharged into the river.

5. *Gold Kist, Incorporated* operates a wastewater treatment facility for their live poultry processing operation located west of Live Oak, at the northernmost end of the lower Suwannee. Treatment consists of screening, primary clarification, extended aeration activated sludge, secondary clarification, a final polishing pond, and disinfection. The treated effluent contains permitted quantities of BOD_5, suspended solids, ammonia, and organic nitrogen.

Figure 14. Location map of known point sources of pollution



Point Sources: Alapaha River

The Alapaha River originates in south-central Georgia and flows south for 125 miles, joining the Suwannee in South Hamilton County. Five domestic surfacewater dischargers are found along the river, four in Georgia and one in Florida.

6. The *City of Alapaha*, Georgia, operates a sewage treatment facility with a design capacity of 0.10 MGD serving a population of approximately 700. Treated effluent is discharged directly to the Alapaha River.

7. The *City of Fitzgerald*, Georgia operates a sewage treatment plant with a design capacity of 2.3 MGD that discharges effluent into a tributary stream of the Alapaha River (Georgia DNR). Details regarding this facility are not presently available.

8. The *City of Lakeland*, Georgia, operates a sewage treatment facility with a design capacity of 0.20 MGD serving a population of approximately 2,600. This facility discharges its treated effluent into Big Creek, a tributary stream of the Alapaha River.

9. The *City of Valdosta*, Georgia, operates two wastewater treatment plants, one which discharges into the Withlacoochee River and one into the Alapaha. Serving the southern portion of the city is a 3.2 MGD design capacity wastewater treatment plant that discharges to Mud Creek, a tributary stream to the Alapaha River. The level of treatment, flow restrictions, and other information regarding this plant is currently unknown.

10. The *City of Jasper*, Florida, operates a sewage treatment facility with a design capacity of 0.40 MGD and serves a population of approximately 900. The treated effluent is discharged into Bell Creek, a tributary stream of the Alapaha.

Point Sources: Withlacoochee River

Like the Alapaha River, the Withlacoochee River originates in southern Georgia near Tifton and flows south for about 86 miles to its confluence with the Suwannee downstream of the Alapaha, at the border junction of Hamilton, Madison, and Suwannee counties. The Withlacoochee River receives more discharge from point sources than the Alapaha as it flows through a more urbanized area, with six domestic wastewater and four industrial wastewater point sources.

11. The *City of Tifton*, Georgia, operates a sewage treatment facility for domestic and industrial wastewater with a design capacity of 8.0 MGD serving a population of approximately 22,500. Tertiary wastewater treatment consists of grit removal, biological treatment, clarification, chlorination, and post aeration, with the treated effluent discharged directly into the New River, a tributary stream of the Withlacoochee.

12. The *City of Lenox*, Georgia, operates a sewage treatment facility with a design capacity of 0.17 MGD, serving a population of approximately 900. Effluent is discharged into Little River, a tributary of the Withlacoochee.

13. *Tift Oil Company*, a petroleum product distribution company, operates a 0.8 MGD facility for treating on-site domestic wastewater. Effluent is discharged to the Middle Creek tributary of New River, itself a tributary of the Withlacoochee.

14. The *City of Nashville*, Georgia, operates a sewage treatment facility with a design capacity of 0.63 MGD, discharging effluent into the Reedy Creek tributary of the Withlacoochee.

15. *Ray City*, Georgia, operates a 0.10 MGD design flow sewage treatment facility that serves a population of approximately 700. Effluent is discharged into the Cat Creek tributary of the Withlacoochee River.

16. The *City of Valdosta*, Georgia, operates a recently upgraded, sewage treatment plant with a seasonal limitation design capacity of 8.0 to 12.0 MGD serving a population of approximately 30,000, primarily in the northern portion of the city. Flow limitations are 12 MGD for January-April, 10 MGD for May, and 8 MGD for June-December. Treatment of wastewater consists of screening, grit removal, and primary clarification. The filtered influent is then aerated, chlorinated, and discharged to the Withlacoochee River.

17. *Packaging Corporation of America, Inc.*, operates a wastewater treatment system for their paper mill operation in Clyattville, Georgia, with a total system flow capacity of 12.7 MGD. The system consists of a settling basin followed by seven lagoons operated in series with wastes undergoing clarification, screening, and skimming. Discharge from the lagoons goes to Bear Garden Swamp, then to Jumping Gulley Creek, which crosses the state line and empties into the Withlacoochee River 0.5 miles downstream.

The following industrial facilities discharge wastes into the Withlacoochee River system. Information regarding these point sources was provided by the Georgia Department of Natural Resources, Environmental Protection Division.

18. *Production Anodizing, Inc.* operates a plating and polishing operation in Adel, Georgia. Effluent is discharged into a tributary of Withlacoochee Creek, which flows into the Withlacoochee River.

19. *Tifton Aluminum Co.* manufactures aluminum extruded products in Tifton, Georgia. The type and amount of effluent discharged, and where it is discharged (which tributary of the Withlacoochee River), are currently unknown.

20. *Wells Aluminum Co.* manufactures metal doors, sashes, and trim in Moultrie, Georgia. The type and amount of effluent discharged into Okapilco Creek, a tributary of the Withlacoochee River, is currently unknown.

Nonpoint Sources

A nonpoint source of pollution can be defined as a dispersed source of pollution or a source that cannot be pinpointed to one specific outflow pipe. Stormwater runoff from urban areas, roads, construction sites, agricultural and silvicultural areas, and septic tank leachate are examples of nonpoint sources of pollution. Approaches to controlling pollution from nonpoint sources involves the application of BMP's such as maintaining buffer zones, as opposed to the technological remedies that are used for point sources.

Limnology of the Suwannee River, Florida (DER, 1985) states that "...although nonpoint source discharges in the basin may be significant they have not been adequately measured." While this still holds true for the most part, the land use monitoring program initiated in 1989 as a component of the protection strategy includes the identification of major potential nonpoint sources of pollution. The water quality and biological monitoring programs will provide information useful in identifying the impact of nonpoint source pollution on the river system.

Onsite sewage disposal systems, typically represented in the Suwannee River Basin as septic tanks, are a documented source of surfacewater contamination nationwide where the systems are improperly installed or poorly maintained. Implementation efforts aimed at identifying nonpoint sources of pollution along the Suwannee River (identified in the 1988 upper and lower Suwannee SWIM plans) were initiated in September 1990. Using funds from the SWIM Trust Fund the SRWMD contracted with HRS for one year to identify and assess existing onsite systems along the river. To date the inventory has identified over 1,200 systems, of which nearly 70% are within 24" of the seasonal high water table. Of the identified violations and illegal systems, at least 90% have been corrected. Further, the presence of the survey team in the field has increased the public's knowledge of system functioning, maintenance, and regulation. This survey should be continued throughout the river system in order to more fully evaluate the impact of existing and potential onsite systems.

Additional nonpoint sources that are in need of identification and monitoring are beyond the scale of the land cover monitoring described in preceding and succeeding sections. Many of these potential and actual sources, such as underground petroleum storage tanks, abandoned landfills, and small-scale hazardous waste users and generators, are being studied by state, regional, and possibly local agencies; these data will be included in the SWIM process to identify threats to surface water quality.

Point and Nonpoint Pollution Sources Operating Without Permit(s)

At present there is no comprehensive listing of pollution sources operating without a permit. The identification of these sources, if any, including ownership, types of discharges, uses, and any other pertinent data, is one of the key elements in determining the appropriate course(s) of action for protecting/restoring the water bodies.

The process of determining the location, type, volume, and discharge of sources operating without permits involves an extensive field survey effort. For areas such as the upper Suwannee project area ,this survey will be time and labor intensive, as it is a relatively large area. This survey cannot be realistically applied to the drainage basin in the State of Georgia, effectively limiting the comprehensiveness of such an effort. However, through field surveys and cooperative efforts with other agencies, the identification of point sources operating without a permit will be included as a component of the land use monitoring program. The elimination of illegal septic tanks as part of the OSDS survey described above is an example of what such an effort can accomplish.

Point and Nonpoint Pollution Sources Operating With a Temporary Permit

There are no point sources of pollution operating with a temporary permit according to the DER Surface Water Discharge Detail Report dated 7/24/90.

Pollution Sources Currently Violating Effluent Limits or Water Quality Standards

DER and U. S. EPA reports indicate there are no known violations of water quality standards from permitted point source discharges.

Other Permitted Discharge Activities

There are no other known permitted activities discharging to the Suwannee River.

Resource Monitoring

In order to assure that any protective measures enacted are having an effect on the Suwannee River system, a comprehensive, ongoing resource monitoring system must be functioning. Equally important, the river system must be routinely monitored to detect changes in the constituents of the system (i.e., water quality and quantity, biota, land cover) and to be able to respond to those changes as they occur.

Resource monitoring is the most essential single component of the Suwannee River SWIM program. The Suwannee River SWIM program is focused on protecting the quality of the river system from degradation, thereby avoiding the costs associated with restoring a natural system--costs to the wildlife of the river, the river itself, and the public money that supports expensive restoration projects. In

order for the river system to be protected from degradation, river managers must have a thorough understanding of the dynamics of the river system (i.e., water quality, biota, etc.) and the distinction between natural and anthropogenic factors affecting the river.

The SWIM program established a resource monitoring program for the Suwannee River in early 1989 aimed at documenting the long-range, basinwide changes occurring in the system. The monitoring network for water quality and biological constituents was designed to characterize the river chemically, seasonally, and areally; as well as to discern longer-term trends in the river system. Although not specifically designed to monitor individual point sources or specific impacts to the river system, the system should enable staff to isolate river reaches exhibiting unexpected or unusual phenomena. It is from this knowledge and understanding of the river's water quality and the health and abundance of indicator organisms that appropriate, informed management decisions can be made.

The key issue with resource monitoring within the Suwannee River Basin is in the continued support, refinement, and implementation of monitoring strategies.

Technical Assistance

As discussed earlier, the counties and cities within the basin have not experienced the tremendous growth rates that much of the rest of the state has, and have subsequently not been active in land use planning and regulation. The requirements of the 1985 Growth Management Act reversed that by making it mandatory for local governments to plan and regulate the future development of their communities. Specific minimum requirements for the local plans for resource protection and land use allocation are stated in Chapter 9J-5, FAC. The communities within the basin are developing and implementing plans and regulations to meet the requirements.

The tie between land use and water quality, habitat, and resource values is of paramount importance in the Suwannee River Basin. Sound, effective land use planning and land development/management regulations are a critical component of the management strategy for the Suwannee River Basin. Thus, it is essential that the SWIM program for the Suwannee River provide the technical assistance needed to ensure that land use planning and regulation effectively account for the needs of the river system. The information being developed through the SWIM program can be an important component of local planning and regulatory programs, as well as in the review of individual development proposals. In order for this information to be acted upon and effective, it must first be developed, analyzed, made available, and interpreted by those with the appropriate expertise.

The databases developed for GIS analysis and map production are the cornerstone for technical assistance efforts. Maps identifying and categorizing soil types, hydrologic regime and/or flooding, habitat areas, vegetative cover, drainage

patterns, etc., are needed by the local governments to bridge the gap between narrative policy statements and on-the-ground actions. Staff resources to develop, analyze, produce, and interpret the GIS products are required for a technical assistance program to be effective.

The SWIM program for the Suwannee River must have as one of its principle components an active technical assistance program for local government land use planning and regulation. No other source of comprehensive surfacewater management assistance exists within the basin for local governments.

Coordinated Management Efforts for the Suwannee River Basin

The Suwannee River has been the focus of attention for various management strategies, apart from navigational projects, for the last several decades. The river system has been recognized as one of the last large free-flowing streams in the southeast, as well as for the largely undisturbed shoreline and floodplain. Development pressures have resulted in a river that is quite different from that which existed a few short decades ago, largely due to areas of relatively intense riverfront development. Each of the major management initiatives in the past have been brought about by a particular crisis situation, in response to development proposals or activities, or in response to specific legislation or programs. To date there has not been a successful, ongoing, comprehensive management program for the river system.

The key issue in past as well as future management efforts for the Suwannee River system in its entirety is in continued intergovernmental and interagency cooperation and coordination. To ensure that the nearly sixty entities with some sort of management capacity over the river system act in unity, it is essential that a vehicle for such cooperation and coordination exists. This vehicle needs to be:

- recognized as legitimate by the parties involved
- have a clear definition of its scope and purpose
- have enough authority vested in it to be able to correct identified deficiencies or to actively promote programs
- be inclusive of all affected sectors (adequate representation),
- meet regularly
- be ongoing and open-ended, and
- be receptive to new ideas or approaches.

Committees comprised of representatives of each of the affected groups have served the "people" side of the equation for the last decade and a half (as discussed below), but there has not been a single, ongoing program to encompass the work of such committees--an "institutional" side of the equation. The Suwannee River SWIM program is the ideal framework for both sides of the equation, as recognized in the Suwannee River Task Force report and the Governor's Executive Order 90-14.

Following is a brief description of the major management initiatives in the recent past.

Wild and Scenic River Designation

The Suwannee was proposed for National River designation in the early 1960's by the National Park Service, a program that would have acquired lands along the river for a linear park. That proposal never materialized, but later evolved into the federal Wild and Scenic Rivers program. The Suwannee was proposed for a protection/management effort in the late 1960's as one of the original study rivers for inclusion in the first Wild and Scenic Rivers bill. That effort never materialized during the development of that program in the late 1960's and early 1970's, due in large part to the combination of local opposition and a lack of support from the area's congressional delegation. The issue resurfaced during the Suwannee River Task Force meetings in 1989 and resulted in a recommendation in the Governor's Executive Order 90-14 aimed at an educational program about Wild and Scenic River designation. Changes in the federal program since its inception have allowed for state-managed river systems, very similar in some aspects to the SWIM management strategy for the Suwannee River.

Suwannee River Authority

The Suwannee River Authority (SRA) was organized in 1957 by the state legislature for the general purposes of developing the river, its tributaries, or other water features within the basin for public recreation and, later, for pollution control. The SRA was empowered with overly broad authority over the river system, but never developed a comprehensive management strategy for the river system. In fact, the SRA was limited both in scope and in practice to those works deemed beneficial to human recreational use and economic development of the river system with little or no regard for the ecological consequences of such activities as constructing dams, blasting shoals, and dredging navigational channels. The SRA contracted the USGS to conduct water quality sampling at various locations along the river in the 1970's and 1980's. Also, the SRA encouraged the retention of a voluntary 50' streamside buffer along the Suwannee for maintenance of scenic values. Funding for the SRA was discontinued in 1986; the organization is currently defunct.

Suwannee River Resource Planning and Management Committee

The Suwannee River Resource Planning and Management Committee was formed by Governor Bob Graham in 1980 under Chapter 380.045, F.S., in response to inappropriate development along the river. The Committee membership was comprised of local government representatives, state and regional agency personnel, and industry and special interest groups. The objective of the committee was to organize a voluntary, cooperative resource planning and management program to resolve existing, and prevent future, problems which may endanger the resources, facilities, or areas that can be considered for critical area designation. Specifically, the

Committee was charged with identifying problems, proposing solutions, and assessing the capability of state, regional, and local government to implement the proposed solutions. A possible outcome of the Committee's work could be, through the recommendation of the state land planning agency, designation of the area as an Area of Critical State Concern, should the voluntary management program prove ineffective.

The Committee met during 1980 and 1981 and adopted the Suwannee River Management Plan on November 6, 1981. The thirty-five recommendations comprising the plan were grouped under nine major issue areas, including floodplain management, water supply, stormwater management and drainage, water quality modeling, wastewater, wetlands and estuarine protection, dredge and fill, recreation, and scenic protection. Implementation actions are listed for each of the involved agencies, detailing steps to be taken to accomplish each recommendation.

The most significant of the recommendations involves a model floodplain management ordinance, which was eventually adopted by each of the local governments along the Suwannee River system. Essential components of the floodplain management strategy included detailed floodplain mapping undertaken by the SRWMD and the U.S. Army C.O.E., land acquisition, and enforcement of dredge and fill violations.

The Committee's work was an important early step in the evolution of a comprehensive management strategy for the Suwannee River by establishing a framework of issues needing action by the various entities involved with the river. The Florida Department of Community Affairs (DCA), acting as the state land planning agency, conducted an evaluation of the implementation of the 35 recommendations, prepared a set of recommendations for further implementation, and made a determination on the designation as an Area of Critical State Concern. In general, the DCA found that implementation by state and regional agencies was satisfactory but implementation by local governments was not satisfactory. The passage of the 1985 revisions to Chapter 163, Part II, F.S. (the Local Government Comprehensive Planning and Land Development Regulations Act) has had a substantial impact on the further implementation of many of the Committee's recommendations--now local governments are required to appropriately plan for future development in the basin and to apply certain protective measures within local plans.

Suwannee River Task Force

The Suwannee River Task Force was created by Governor Bob Martinez in 1988 with the signing of Executive Order 88-246. The Task Force was formed to evaluate, analyze, and report to the Governor on the effectiveness of current planning, regulatory, and land acquisition programs and to develop a plan for the future protection and management of the Suwannee River and related resources.

Members of the Task Force included state and regional agencies, local governments, industry representatives, and environmental groups. Although the Task Force does not have the statutory background of the Resource Planning and Management Committee (i.e., Chapter 380, F.S., authority), there exists a high degree of similarity in the issues each of the groups faced. In fact, the Task Force may appropriately be considered to be an extension or evolutionary phase of the original Committee in that many of the predominant themes from the first group were carried forward and furthered by the second.

The Task Force met during 1989 and developed a final report, presented to the Governor in November 1989. The report includes 44 recommendations under ten general headings of floodplain development, provision of buffers/setbacks, boating restrictions, land acquisition planning and funding, water quality, septic tanks and wastewater management, intergovernmental coordination, recreation, Wild and Scenic designation, and wildlife habitat. The Task Force recognized that two planning programs affecting the river system currently exist, as do various regulatory programs, and that these programs should be emphasized as the means to implement the recommendations rather than an attempt to establish new programs. These two planning programs are the SRWMD's SWIM program for the Suwannee and the local government comprehensive plans required under the 1985 Growth Management Act. Other existing programs were recommended to be used to the greatest extent possible, including regulatory programs of local, regional, and state governments.

On January 17, 1990, Governor Martinez signed Executive Order 90-14, endorsing the Task Force report with minor modifications, and directing/requesting the various agencies involved to implement the recommendations. The Executive Order named the SRWMD as the lead agency in the implementation of the report, and created an oversight committee to oversee the implementation efforts and make recommendations for any changes deemed necessary. Following this directive, the SRWMD created the Suwannee River Coordination Committee (SRCC), made up of the same representatives on the Task Force and several local representatives not originally included. In June 1990, the SRCC adopted a work plan detailing the tasks and actions to be undertaken by the parties responsible for implementing the 44 recommendations. This work plan is included as Appendix F.

Of the forty-four recommendations, several have direct linkage to the SRWMD's SWIM program and several more have indirect linkage. The SRWMD SWIM program for the Suwannee River will emphasize the completion of those tasks for which SWIM is best suited to accomplish. The projects and tasks associated with the Task Force recommendations are detailed in the Management Strategies and following sections.

Surfacewater/Groundwater Interaction

Despite many years of various studies by state and federal agencies and universities, there still exists a need to develop a more thorough understanding of the interaction of ground and surface waters within the Suwannee River Basin. The variability in flow of the river system and the significant input of base flow from springs and seepage within the river corridor combine to increase the importance of more fully understanding the relationship between these two components of the river system. Such an understanding would provide a basis for the establishment of low flow standards and/or regulations relating to water quality and water quantity concerns.

These two areas of concern predominate: the amount and quality of water. The amount and conditions of interchange between surface and ground waters and the factors infuencing the disposition of one source in relation to the other (i.e., during low- or high-flows, low or high groundwater levels) is crucial to management of the river system in its entirety. The effect of increased groundwater withdrawal in inland areas hydrogrologically connected to the river system must be calculated before increased demand adversely affects the river system by reducing base flow. Similarly, water quality issues must be more fully understood in order to manage our impact to the river system from water use in two perspectives, possible contamination of public supplies and contamination of the river system from contaminated groundwater input. For example, high nitrate values have been detected in selected springs along the middle Suwannee (SRWMD, unpublished data). These nitrate values have been attributed to land use activities in the vicinity.

Land Acquisition

The SRWMD has been actively acquiring lands for water management purposes under the Water Management Lands Trust Fund (Save Our Rivers program) since 1983. To date the acquisition program has largely been dependent upon the presentation of offers by interested landowners, with primary attention focused on the 100-year floodplain of the Suwannee River system, in keeping with the SRWMD's nonstructural floodplain management strategy. Since 1984 the SRWMD has acquired numerous tracts along the Suwannee River, becoming the single largest landowner along the river. In order to fully implement a nonstructural floodplain management approach, as well as to preserve habitat and water quality, the most strategic lands (i.e., the most environmentally sensitive) must be protected--either by outright acquisition or other methods. The acquisition process should become more dependent upon objective criteria such as physical site conditions and features.

The acquisition program is aimed at acquiring the most environmentally sensitive areas within the floodplain. Guidance within the SRWMD's Land Acquisition and Management Plan is provided by a reconnaissance report conducted by J. Merril Lynch for The Nature Conservancy in 1984, which identified four major areas and

many smaller areas of high ecological significance. Many of these areas have been acquired by the SRWMD to date and several are currently under negotiation. As the acquisition program progresses it is critical that a thorough evaluation be done of the basin to identify additional areas that are important in maintaining the natural systems which function to protect water quality and habitat.

The development of GIS coverages of the physical features of the basin is an essential step in conducting analyses to identify sensitive areas in need of acquisition or other preservation measures. Specifically, the land cover, soils, topography, and floodplain parcel ownership coverages initiated under the SWIM program will provide a basis for detailed analyses of environmentally sensitive lands. Existing coverages of subsurface geology and hydrogeology will also be used in overlay analyses to identify critical areas for acquisition. The statewide habitat mapping effort currently being conducted by the FGFWFC will provide yet another coverage for the analyses.

The priority issue concerning land acquisition within the Suwannee River Basin is in developing a GIS model which can identify the most sensitive areas of the river system and assist in prioritizing, based on physical features, tracts being considered for purchase.

Suwannee River Estuary and Coastal Management

The Suwannee River estuary is one of the least impacted estuarine systems in the state, yet relatively little is known about the natural functioning of the system and the existing or potential impacts resulting from upstream conditions and use patterns as well as in the coastal area itself. Ongoing water quality and biological monitoring efforts to date have not completely characterized the dynamics of the estuary. Sampling regimes, including frequency of sampling, sampling parameters, and the spatial distribution of sampling stations need to be expanded to include the estuary to more fully define the whole river system. Information needs for proper management of the coastal area need to be defined.

As the ultimate downstream recipient of virtually all that occurs within the basin, the estuary is a key indicator of the health of the overall river system. Water-related concerns in the estuary revolve around the same two concerns: water quality and water quantity. Just as the constituents of the water column may represent contamination or impacted water quality, the influx of fresh water from the river can, depending on many physical factors such as tide or amount of discharge, represent a threat to the estuary. Too much fresh water (caused by overdrainage, storm events, or hydrologic alterations) drives marine organisms further into the gulf as a result of changes in salinity. Too little fresh water (caused by excessive withdrawals or drought) allows marine predators to prey on estuarine organisms or changes the salinity enough to harm organisms or habitat. Delivery of the proper quantity and quality of fresh water to the estuary is an important management issue.

Permit Tracking and Enforcement

Permits for land development and related activities are issued by at least four levels of government within the Suwannee River Basin: federal, state, regional, and local. As previously mentioned, virtually every activity we conduct within the basin has the potential to impact the water and related resources of the river system--hence the need for regulatory controls. Within the basin, however, there does not exist a single clearinghouse function that collects, tracks, or analyzes permitting activity collectively, from all four levels of government.

Individual agencies are typically involved with permit tracking and enforcement of their regulations only, with the GFC Environmental Enforcement program the only multi-jurisdictional enforcement capability. Further, with any given development activity there are various aspects regulated by different agencies, often with little or no coordination among the regulators. An opportunity exists to examine the myriad permitting and regulatory procedures, identify duplicative or inefficient procedures, and essentially to streamline the process.

Two aspects of this issue are addressed within this management plan. First, the technical assistance/development review capacity instituted by local comprehensive plans and land development regulations open the doors to interagency communication specifically regarding regulations and requirements. Second, the establishment of a central permitting/permit tracking database is identified as one of the tasks of the Interagency Coordination project, under the Program Implementation program.

Public Education and Information

Public education and information about the natural systems of the Suwannee River is an area that has not been actively pursued as a component of the SRWMD's SWIM program to date. An informed public can be an important resource in the management effort of the river basin by knowing how their activities within the basin, both individually and collectively, can affect the river system and by properly governing their activities to minimize adverse impacts.

Among the different approaches to public involvement in such a program as SWIM, the establishment of a network of volunteers who would monitor the river system could be one of the most effective. "River Watch" programs have been established in many areas of the country, most with a high degree of success. The volunteers participating in such a program do a variety of tasks from citizen patrols of the river to performing basic scientific tests and monitoring activities to help maintain information on riverine conditions.

To ensure the successful implementation of the SWIM program for the Suwannee River, members of the public must be educated about the natural river system, they must have an opportunity to become involved in protecting the system, and they must be a part of the management strategy for the river system.

The SWIM Program to Date

The SRWMD's Suwannee River SWIM program has been in place since September 1987, when the river was placed on the top of the priority list. Since that time, preliminary management plans were written for the upper and lower Suwannee (September 1988) and have been implemented to the extent possible by SRWMD staff. The original plans were intended to provide the framework for developing a more thorough knowledge of the river system, in addition to establishing a long-term, ongoing resource monitoring program.

The projects and tasks originally outlined in the plans have been, for the most part, initiated and/or implemented. Most of the tasks are in need of redefinition in light of recent findings and modifications to the SRWMD's program. The completion of the initial SWIM tasks was dependent to a large degree on additional staff that were not made available to the SWIM program. Also, the timeframe for several of the GIS database development projects--one of the cornerstones of the SWIM program--were not met, extending the projects beyond the calculated period.

Table 12 is a simple evaluation matrix of the state of completion of the 41 tasks identified within the initial Suwannee River SWIM plans. A cross reference of the initial SWIM tasks and the revised tasks outlined in the Strategies section is included. For more detail on the initial SWIM tasks, refer to the 1988 upper Suwannee and lower Suwannee and Falling Creek SWIM plans.

Priority Issues Summary

The preceding section details the most pressing issues that need to be dealt with on the river system through the SWIM program. These issues are intended to be addressed by the programs and projects identified in the following section. The prioritized issues to be addressed include:

1. Identification, analysis, and more complete definition of **point and nonpoint sources of pollution** and their impacts within the basin, including reduction of pollution source impacts (e.g., through water quality standards, enforcement, rule revision, etc.).

2. Continuing the ongoing **resource monitoring** program for water quality, biology, and land cover.

3. Providing **technical assistance** to local governments in land use planning, regulation, and management to ensure the protection of surfacewater quality, habitat, and natural system values.

Table 12. SWIM Task Implementation

1988-89 SWIM TASKS	Initiated	Not Initiated	Revised Task No.
LAND USE MONITORING			
1.1: Land Cover Data Base	X		completed
1.2: ID Urban Areas		X	1.3.1, 1.3.3
2.1: Land Development Monitoring		X	3.3.3
3.1: Local Regulatory Review	X		3.4.1, 3.4.2
3.2: Fed/State/Regional Regulatory Review		X	3.5.2, 3.6.1
WATER QUALITY MONITORING AND STUDIES			
1.1: Sampling and Field Measurements	X		1.1.1
1.2: Level 1 Lab Analysis	X		1.1.1
1.3: Level 2 Lab Analysis	X		1.1.1
1.4: Data Management and Analysis, Reporting	X		1.1.4, 1.1.6
BIOLOGICAL MONITORING AND STUDIES			
1.1: Vegetative Cover Mapping	X		1.3.1, 1.3.2
2.1: Water Quality	X		1.1.1
2.2: Substratum, Microhabitat Characterization	X		completed
2.3: Benthic Community Studies	X		completed
2.4: Fisheries Studies		X	3.5.3
2.5: Wildlife Studies		X	3.5.3
1989-90 SWIM TASKS			
LAND USE MONITORING			
1.1: Begin Soils Coverages	X		2.1.1
1.2: Begin Topographic Coverages	X		2.1.2
1.3: ID Subdivisions & Facilities, etc.		X	1.3.1
1.4: Census/Demographic Database		X	2.1.3
2.1: ID Stormwater Facilities	X		2.2.3, 2.2.5
2.2: ID Permitted PS/NPS Pollution	X		2.2.3, 2.2.5
2.3: Field Surveys for Unpermitted PS		X	2.2.2
2.4: ID Unsewered Urban Areas	X		1.3.1, 2.2.1
2.5: Map the above as GIS Coverage		X	3.1.3
2.6: Tie ID'd Sources to Regulations		X	3.5.2
2.7: Enforcement, Regulations Revision		X	3.6.3
3.1: Use GIS Coverages to ID Env. Sensitive Areas		X	3.1.5
3.2: County-level Env. Sens. Area Mapping		X	3.1.5, 3.3.1
3.3: Land Use Alternatives for ESA's	X		3.3.1, 3.3.2
4.1: Development Review Committees	X		3.3.2

(Table 12 continued)

	Initiated	Not Initiated	Revised Task No.
WATER QUALITY MONITORING AND STUDIES			
1.1: Increase Frequency of WQ Sampling	X		completed
1.2: Special Event Monitoring-Storms		X	1.1.8
1.3: Georgia WQ/Permit Coordination		X	2.2.4
1.4: Parameter List Revision	X		1.1.3, 3.2.5
2.1: Watershed Modeling Survey	X		2.4.2
2.2: Watershed Modeling Recommendation	X		2.4.3
BIOLOGICAL MONITORING AND STUDIES			
1.1: Long-term Vegetative Mapping	X		1.3.1, 1.3.2
1.2: Substratum Studies		X	1.2.1
1.3: More Frequent Benthic Sampling		X	1.2.1
1.4: Plankton and Productivity Studies		X	1.2.1
1.5: Tributary Fisheries Studies		X	3.5.3

4. **Interagency, intergovernmental cooperation and coordination** in river system management.

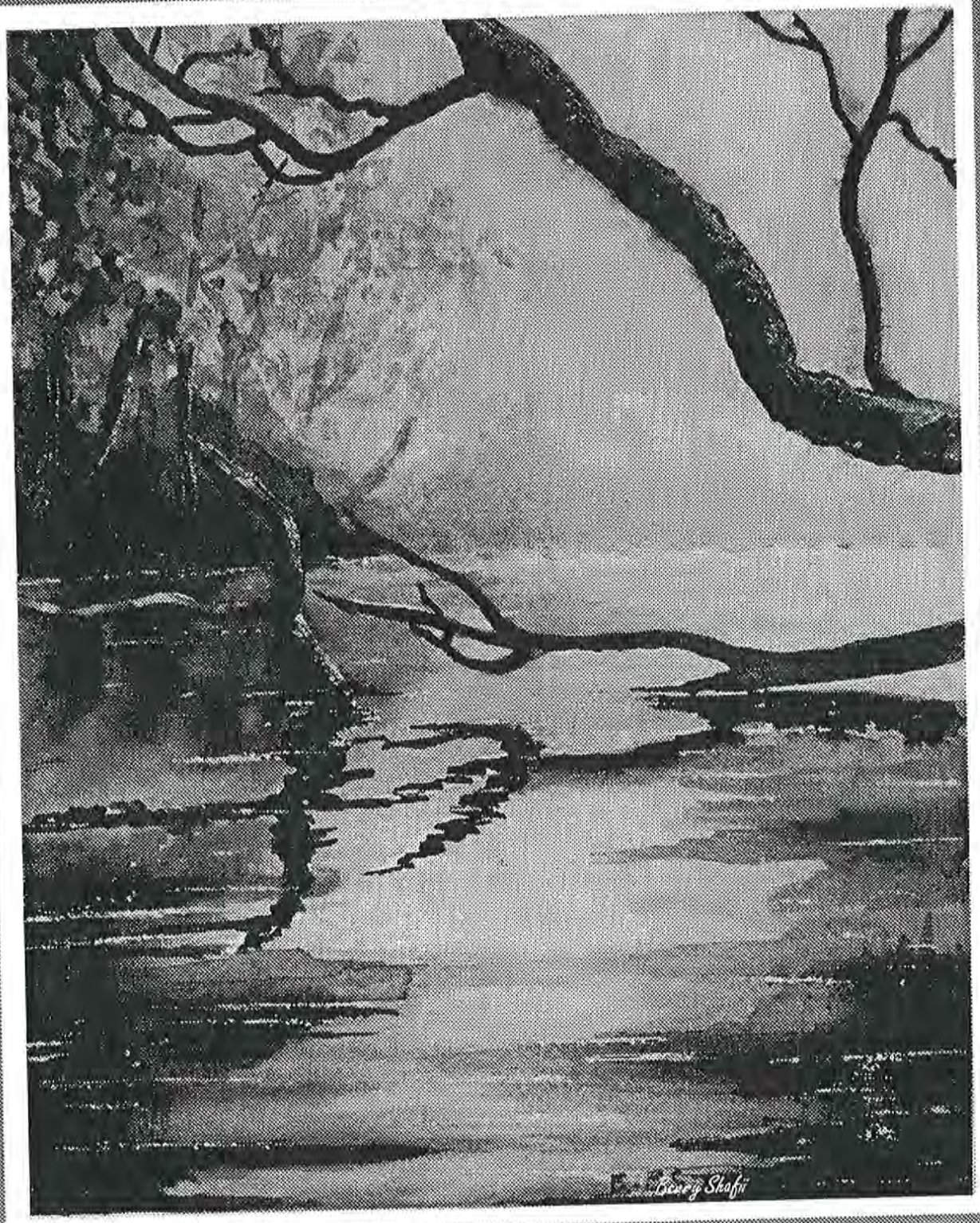
5. Better definition of the **interaction of surface and ground waters** in the Suwannee River Basin, particularly the effect of withdrawal of surface or ground waters on the river system. This information should lead into the establishment of minimum flow standards for the river, and also integrates SWIM as the surfacewater component of the SRWMD Water Management Plan.

6. Continued **land acquisition** of environmentally sensitive areas within the Suwannee River Basin, including targeting and prioritizing specific areas based on resource analyses.

7. Including **estuarine management** concerns through better definition and understanding of the dynamics of the river's estuary, Suwannee Sound, and related coastal ecosystems of the Suwannee River.

8. **Permit tracking, coordination, and database management** for all regulatory activities within the Suwannee River Basin, including analyses and critical evaluations of the collective permitting processes in the basin.

9. Increasing **public education, information, and involvement** efforts to support management initiatives with the Suwannee River Basin.


Bonny Shafer

IV. Management Strategies for the Suwannee River Basin

The management strategies for the Suwannee River Basin reflect a continuation and modification of those identified in the original SWIM plans for the system (SRWMD, 1988), with minor revisions that provide more specific direction for management activities. Four major components make up the program: Resource Monitoring, Resource Planning, Program Implementation, and Waterbody Planning. Each of these programs are in turn comprised of a number of projects intended to address specific priority issues. Projects identified are then further broken down into the tasks--specific actions--which the SRWMD intends to undertake to implement the management strategies. Implementation of programs, projects, and tasks is entirely dependent upon the availability of adequate funding. For this reason the issues of the preceding section are prioritized; likewise, projects corresponding to the priority issues are noted by an asterisk (*).

SWIM Programs

1. Resource Monitoring

Program Definition: Resource Monitoring involves those activities related to the collection of data at specified intervals of time. Examples include water quality sampling, biological sampling, and land cover and land use determinations. 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. The SRWMD has understood and emphasized the importance of maintaining an ongoing monitoring program of the state of the natural systems important to the health of the river system. By keeping watch over the changes occurring to natural systems--both natural- as well as anthropogenic-induced changes--the SRWMD and other agencies will be better equipped to determine the occurrence and magnitude of alterations to the system, ascertain possible causes of the alterations, and respond appropriately and in a timely manner. The Resource Monitoring program is comprised of three elements: water quality monitoring, biological monitoring, and land cover/land use monitoring.

The establishment of a long-term water quality and aquatic biological monitoring program in 1988 was an important first step for the SWIM program in protecting the Suwannee River system. Since that time, water quality samples have been collected and analyzed at 31 stations throughout the basin at bi-monthly and monthly intervals (the original bimonthly sampling schedule was switched to monthly beginning February 1990). Biological sampling of benthic macroinvertebrates, phytoplankton, or periphyton has been conducted at 16 stations along the Suwannee on a quarterly basis.

Land cover and land use are important determinants of the quality of natural systems, particularly riverine or other aquatic systems. Habitat 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 the natural systems of the Suwannee River. Land cover was recognized in the early stages of program development as a means to track development trends within the basin. Since there was a lack of recent (and historical) data providing an accurate portrayal of development and land conversion trends, it was necessary to obtain accurate, reliable data on existing land cover throughout the basin. Satellite imagery was obtained in 1989 for the basin and converted to digital data to be incorporated as a coverage for the SRWMD's GIS, ARC/INFO. This information is scheduled to be updated on a three- to five-year interval, with the next coverage of satellite imagery to be obtained in 1992 or 1993.

***Project 1.1: Water Quality Monitoring**

Project Goal: To characterize river water composition in general terms, and to characterize compositional variation due to spatial geological features, seasonal climatic and hydrological features, and inputs into the system from point and nonpoint sources.

The first need in monitoring water quality is to develop and document a water quality monitoring network design which 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 Suwannee River and the tributaries thought to provide water quality information paramount in Suwannee River water characterization. Tables 13 and 14 list the sample collection locations, the variables tested, and the frequency each variable is tested. These tables list the network as of February 1991. Slight modifications were made to the network initiated in 1989.

Task 1.1.1: Conduct monthly water quality sampling 1991-1994

Midchannel, mid-depth water samples will be obtained and measurements made *in situ* for basic physical descriptors twelve times yearly (once monthly) at 31 stations (Table 13 and Figure 14). Bottom sediment samples will be taken once yearly at seven stations, indicated by an asterisk on Table 13.

Table 13. Water Quality Sampling Stations

River Mile	Station No.	Station Name and Location
195.5	SUW010	Suwannee River at Benton, S.R.6
2.2	ROK010	Rocky Creek near Belmont, Woodpecker Rt.
0.8	HNT010	Hunter Creek near Belmont, C-135
192.6	SUW020	Suwannee River below Hunter Creek
1.8	ROR010	Roaring Creek, C-135
3.5	DEP010	Deep Creek, US 441
3.8	ROB010	Robinson Branch near Suwannee Valley, C-246
14.3	FAL010	Falling Creek swamp headwaters
6.8	FAL020	Falling Creek above falls
171.5	SUW030	Suwannee River above White Springs STP discharge
171.2	SUW040	Suwannee River below White Springs STP discharge
163.0	SUW050	Suwannee River above Swift Creek
2.8	SWF010	Swift Creek at Facil, US 41
162.3	SUW060	Suwannee River below Swift Creek
3.5	CMP010	Camp Branch, S.R. 132
150.0	SUW070	Suwannee River at Suwannee Springs , old bridge
135.5	SUW080	Suwannee River above Alapaha Rise
11.0	ALA010	Alapaha River near Jennings, C-150
129.0	SUW090*	Suwannee River above Withlacoochee River
27.2	WIT010	Withlacoochee River at State line, C-145
22.0	WIT020	Withlacoochee River near Pinetta, C-150
12.0	WIT030	Withlacoochee River at S.R. 6
127.5	SUW100*	Suwannee River below Withlacoochee River
125.0	SUW110	Suwannee River below GoldKist Poultry discharge
113.0	SUW120	Suwannee River at Dowling Park Bridge
89.3	SUW130	Suwannee River at Luraville Bridge
76.2	SUW140*	Suwannee River at Branford
57.0	SUW150*	Suwannee River near Rock Bluff
34.5	SUW160*	Suwannee River near Wilcox, near Fannin Springs
17.0	SUW240	Suwannee River at Fowler Bluff
7.25	SUW275*	Suwannee River at Gopher River
3.5	SUW305*	Suwannee River in West Pass of estuary
0.0	SUW410	Suwannee River in East Pass of estuary

* indicates location of sediment sampling

Table 14. Water Quality Variable List and Frequencies

Parameter	Variable	Frequency	STORET Code
Water Column Field	Sample depth	Monthly	
	Total depth		
	Water temperature		10
	pH		400
	Dissolved oxygen		299
	Salinity		480
	Conductivity		94 & 95
	Secchi depth		78
	Stage		
Basic Physical	Color	Monthly	81
	Turbidity		82079
	5-day BOD		310
	Residue, total		500
	Residue, suspended		530
	Residue, dissolved		515
	Alkalinity as CaCO3		410
	Chlorophyll - a		32211
	Total organic carbon		680
Major Ions, total	Potassium	Bimonthly	937
	Sodium		929
	Magnesium		927
	Calcium		916
	Chloride		940
	Fluoride		951
	Sulfate		945
Nutrients, total	Nitrite plus Nitrate	Monthly	630
	Total Kjeldahl N		625
	Ammonia N		610
	Total Nitrogen		600
	Orthophosphate		671
	Total Phosphorus		665
Sediments	Composition	Annually	multiple
	Total Phosphorus		668
	Trace Metals		multiple
	Organic Content		-

Figure 15. Monitoring Station Location, Upper Suwannee River

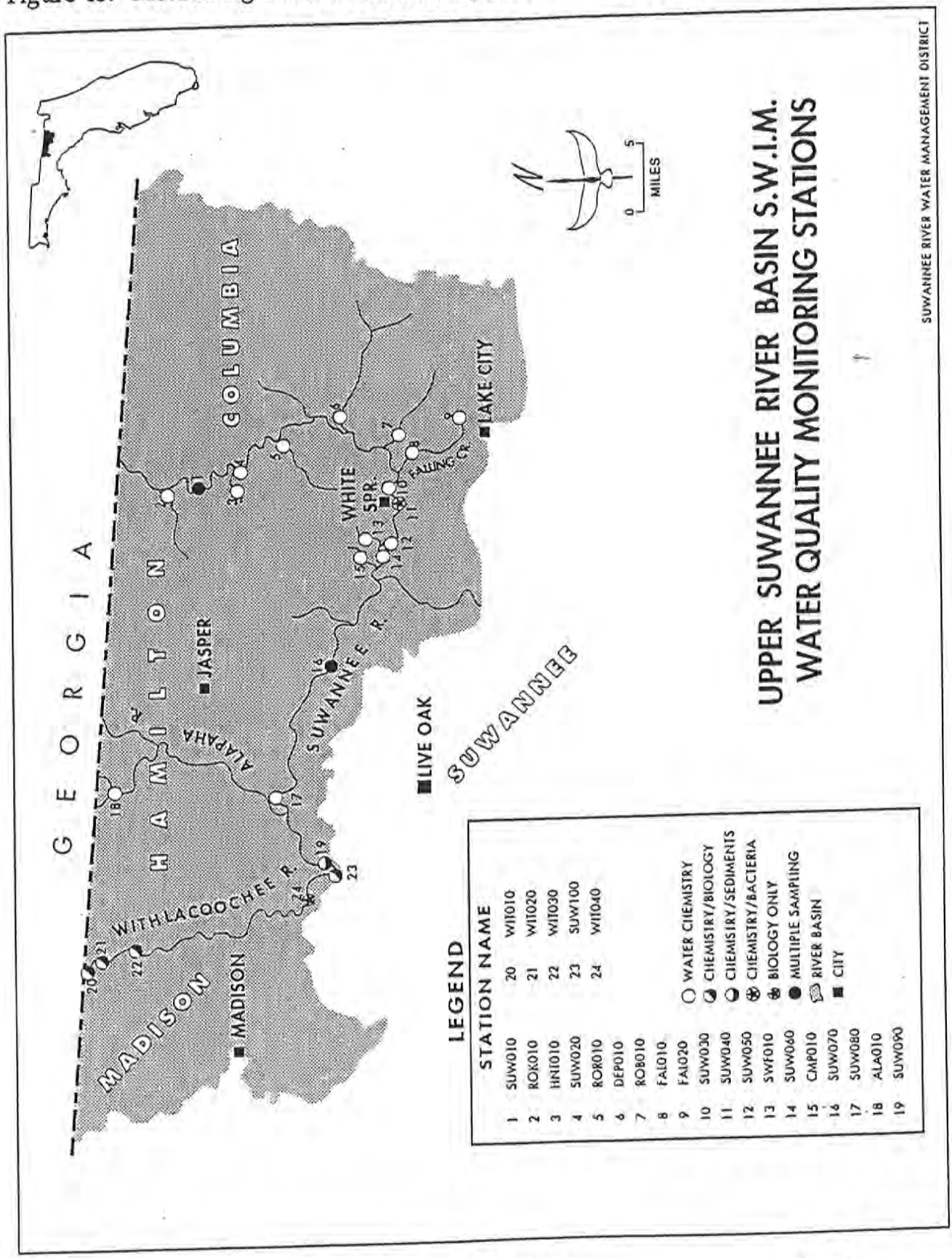
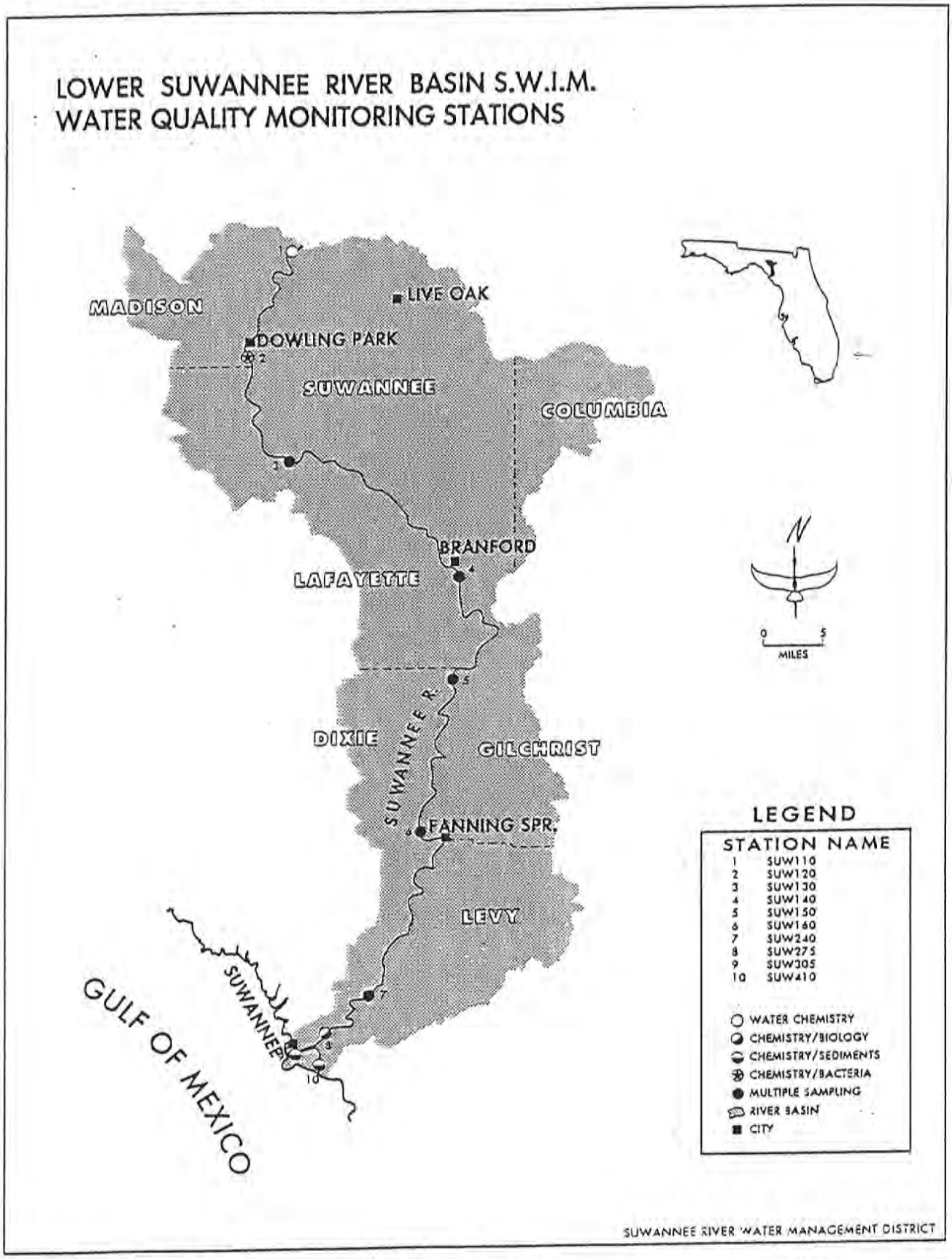


Figure 15 (cont'd). Monitoring Station Location, Lower Suwannee River



Task 1.1.2: Laboratory Analyses 1991-1994

Analyses for the parameters and variables listed in Table 14 will be conducted twelve times yearly (once monthly) for each of the 31 sampling stations by the contracted laboratory.

Task 1.1.3: Existing network modification 1991-1992

Modify the existing water quality network that was implemented in 1989 to determine the sampling variables and analytical procedures that can best characterize the river or segments of it. Modifications to the existing system must be designed to achieve a statistically sound interface with the data that has been collected in the first two years of SWIM water quality monitoring.

Task 1.1.4: Data management 1991-1994

Develop 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.

Task 1.1.5: Statistical analyses 1991-1994

Document statistical protocols that will be employed in reference to the principle questions, and the procedure of interpretation, inference, and information dissemination.

One of the principle goals of the water quality monitoring is the dissemination of data collected and analyses conducted. Entrance into a rigorous phase of information compilation and reporting, with target audiences of both the Governing Board and the public, is the second aspect of the monitoring program.

Task 1.1.6: Quarterly water quality reports 1991-1994

Reports will be made on a quarterly basis to the Governing Board with graphical materials available to the public. Trends involving basic parameters characterizing portions of the river will be presented, with discussion of possible causal relationships. Annual reports will be made available in September of each year, summarizing the water quality monitoring program during the year, the data collected, the interpretations that have been made from the data, and any projected program modifications and focus.

Task 1.1.7: Public information and education 1991-1994

Provide assistance and information to SRWMD public information and education programs regarding water quality, monitoring techniques, and the overall monitoring program. Includes presentations at Governing Board workshops, public meetings, brochures and publications (see also Task 3.8.3).

Task 1.1.8: Special event monitoring 1991-1994

Water quality sampling of special events such as individual, site-specific storm or rainfall events, analyzing problem areas detected by the regular monitoring program, monitoring emergency events such as oil spills, train derailment, etc., and other site- or areally limited situations in which special monitoring, outside regularly scheduled monitoring efforts, needs to be conducted. Analyses of these samples are included in this task.

Task 1.1.9: Salinity Monitoring 1991-1992

Using SWIM funds supplemented by funding from a federal Coastal Zone Management Grant, measure salinity gradients and dynamics in the Suwannee River estuary to determine relationships between the river salt wedge, tides and river flow.

***Project 1.2: Biological Monitoring**

Project Goal: To define existing conditions of aquatic biota in the Suwannee River on an ongoing basis, to determine relationships between physical-chemical conditions and aquatic communities, and to report these data and information/conclusions derived from the data to the SRWMD administration and other resource management agencies.

Biological monitoring of the Suwannee River has been conducted quarterly at ten stations along the river since 1989 (Figure 15). The biological monitoring component of the overall resource monitoring program is continued from the initial management plans through the time period of this management plan. The initial SWIM plans for the Suwannee River system detailed the ongoing biological monitoring program, including rationale, sampling protocol, and programmatic details.

Task 1.2.1: Develop and implement aquatic biology monitoring network, 1991-1994

Monitoring of aquatic biota was initiated in 1989 on the Suwannee and Withlacoochee rivers. Benthic macroinvertebrates were sampled in 1989. Invertebrates, periphyton, and phytoplankton were sampled in 1990. Table 15 lists the stations and biological elements which will be sampled in the aquatic

Table 15. Biological Sampling Stations* - Suwannee River.

Station No.	Station Name	Sampling Regime
SUW010	Suwannee River at Benton (S.R. 6)	Quantitative benthic invertebrate sampling (artificial substrata); qualitative benthic invertebrate sampling (various microhabitats); periphyton sampling
SUW050	Suwannee River above Swift Creek	Qualitative benthic invertebrate sampling (various microhabitats)
SUW090	Suwannee River above Withlacoochee River	Qualitative benthic invertebrate sampling (various microhabitats)
SUW100	Suwannee River at Ellaville	Quantitative benthic invertebrate sampling (artificial substrata); qualitative benthic invertebrate sampling (various microhabitats); periphyton sampling
SUW130	Suwannee River at Luraville (S.R. 51)	Quantitative benthic invertebrate sampling (artificial substrate); qualitative benthic invertebrate sampling (various microhabitats); periphyton sampling
SUW150	Suwannee River near Rock Bluff (County Road 340)	Quantitative benthic invertebrate sampling (artificial substrata); qualitative benthic invertebrate sampling (various microhabitats); periphyton sampling;
SUW240	Suwannee River at Fowler's Bluff	Quantitative benthic invertebrate sampling (natural and artificial substrata); qualitative benthic invertebrate sampling (various microhabitats);
SUW275	Suwannee River at Gopher River	Quantitative benthic invertebrate sampling (natural and artificial substrata); periphyton sampling

* Refer to Figure 15 for station location

Table 15 (continued) Biological Sampling Stations*

Station No.	Station Name	Sampling Regime
WIT010	Withlacoochee River at C-145 (at state line)	Quantitative benthic invertebrate sampling (artificial substrata); periphyton sampling
WIT020	Withlacoochee River near Pinetta (at C-150)	Quantitative benthic invertebrate sampling (artificial substrata); periphyton sampling
WIT030	Withlacoochee River at State Road 6	Quantitative benthic invertebrate sampling (artificial substrata); periphyton sampling
WIT040	Withlacoochee River above Suwannee River	Quantitative benthic invertebrate sampling (artificial substrata); qualitative benthic invertebrate sampling (various microhabitats)
ALA010	Alapaha River near Jennings (CR 150)	Qualitative benthic invertebrate sampling (various microhabitats)
ALA020	Alapaha River near Nobles Ferry (CR 249)	Qualitative benthic invertebrate sampling (various microhabitats)

* Refer to Figure 15 for station location

biology network. Monitoring schedule at all sites will be quarterly (February, May, August, and November).

Task 1.2.2: Report on data collected. 1991-1994

Verbal reports will be given to the SRWMD Governing Board twice a year, covering the aquatic biological sampling aspects of the resource monitoring program.

Task 1.2.3: Prepare Annual Report. 1991-1994

Each year, an Annual Report will be prepared summarizing aquatic biological activities and data collected for the previous year's sampling. The SRWMD has prepared and issued a report on the 1989 data collected on the Suwannee River. The report prepared in 1991 will summarize the 1990 biological data. Reports will include analysis of the biological data and comparison with physical/chemical data collected in the Water Quality Monitoring project.

***Project 1.3: Land Cover and Land Use Monitoring**

Project Goal: Monitor changes in land cover and land use throughout the Suwannee River Basin to define and analyze long-term regional trends in land conversion and development activity as they affect the Suwannee River system.

Task 1.3.1: Land Cover database refinement 1991-1994

Continually refine the ARC/INFO GIS land cover data base and coverage developed during the first year SWIM effort. Errors in the original classification of lands should be corrected when found on the ground, changes in regional land cover should be coded into the coverage as they occur, and the coverage and data base should be maintained in such a manner as to facilitate the production of maps and analysis procedures.

Task 1.3.2: Land Cover database update 1993-1994

Prepare preliminary estimates for the acquisition of updated satellite imagery for FY 1992-93. Stay apprised of new technologies or new features that could be made part of the land cover updating.

Task 1.3.3: Aerial photography 1992-1993

Obtain recent (1990 or 1991) aerial photography of the Suwannee River Basin for use in detailed studies or analyses of the river basin. This information should also be used in the maintenance of the digital land cover data base and coverage, as well as for providing assistance to local governments and other agencies.

Task 1.3.4: Land Cover Report and Imagery 1992

Land cover maps for the Suwannee River Basin will be produced based on the 1988 satellite imagery obtained through the SWIM program. A report will be prepared discussing how the information was collected, what it means, and how it can be used for distribution to local governments, state agencies, libraries and schools, and interested parties.

2. Resource Planning

Program Definition: The Resource Planning program encompasses those activities related to the development of plans and strategies for basin management, and includes activities such as subbasin assessments and GIS development. Included are digital data base development, special studies aimed at specific geographic areas (e.g., sub-basins) or at particular events (e.g., storm monitoring in a specific area), 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

Project Goal: Develop and maintain a computerized, geographically referenced data base of the physiographic, hydrologic, and cultural features that comprise the Suwannee River Basin that can be used in analyses aimed at better understanding the natural processes of the basin and at providing basin management tools and alternatives.

The SRWMD's single biggest management tool for the Suwannee River Basin, if any single tool exists, is the computerized GIS. The abilities represented by the powerful ARC/INFO GIS program--coupled with new, highly efficient hardware--include many types of analyses including suitability studies, scenario-building, full mapping capabilities, data base management and updating, responding to queries, and many more.

The GIS is entirely dependent upon the data which comprise it and with which it responds. The development of data bases, including their design and construction, data entry, data quality control, and data updating/revision is the foundation upon which the entire GIS is built. Thus, it is essential that great care be taken to obtain quality data, to input the data in an efficient, productive manner, and to maintain the data bases in peak performance.

The SRWMD has been in the data development phase since 1988 and will likely be involved in one aspect of data base development or another for the foreseeable future. With relatively few exceptions, data are in constant need of revision or updating, as are the changing data needs over time.

Task 2.1.1: Completion of Soils Coverage 1991-1992

Soils are an integral component of a natural features GIS coverage. The physical properties of soils as mapped by the SCS provide invaluable information about any given site such as particle characteristics, depth to water table and other indicators of hydric regime. As a primary consideration in any number of land use analyses, soils information and soils coverages are a critical component of the GIS structure.

The compilation and digitization of the detailed SCS soils surveys as an ARC/INFO coverage was initiated by the SRWMD in 1989. The timing of this process is currently determined by the schedule for completion of the soil surveys for all the counties of the basin. The schedule for completion of the soil surveys and subsequent compilation, digitization, and data base development are as follows.

Soils Survey and Coverage Completion Schedule

County	Survey Complete	Compilation/ Digitization	Database Work
Columbia	Yes	mapping complete	October 1991
Dixie	In progress	*	*
Gilchrist	Yes	March 1991	October 1991
Hamilton	In progress	*	*
Lafayette	In progress	*	*
Madison	Yes	March 1991	December 1991
Suwannee	Yes	March 1991	October 1991
Levy	Yes	March 1991	December 1991

Task 2.1.2: Completion of Topography Coverage 1991

Topography represents a second important physical land feature to be included as a basic component of a GIS data base and coverage. Land feature attributes such as slope, benchmark elevation, and drainage patterns and features are also integral components of GIS modeling and analyses. Information is obtained from the USGS 7.5 minute topographic quadrangles for the Suwannee River Basin, at five- and ten-foot contour intervals.

As with the soils data, digital topographic data acquisition was initiated under the original SWIM plans for the Suwannee River. The completion of the topography data base is scheduled for December 1991.

Task 2.1.3: Census Data Coverage 1992

Population information is a necessary component of any watershed analysis that considers or affects the human population of the watershed. Information collected by the U.S. Census Bureau that can help discern trends in population migration, population composition, household characteristics, and patterns of housing tenure can all contribute to a fuller understanding of anthropogenic contributors of watershed issues.

The 1990 Census data for the Suwannee River Basin will be acquired through this task. Data and coverages should also be acquired for the 1970 and 1980 Census reports for trend analyses. Task 3.1.4, wherein the data collected through this task is analyzed, is contingent on this task.

Task 2.1.4: 100-year Floodplain Parcel Coverage 1991-1992

The 100-year floodplain of the Suwannee River is a critical area within the basin, and is the focus of much of the detailed studies in the SWIM program. Whereas most of the GIS data bases and coverages are of natural physical features of the land, a parcel ownership coverage includes vital information relating to policy-oriented issues to be addressed.

A floodplain ownership coverage serves several basic functions. It is a source of information regarding land use that is not readily accessible in other means, such as parcel density, parcel configuration and size, assessed property values, ownership information, parcel use, and stage of development. It allows for more thorough analyses (policy or economic impact, nonpoint source assessments, etc.) to be conducted by adding a known economic component. It also facilitates other SRWMD programs dealing with floodplain lands such as regulation enforcement and land acquisition.

Task 2.1.5: Florida Natural Areas Inventory Database 1992

Information mapped by the Florida Natural Areas Inventory (FNAI) provides element occurrences (EO) of threatened, endangered, and special concern species throughout the state. Acquiring a coverage of known EO's in the Suwannee River Basin will provide the capability to include special habitat areas in GIS analyses. Of critical interest are records for aquatic and riverine-dependent species within the Suwannee River corridor (and tributaries).

Task 2.1.6: FGFWFC Habitat Mapping 1992

A second coverage and data base useful in GIS analyses of lands within the Suwannee River Basin is the statewide wildlife habitat GIS coverage currently being developed by the FGFWFC. The GIS database development should be coordinated between the SRWMD and the FGFWFC.

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

Project Goal: Develop a comprehensive inventory of point and nonpoint sources of pollution to the Suwannee River system, including GIS data and coverages to allow for modeling and impact analyses that will support the establishment of maximum allowable pollutant loadings for the Suwannee River system.

One of the factors recognized by the Florida Legislature in the SWIM Act as contributing to the decline of surfacewater systems throughout the state are point and nonpoint sources of pollution. Before much of anything can be done to control the discharges, they must be identified, including what the pollutants are, how they reach the river system, and where they are. For point sources of information regulated by the Clean Water Act, the U.S. EPA, and the DER, this task is relatively easy and straightforward. Nonpoint sources, the "unregulated" sources of pollution to the Suwannee River, on the other hand are not completely characterized at the present.

As previously discussed, some impacts to the river system have already been detected through the ongoing water quality monitoring project. The source or cause for some of these situations are not fully understood, nor are the detailed analyses to quantify their impact on the river system possible. A means to quantify the impact these nonpoint sources have on the river system is needed; mapping these areas and constructing a data base 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 river.

Task 2.2.1: Onsite Sewage Disposal System (OSDS) Inventory 1991-1993

This task has been initiated under the momentum provided by Governor's Executive Order 90-14 and the Suwannee River Task Force. An inventory of the number, location, and condition of existing onsite sewage disposal systems (e.g., septic tanks) was started by HRS employees under contract to SRWMD in September 1990.

Failing or improperly constructed and maintained OSDS's are recognized as a leading contributor in water quality degradation statewide and nationwide. The collective or cumulative impact of the existing OSDS's in the floodplain of the Suwannee River system is suspected of being high; the cumulative impact of development of the estimated 30,000 lots within the floodplain could be significantly higher.

The inventory of existing OSDS's within the floodplain of the Suwannee River system started at the town of Suwannee at the mouth of the river and

proceeded upriver. Data are collected daily and reported weekly and monthly to SRWMD staff for data entry into an established data base. Failing systems are flagged immediately for enforcement as provided by law.

Task 2.2.2: Field Surveys 1991-1994

Further field studies are proposed for site specific source checks, mapped area confirmation, compliance checks, and general reconnaissance. Once particular reaches of the river or specific geographic areas are targeted for further investigation, field surveys are conducted to obtain more detailed information, verify potential sources, and to further refine modeling or other analyses.

Field surveys can be considered as a culmination of 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 2.2.3: Point Source Coordination 1991-1993

The known point sources of pollution within the Suwannee River system, permitted through DER and the U.S. EPA, represent a part of the existing river system that should be comprehensively monitored. The SWIM program for the Suwannee River is not a regulatory program, yet the decisions, processes, and results of the permitting process profoundly affect the management of the river system. The intent of this task is to involve the Suwannee River SWIM program in the review of point source discharge permits.

An evaluation of the current permit coordination and review process between the SRWMD and permitting agencies is the first step of this task. Following is the development of alternative procedures, should the evaluation determine areas in need of remedial action--such as review timeframes, logistical procedures, etc. Recommendations then follow to the appropriate governing bodies to implement an effective process for coordinating permit review.

Task 2.2.4: Georgia Coordination 1991-1994

Over half of the Suwannee River Basin is located in southeast Georgia. Different laws and regulations affect water bodies in Georgia, including different standards for water quality and point source regulation as well as for nonpoint sources. Coordination between regulatory agencies in Georgia and their counterparts in Florida is an important component of basin management--particularly so for downstream Florida.

A contact or liaison for the state and regional agencies in Georgia should be established to provide information about existing and pending permits, as well as general information exchange. SRWMD staff should meet with the appropriate Georgia agency staff to discuss the Suwannee River SWIM program, its needs, and request assistance in management efforts undertaken in the basin.

Task 2.2.5: GIS Analyses

Using GIS coverages and data bases, analyses will be conducted based on physical criteria associated with each coverage in order to help identify areas which are potential nonpoint source problems. Modeling strategies using different methodologies will be investigated and/or developed to estimate the type, magnitude, and extent of potential nonpoint sources such as heavy agricultural areas, erosion-prone soils groups, or developed (subdivided) areas. Field surveys will be valuable to verify, target, or even identify potential nonpoint sources.

Project 2.3: Falling Creek Basin Project

Project Goal: To develop and implement a basin management plan for the Falling Creek watershed, a sub-basin of the Suwannee River system, based on a thorough assessment and evaluation of the basin. The basin management plan will focus on the hydrology, water quality, habitat quality, and interaction of land use and land development on these resource attributes.

The Falling Creek watershed is an important sub-basin of the upper Suwannee River due to the presence of the growing urban area of Lake City. The creek itself is somewhat unique to the area in several ways: its two headwater branches emanate from diverse sources, one deep within the Osceola National Forest, one from Lake DeSoto in downtown Lake City. The creek goes over a limestone shelf north of Lake City, creating a spectacular scenic waterfall, one of the largest in Florida; and before the creek drains to the Suwannee, it is captured by a sinkhole, resurfacing a short distance downstream.

Falling Creek is of particular interest in the SWIM program for the Suwannee River since part of its headwater reaches drain an urbanized area. Typical urban nonpoint source pollution is of primary concern (e.g., stormwater contaminants, septic leachate, etc.) but the alteration of the creek's basin itself is cause for attention. Urbanization has had impacts on the creek in the form of floodplain alteration and development, illegal fill and dumping activities, increased rates and volumes of untreated stormwater runoff, and disruption of habitat. Most of these activities have been focused on that portion of the creek's basin in closest proximity to Lake City.

Task 2.3.1: Basin Assessment 1991

A preliminary reconnaissance of land use patterns and activities, ecologic and hydrologic characteristics, and other physical features of the Falling Creek basin needs to be conducted to identify issues which will shape the development of strategies for managing this important tributary of the Suwannee River. This task will be completed in 1991 using existing data supplemented by field reconnaissance. Further study and sampling efforts will likely result from this first run, efforts that are aimed at characterizing and understanding smaller geographic areas or particular problems. The product of this task is the identification of the management and restoration issues for the Falling Creek basin in a comprehensive basin assessment report.

Task 2.3.2: Assessment of Restoration and Management Needs 1991-1992

Based on the reconnaissance of the basin described above, as well as any subsequent surveys and issue identification, an assessment of the need for restoration activities within the basin should be made. This task is aimed at assessing the needs for restoration and providing an analysis of known restoration techniques and subsequent management needs. Recommended restoration and management alternatives will be the result of this task.

Task 2.3.3: Development of Basin Management Plan 1992-1993

The culmination of the Falling Creek planning project is the development of a basin management plan which provides specific management directives for the basin. The issues identified through the preceding tasks, as well as the recommended alternatives, will be central components of the plan. This sub-basin SWIM plan should include Lake City and Columbia County as responsible entities for managing the basin, through their respective comprehensive plans and land development regulations. Goals and objectives for restoration activities, schedules, and implementation requirements will be included.

***Project 2.4:** Groundwater-Surfacewater Relationships in the Suwannee River Basin

Project Goal: To develop a more complete understanding of the hydrologic relationship between ground water and surface water in the Suwannee River Basin, including water quality and water quantity.

The Suwannee River Basin is widely known for its unique karst features, foremost among which are the numerous first- and second-magnitude springs throughout the river system. The basin's rolling-hill landscape, formed by limestone solution and riddled with sinkholes of varying ages, reveals a geographic area with a

complex, intricate ground-surfacewater hydrology. The influx of ground water into the surface waters of the system results in the single greatest change in the chemistry, appearance, and life-structure of the river. During periods of low flow, the vast percentage of water flowing into the Gulf is of groundwater origin, with only enough surface water to slightly color the river water with tannins.

With the exception of spring gaging by the USGS and the SRWMD and some limited springwater testing, little data exists with which a comprehensive analysis of the relationship between ground and surface waters. Of particular concern to the SWIM program are areas which provide base-flow ground water to the river that are susceptible to water quantity or quality alterations. These areas must be located, mapped, and analyzed and quantified as to their effect on the river system. This project will be coordinated with the SRWMD's groundwater monitoring (quantity and quality) and with the water use and groundwater withdrawal permitting and planning programs.

Task 2.4.1: Data Inventory 1991-1992

Existing data on surfacewater-groundwater interaction should be reviewed to determine if additional studies are needed to develop an adequate data base to draw from in watershed modeling efforts. Data gaps, deficiencies, and needs should be identified as well as strategies for addressing these needs.

Task 2.4.2: Modeling Review 1992

A review should be conducted to evaluate computer modeling techniques to accurately portray the surface-/groundwater relationship within the Suwannee River Basin. The evaluation should include recommended alternatives for hydrologic modeling of the Suwannee, including the model's input and maintenance requirements and assumptions.

Task 2.4.3: Select Basin Surface/Groundwater Model 1993

Based on the evaluation of existing data and a review of surface-groundwater computer modeling techniques, an appropriate hydrologic model should be selected or developed which will meet the needs for appropriate basin management.

Task 2.4.4: Investigation of Low-Flow Methodologies and Standards 1992-1993

Coupled with the investigative efforts to develop a computer model to assist in basin management, the establishment of low flow standards is a component of overall basin management. Such standards or regulations should serve to protect both the natural needs of the river system as well as the needs of the basin residents. This task, focusing on the Suwannee River, will be coordinated with the SRWMD's efforts at establishing low flow and

low groundwater level standards throughout the SRWMD's jurisdiction as required by Ch. 373.042, F.S.

3. Program Implementation

Program Definition: Program Implementation is the action- or result-oriented component of the Suwannee River system SWIM program, encompassing the activities related to carrying out the policies and tasks identified in the plan (self-inclusive). Included are such activities as conducting analyses or the presentation of the 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.

Project 3.1: GIS Analyses

Project Goal: To use the GIS data bases and coverages to conduct analyses to: 1) provide information and technical assistance to local units of government and other agencies; 2) use in SRWMD review of permits, local comprehensive plans and plan amendments, and development proposals and permits, including developments of regional impact; and 3) to support the establishment of maximum allowable pollutant loadings to the Suwannee River system by locating, mapping, and gaining a better understanding of and controlling the impact of nonpoint sources of pollution to the Suwannee River.

Task 3.1.1: OSDS Suitability 1991-1992

OSDS's are the primary means of wastewater disposal available to serve developed land uses along the Suwannee River and within the basin. Limited areas are served by central wastewater collection and treatment facilities (White Springs, Boy's Ranch, Dowling Park, Branford). In order to assist local governments in planning for future residential growth within the basin, focusing on the 100-year floodplain, composite suitability maps for OSDS placement will be developed.

Using physical site criteria of soil conditions, flooding regime, topography, and vegetative cover (each GIS coverage and data base), it will be possible to delineate areas along the floodplain which are more suitable for OSDS. Likewise, areas with severe limitations and constraints will be identified. Other modeling criteria that may be included, such as density of existing or proposed systems, distance to existing treatment facilities, or package facility siting may be included to assist in developing policy alternatives to improve the level of wastewater treatment within the floodplain and the basin. This task will be closely coordinated with Task 2.2.5.

Task 3.1.2: Composite Development Determinants 1991-1992

Other criteria with which to determine the suitability of areas within the 100-year floodplain and the entire basin will be developed to determine development constraints and factors. Physical site determinants such as soils, topography, proximity to facilities, hydrogeologic conditions, aquifer recharge and discharge zones, hydrography, and vegetative cover/habitat are all mapped or are being mapped. Modeling schemes using different weights for various combinations of factors or GIS coverages can be developed for a wide variety of analyses.

The results of these modeling efforts will guide the SRWMD's interaction with local governments and other agencies in two principle ways. First, recommendations can be made to local governments and other agencies regarding land use planning, development review, and permit reviews. Second, this information can provide a detailed basis for SRWMD staff to use in reviewing local comprehensive plan amendments, developments of regional impact, and SRWMD water use, wetlands, and surfacewater management permits.

Task 3.1.3: Nonpoint Source Modeling 1992-1993

Nonpoint sources of pollution are intuitively known to be a significant contributor to the degradation of the Suwannee River system, yet they are not accurately mapped or quantified. In order for programs to be enacted that will work toward reducing or eliminating nonpoint source contributions, they must be accurately identified, mapped, monitored, and quantified. Task 2.2.5 accomplishes the identification and mapping aspects, this task is aimed at quantifying the impact of these sources.

Several elements of the SRWMD's GIS program are developing or have developed information that will be useful in identifying potential nonpoint sources of pollution. Coverages and associated data bases that can be used include land cover, soils, topography, hydrography, surface-and groundwater quality, and hydrogeology. Coupled with investigative efforts from the pollution source survey, aerial photographs, and Task 2.2.5, these factors can then be used in the development of formulas and modeling techniques to better quantify the individual and/or collective impact of nonpoint sources of pollution. Existing nonpoint source loading models and assessment techniques may be incorporated with the GIS analyses.

Task 3.1.4: Growth Projections 1992-1993

As discussed earlier throughout the Suwannee River SWIM plan, the connection between land use and water quality is inseparable and recognized

as one of the fundamental rationales for the management of the Suwannee River system. Population growth is the single greatest factor influencing the location, type, and density of developed land uses--as such, it is a critical component of any analyses aimed at providing policy alternatives for growth management planning.

Information provided by the U.S. Census Bureau about population changes and characteristics, household characteristics, and other demographic data are useful in mapping the distribution of the basin's population. GIS coverages and related data bases of the 1970, 1980, and 1990 Census tracts and enumeration districts will provide an important layer of information to be used in GIS analysis of the basin.

Task 3.1.5: Identification of Environmentally Sensitive Lands for Acquisition 1991-1994

The analyses described above all contribute to an overall analysis of the basin to identify environmentally sensitive lands that should be acquired by the public for public use and resource protection. Complemented by information gathered through field surveys such as described in Task 2.2.2, this task provides recommendations and preliminary studies of potential acquisitions. This task is specific to developing recommendations on an ongoing basis to the SRWMD's Land Acquisition and Management Department, the Conservation and Recreational Lands (CARL) program administered by the Department of Natural Resources, and to local governments and any other entity acquiring land for resource protection or conservation.

*Project 3.2: Water Quality Standards Recommendation

Project Goal: To implement the DER policy to afford a high level of protection to OFW's. There are current standards specified in the State Class III Water Quality Criteria that do not provide the best protection of ambient water quality for the Suwannee River. Detailed review of permit monitoring data, and permit reissuance processes that require that water quality degradation has, or is, occurring is difficult and cumbersome; and possibly inconsistent due to staff turnover and differences in perspective.

This project will combine all water quality data collected from the Suwannee River into a useable and defensible data base. Appropriate statistical and analytical methodologies will be applied to the data in order to provide a basis for water quality standard recommendations for the nutrients total nitrogen (N) and total phosphorus (P). The methodology developed will allow the District to consider including other variables, where ambient levels are much lower than Class III criteria, if a suitable methodology is developed, and time and resources are available within the applicable contract(s).

This project is prioritized under Priority Issue 1 from the preceding section, reducing the impact of point and nonpoint sources of pollution to the river system.

Task 3.2.1: Data Base Assembly 1991

There are four sources of data that were be assembled as part of this task. Quantity data, quality data, previous studies where data has been compiled and evaluated, and related data on land use and demographics. A data base can be established once individual values have been checked, detection limit deviations analyzed, and period of record time sequences established. The SRWMD, with the assistance of an advisory task force, will determine the completeness of the data set to support recommendations for waterbody specific water quality criteria.

Task 3.2.2: Water Quality Standards Methodology Review 1991-1992

Review of related work on the development of water quality standards based on ambient water quality conditions and criteria. Most water quality standards have been determined by bioassay results or human health criteria. This approach does have some precedence both in the United States and abroad; therefore, a review of prior work is important. The review will be focused on methodology rather than policy development.

Task 3.2.3: Data Base Analysis 1991-1992

Baseline water quality will be determined through various reviewed methodologies. This task will define the characteristic seasonality behavior of the variable of interest, and establish a procedure to interface quantity and quality variation.

Task 3.2.4: Water Quality Standard Distributions 1991-1992

Development of water quality standard distributions for each variable for some designated reach of the river, upon which recommendations can be made.

Task 3.2.5: Monitoring Network Development 1992

Development of a monitoring network design to support standard implementation, and provide a continued monitor of ambient water quality.

Task 3.2.6: Present Water Quality Standards Recommendations to ERC 1992

Recommended water quality standards will be presented to the Florida Environmental Regulatory Commission for inclusion in State water quality standards.

***Project 3.3** Nutrient Load Reduction Goal for the Suwannee River System

Project Goal: To establish a nonpoint source nutrient load reduction goal for the Suwannee River to address the requirements of Chapter 17-40.420, F.A.C. and to implement a strategy to meet the goal based on SWIM water quality monitoring.

This project carries forward the results of Project 3.2 by allowing the District to develop criteria for determining significant change in the river water quality for total nitrogen and total phosphorus. These criteria will then be used in computer applications to evaluate SWIM water quality data continuously for compliance with the goal. This project will be coordinated with the Surfacewater Quality Management element of the District Water Management Plan.

Task 3.3.1. Criteria Determination. 1992

Using the ambient water quality conditions for total nitrogen and total phosphorus developed through Project 3.2, develop criteria for determining when nutrient loadings at each monitoring station on the Suwannee River exceed ambient conditions.

Task 3.3.2. Nutrient Load Reduction Goal. 1992

Develop a SWIM goal statement for adoption by the Governing Board that will establish ambient total nitrogen and total phosphorus levels as defined through Project 3.2 as the goal for maintaining and/or reducing instream nutrient levels. This goal statement will be presented at the June, 1992, SWIM workshop with the Governing Board.

Task 3.3.3. Nutrient Monitoring. 1992 ongoing

The computer applications used in Project 3.2 will be transferred from the contractor (University of Florida) to the District. These applications will be used for District evaluation of SWIM water quality monitoring data to determine compliance with the load reduction goal for each sampling frequency.

Task 3.3.4. Goal Implementation Strategy. 1992 ongoing

In order to implement the goal beyond the nutrient monitoring task above, a strategy must be developed which will allow the District and cooperating agencies to identify the sources of nutrient loading and reduce the loadings and impacts resulting therefrom. The basic steps that the strategy will include are:

1. Identify sources of nutrient loads such as tributaries, point sources, nonpoint sources. Assess anthropogenic versus natural sources.

2. Identify means of nutrient transport: surface stormwater runoff, groundwater input through spring discharge and seeps, direct discharge, and stream confluence.

3. Identify quantity and seasonal variation of nutrient loading.

4. Assess existing enforcement mechanisms to reduce loading, including state and regional regulations, local ordinances, and application of best management practices.

5. Enact enforcement procedures, rule revision, or other appropriate mechanisms to bring source into compliance with the adopted load reduction goal.

The implementation strategy will be built upon at a minimum the following related tasks:

1.1.1. Water Quality Monitoring
1.1.2. Water Quality Sample Analysis
1.1.5. Statistical Analyses of Water Quality
1.1.8. Special Event Monitoring
1.3.2. Land Cover Database Update
2.2.1. OSDS Survey
2.2.2. Field Surveys
2.2.3. Point Source Coordination
2.2.5. GIS Analyses
3.1.3. Nonpoint Source Modeling
3.2.6. ERC Recommendation

***Project 3.4:** Local Government Technical Assistance

Project Goal: Provide technical assistance in the form of data, maps, reports, and interpretations. Local units of government within the Suwannee River Basin, as elsewhere in the state, are entering a new phase of land use planning and regulation as a result of the 1985 Growth Management Act. New local comprehensive plans and land development regulations are being developed and enacted which require environmental analyses beyond the scope previously required anywhere in the basin. Specific requirements for protecting environmentally sensitive areas such as the Suwannee River system are required throughout the local plans, consistent with state and regional plans and agency rules.

The rural counties within the Suwannee Basin generally have limited capability to interpret, administer, and enforce the complex requirements of the new planning and land development regulation processes. For the water resources of the Suwannee River system, 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 basin. 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 as well as to meeting the needs of the river system and all its varied components.

Task 3.4.1: Technical Assistance Workshop 1991-1993

The SRWMD provided local units of government with maps, data, and reports relating to the surface waters of the Suwannee River system within their jurisdiction at a workshop in June 1991. Such maps, data, and reports included the best available information relating floodplains and flood elevations, SRWMD surfacewater programs, land acquisition, and water quality information. The workshop for local technical assistance through the SWIM program will be held in conjunction with other SRWMD programs in June of each year.

Task 3.4.2: Development Review and Ongoing Technical Assistance 1991-1993

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.

***Project 3.5:** Local Government Comprehensive Plan and Plan Amendment Review

Project Goal: Ensure that local comprehensive plans within the Suwannee River Basin provide for adequate protection of the various elements of the Suwannee River 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 associated with the river. Within the current framework of regulatory and management programs affecting the river, that link can best be defined as land use planning. Hence, the preparation and implementation of local comprehensive land use plans is of great interest to the SRWMD SWIM program.

Local units of government within the Suwannee River Basin in Florida are required to submit new or revised comprehensive plans pursuant to Chapter 9J-5, FAC, and Chapter 163, Part II, F.S. The SRWMD is a designated review agency pursuant to Ch. 163.3184, F.S., and reviews local plans for water resources issues. Local governments within the Suwannee River Basin have submitted and adopted

plans by July 1991. All local plans are currently being revised for compliance with Rule 9J-5, F.A.C. and can be amended up to twice yearly.

SWIM review of local plans and plan amendments is conducted under the program direction as outlined in the goals, objectives, and policies section. In addition, local plans and plan amendments are reviewed for consistency with SRWMD SWIM programs and projects. Review comments are coordinated with other SRWMD departments, including permitting, land acquisition, and ground water.

Task 3.5.1: Local Government Comprehensive Plan Amendment Review 1991-1993

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

***Project 3.6:** Interagency Coordination (Technical Coordination)

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

Task 3.6.1: Suwannee River Technical Advisory Group 1991-1994

Conduct two meetings per year of the SRWMD SWIM Technical Advisory Group to provide status reports, program updates, and to obtain technical assistance from cooperating agencies in SWIM programs and projects.

Task 3.6.2: Enforcement Coordination 1991-1994

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

Task 3.6.3: Cooperative Studies 1991-1994

Interagency technical coordination for studies on or within the Suwannee River system will be increased through cooperative studies. Included may be joint study efforts, shared data and/or resources, or coordinated review of procedures and results.

Task 3.6.4: Special Advisory Groups 1991-1994

Sub-groups of the Technical Advisory Group will be formed to study and recommend action for specific issues along the river. Examples include sub-basin issues, specific point source impacts, research and monitoring protocol, joint studies, and data interchange.

Task 3.6.6: Permit Coordination and Tracking 1992-1994

An ongoing process for permit coordination and tracking within the Suwannee River Basin will be established between all regulatory agencies with jurisdiction in the river basin. This will allow for the establishment of a central clearinghouse for information regarding permit conditions, stipulations, status, and applications.

***Project 3.7:** Intergovernmental Coordination (Policy Coordination)

Project Goal: To provide for increased coordination between governmental entities within the Suwannee River Basin, including interstate, intrastate, and intercounty levels of communication.

Task 3.7.1: Suwannee River Coordination Committee 1991-1994

Provide technical, logistic, and staff support to the Suwannee River Coordination Committee as the lead agency as designated in Executive Order 90-14. SWIM policy issues, intergovernmental cooperation and coordination requests, basin management issues, and the review of planning and management programs affecting the river system are examples of issues the committee will address.

Task 3.7.2: Issue-specific intergovernmental coordination issues 1991-1994

The need for intergovernmental coordination through policy advisory groups for specific issues in which several agencies have direct jurisdiction, interest, and can provide support for issue resolution exists outside a larger forum such as the Suwannee River Coordination Committee. Examples of issues a smaller policy advisory group might coordinate include joint enforcement of identified rule violations, review of Administrative Code rules for efficiency or consistency, or various emergency response situations.

***Project 3.8:** Land Acquisition Review and Recommendations

Project Goal: To use the information developed through the SWIM program to guide and assist public land acquisition projects aimed at resource protection, recreation, and resource management.

Task 3.8.1: Land Acquisition and Management Plan 1991-1994

Review annual revisions to the SRWMD Land Acquisition and Management Plan. Prepare recommendations for specific acquisition and management strategies, including analyses prepared under Project 1, GIS Analyses.

Task 3.8.2: Land Acquisition Technical Support 1991-1994

Provide technical support to the Land Acquisition Department, DNR (CARL) in land acquisition planning and strategizing, 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. (1990 and ongoing)

***Project 3.9:** Public Involvement and Education

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

Task 3.9.1: Techniques of Public Involvement and Education 1992

Review and research public involvement strategies and programs of other resource management agencies and develop alternative strategies and programs for the SRWMD's SWIM program.

Task 3.9.2: Environmental Education 1991-1994

SWIM brochures and documents, developed for elementary and secondary students, that provide information about the basic functioning of the Suwannee River system and outline activities that can bring about a more complete understanding of the river will be prepared. Field trips to SRWMD Save-Our-River lands, science projects, and classroom projects and presentations are examples of components of an environmental education program.

Task 3.9.3: Educational Brochures and Publications 1992-1994

Printed information about the Suwannee River system, specific reaches of the river, and unique natural areas such as springs and floodplain forests,

flooding events, wildlife habitat, ecological restoration and protection programs, and water quality issues relating to SWIM will be prepared and distributed. Target audiences include recreational boaters, recreational anglers, and riverfront and floodplain homeowners.

The focus of the brochures and publications will be to outline common activities and the threats they pose to the river system--such as gasoline and oil spills from boats, activities leading to riverbank erosion, boat speeds, wildlife needs, and littering or dumping. Appropriate use of the river system and low-impact techniques of river use will be provided, as well as reference information for law enforcement, emergency numbers, etc.

Task 3.9.4: River Watch Program 1992-1994

Research into river watch programs in other parts of the state and country will be conducted in order to organize an effective volunteer river watch program. The establishment and support of such a system on the Suwannee River and its tributaries will provide invaluable assistance, support, and information for management of the river system. Such volunteer groups usually conduct such activities as basic water quality monitoring, river clean-up campaigns, and wildlife or fisheries monitoring, as well as providing many extra, needed "eyes and ears" on the river system.

Task 3.9.5: Annual River Day and Special Activities 1992-1994

An annual SWIM Suwannee River Day will be declared to bring attention to the accomplishments of the SRWMD's SWIM program and to provide information in a public celebration of the river system. The River Day will likely include opportunity for river recreation, games, contests, and river clean-up projects. The location of the annual River Day celebration will vary from year to year. Other special activities, such as volunteer spring restoration/clean-up projects, wildlife surveys and cooperative activities with other organizations will be conducted.

***Project 3.10:** Erosion Evaluation and Control

Project Goal: To identify areas along the Suwannee River and its tributaries which are experiencing accelerated shoreline erosion caused by human activities, and to remediate the nonpoint source impacts to the river system caused by these activities. Areas which have been degraded by overuse or lack of appropriate land management practices abound along the Suwannee River and its tributaries--especially springs. Causes of this anthropogenic erosion include boat wakes and heavy boat traffic, trampling and removal of stabilizing bankside vegetation, inadequate natural buffering and subsequent stormwater runoff erosion, and other activities which individually or cumulatively cause degradation of the Suwannee River system.

Personal and anecdotal references about erosion problems and causes are available to any who visit the river, yet a comprehensive survey, followed by a series of demonstration projects, has not been conducted for the river system. The tasks outlined below are directed at addressing this river management issue.

Task 3.10.1: Erosion Problem Area Survey 1992

A systematic, comprehensive survey of the river and its tributaries is one of the prerequisites to establishing demonstration erosion control projects. The function of this task is threefold: to map the location of anthropogenic erosion problems on the river system, to classify each area according to the severity of the erosion as well as the causes, and to select specific areas, representative of each major type of erosion, for demonstration restoration projects.

Task 3.10.2: Riverbank Erosion Control Manual

One of the principle land uses along the river system is residential. Many typical homesite activities can lead to serious erosion problems--and are easily avoided by wise land management practices. This task will result in a lay-person oriented manual for riverfront homeowners' use in ensuring that their activities do not lead to erosion problems, as well as other related guides to appropriately managing riverfront activities.

Task 3.10.3. Spring and Coastal Shoreline Restoration Projects 1992

Many springs, parks, and public areas along the river system have experienced erosion and other problems associated with heavy, unmanaged public use. It is the aim of the District, through the SWIM program, to use all available funding sources to restore degraded springs, parks, and points of public access to the river system, including District funds, SWIM funds, local match funds, and state and federal grant and aid programs. The primary criteria for determining project areas will be public ownership, the degree or magnitude of impact from unmanaged use, the technical, economic, and environmental feasibility of restoration, and continued management to avoid further degradation.

The SRWMD has nominated several candidate sites for environmental enhancement/restoration projects using dollars from the Pollution Recovery Trust Fund (PRTF), supplemented by SWIM staff efforts. The PRTF is the repository for all monetary penalties resulting from DER enforcement efforts. After a review of potential projects, staff from the SRWMD nominated the following projects. District staff developed conceptual plans of work for three of these projects, providing general overviews of work needed and proposed,

but at this time the need exists to develop final project designs for the following three sites and secure permits to conduct the work.

1) Ruth Spring (Lafayette County). Ruth Spring is a second magnitude spring located in a county park. This site is experiencing erosion into the spring pool from surrounding upland areas, largely due to uncontrolled vehicle access. This project would provide more control on vehicle access, provide appropriate parking areas, and provide boardwalk access to the spring pool. Other measures will be taken to stop some existing erosion around the spring basin area. Project budget $24,450.

2) Royal Spring (Suwannee County). Proposed work on this second magnitude spring would address some existing bank erosion problems at the spring, provide boardwalk access to reduce user degradation of spring banks and provide more control on vehicle access and parking. Project budget $30,000.

3) Town of Suwannee Park (Dixie County). The community park in the Town of Suwannee, in the estuarine part of the Suwannee River, is experiencing considerable amounts of shoreline degradation due to boat traffic in the adjacent tidal canals. This project would use a series of "hard" and "soft" shoreline treatments to address erosion problems along the banks of the canals bordering the park, providing a variety of examples to property owners with similar canal frontage. Project budget $30,000.

A fourth project proposed for PRTF funding only needs the dollars to implement it, as it has been designed and permitted by the Suwannee River Resource Conservation and Development Council and Suwannee County. This is the restoration of Charles Spring in Suwannee County. Charles Spring is a second magnitude spring which is being degraded due to heavy public use, including unrestricted vehicle access, lack of adequate parking and user degradation of the spring banks. This project would provide appropriate parking areas, control runoff from the adjacent upland areas and provide stairway/boardwalk access to the spring pool. Additionally, some sediment removal in the spring run would be conducted when the Suwannee River is at low water. Permits from the FDER and the Corps have already been obtained for this work. The proposed project budget for this work is $51,500.

4. Waterbody Planning

Program Definition: Waterbody planning encompasses those activities involved with the ongoing SWIM planning process as it affects the Suwannee River 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 Suwannee River 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 4.1: Santa Fe River SWIM Plan Revision

Project Goal: To revise the Santa Fe River SWIM Plan consistent with the revised Suwannee River SWIM Plan and expand the overall river management plan and program to include this important tributary to the Suwannee River.

The Santa Fe River is currently ranked as the second priority water body within the SRWMD. The Santa Fe River is the only major tributary of the Suwannee that is entirely within Florida--a fact that supports a separate, yet related, management strategy to that for the overall Suwannee basin.

Descriptions of the characteristics of the Santa Fe River and some of the management issues are provided in the 1988 Santa Fe River SWIM plan. Physical characteristics that distinguish the Santa Fe within the overall Suwannee River Basin include the headwater lakes and swamps, different development patterns along the river's headwaters, more intense human use of the river in certain reaches, the river's sink and rise at O'Leno, and the significant base flow provided by spring input. While there exist certain distinguishable characteristics that warrant consideration of the Santa Fe apart from the Suwannee, the similarities in both the river systems as well as the management approach taken by the SRWMD mandate the close coordination and connections between the two plans. In fact, the Santa Fe River SWIM plan, when revised, could be considered as an element of the overall Suwannee River Basin SWIM plan.

Task 4.1.1. Santa Fe River SWIM Plan Review 1991-1992

The existing, approved SWIM plan for the Santa Fe River developed by the SRWMD in 1988 will be reviewed and evaluated in preparation for plan revision.

Task 4.1.2. Santa Fe River SWIM Plan Revision 1992

The Santa Fe River SWIM Plan will be revised to be consistent with the revised Suwannee River SWIM plan, including revision to and further refinement of the projects and tasks proposed to implement the management strategy for the river. Special attention will be given to the specific problems

and impacted areas of the Santa Fe River system, ongoing resource monitoring, and program implementation.

Project 4.2: Annual SWIM Plan Review and Evaluation

Project Goal: To annually review and evaluate the Suwannee River 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 Suwannee River SWIM program is an ongoing program--the Suwannee River 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 4.2.1. Suwannee River SWIM Plan Review and Evaluation 1992-1994

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

Project 4.3: 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 Suwannee River system or the need for additional priority waters within the system.

Task 4.3.1: Annual Priority List Review 1991-1994

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

Appendices

A. Governmental Units with Jurisdiction in the Suwannee River Basin

As required in the SWIM legislation, following is an identification of all governmental units that have jurisdiction over the water body and the land within a one mile perimeter of the water body, including local, regional, state, and federal units.

Federal Agencies

Army Corps of Engineers (navigation, wetlands, and dredge/fill permitting)

Department of Interior, Fish and Wildlife Service (Okefenokee and Lower Suwannee National Wildlife Refuges)

Environmental Protection Agency (National Pollutant Discharge Elimination System (NPDES), other permitting activities)

State Agencies

State agencies with jurisdiction over the Suwannee basin area are divided into those in Georgia and those in Florida. In Georgia, the agency and its management responsibilities relating to water resources are:

Georgia Department of Natural Resources, Environmental Protection Division (Point source discharge permits)

Georgia Department of Transportation (State and Federal road network, drainage systems)

The Florida state agencies exercising jurisdiction within the upper basin project area are:

Florida Department of Natural Resources (State-owned sovereign lands, State Parks, mine reclamation, Florida Marine Patrol, and aquatic weed control)

Florida Department of Environmental Regulation (NPDES water quality certifications, dredge and fill permitting, surface and groundwater quality management, point source discharge permitting, stormwater discharge permitting, solid and hazardous waste)

Florida Department of Transportation (State and Federal road network, drainage systems)

Florida Game and Fresh Water Fish Commission (freshwater fishing licensing, game and wildlife management, habitat protection, protected species regulation, enforcement activities)

Florida Department of Community Affairs (Areas of Critical State Concern, Developments of Regional Impact, review of local comprehensive plans)

Florida Department of Health and Rehabilitative Services (Regulation and permitting of onsite sewage disposal systems)

Regional Agencies

Suwannee River Water Management District (surfacewater management permitting, water quality stormwater management permitting, water well construction, consumptive use permitting, artificial recharge)

North Central Florida Regional Planning Council (Developments of Regional Impact, Federal A-95 review, Comprehensive Regional Policy Plans, technical assistance to local governments)

Withlacoochee Regional Planning Council (Same responsibilities as above)

Local Governments

Florida Counties:

Management Responsibilities: The management responsibilities of county government relating to or impacting on water quality are land use controls, public facilities construction and operation, comprehensive plan development, and the issuance of development orders and construction permits. Specific direction in the management of land use activites and water resource issues is provided for local governments in Florida through Chapter 163, Part II, F. S., and Rules 9J-5 and 9J-24, F.A.C.

Columbia County
Suwannee County
Lafayette County
Dixie County
Hamilton County
Madison County
Gilchrist County
Levy County

Florida Cities:

City of White Springs, Hamilton County
City of Jennings, Hamilton County
Branford, Suwannee County
Fanning Springs, Levy County

Georgia Counties:

Atkinson County	*Colquitt County*	*Lowndes County*
Ben Hill County	*Cook County*	*Tift County*
Berrien County	*Crisp County*	*Turner County*
Brooks County	*Echols County*	*Ware County*
Charlton County	*Irwin County*	*Wilcox County*
Clinch County	*Lanier County*	*Worth County*

Georgia Cities (within one mile of principle tributaries)

City of Valdosta, Lowndes County
City of Quitman, Brooks County
City of Tifton, Tift County
City of Fargo, Clinch County

B. Past and Present Studies of the Suwannee River System

GENERAL DESCRIPTIONS AND BIBLIOGRAPHIES

Claiborne, M,T. L. Embry, N. D. Hoy, D. H. Weldon, and T. D. Wilson. 1987. Bibliography of U. S. Geological Survey Reports on the Water Resources of Florida, 1886-1986. Fourth Edition. U. S. Geological Survey Open File Report 85-424.

Corps of Engineers. 1983. Reconnaissance Report. Suwannee River. Georgia and Florida. A report prepared by the Jacksonville District.

Florida Department of Environmental Regulation. 1980. The proposed redesignation of the Suwannee River between State Road 6 (Hamilton and Columbia counties) and Suwannee Springs (Hamilton and Suwannee Counties) as an "Outstanding Florida Water." Report to the Environmental Regulation Commission.
This report summarizes the information used to develop the recommendation to designate the named portion of the upper Suwannee as an OFW. Results of the public hearings, correspondence received and news coverage of the proposed designation are also presented.

_____. 1984b. Florida Water Resources. Bibliography. Report prepared by the Water Quality Monitoring and Quality Assurance Section, Bureau of Water Analysis. April, 1984.
Comprehensive bibliography of Water Resource Investigations in the State of Florida, arranged by author. No annotation, no subject or geographic organization. Subject matter covered includes hydrological, water quality and natural resource studies.

General Accounting Office, U. S. 1986. Wild and scenic rivers. Certain rivers not in national system generally retain original values. A report to the Chairman, Subcommittee on National Parks and Recreation, Committee on Interior and Insular Affairs, House of Representatives. General Accounting Office, U. S. Government, Washington, D. C.

Leadon, C. J. 1980. The upper Suwannee River, an outstanding national water. SRWMD Staff Report 80-1.

Lynch, J. M. 1984. Suwannee River Preserve design project. Report prepared for the Florida Natural Areas Inventory Program and the Southeast Regional Office of the Nature Conservancy. Vols. 1 and 2.
This two volume set presents a summary of an inventory of the natural resources (vegetation, wildlife, geological and water resources) of the Suwannee River from the Florida/Georgia border to the town of Fanning Springs. Vegetation and wildlife species lists are presented for a number of

large (> 500 ac) and small parcels of land along the Suwannee. Spring locations are mapped, field data sheets and observations are presented in an appendix.

North Central Florida Regional Planning Council. 1977a. Natural Resources. Report prepared for the Florida Department of Housing and Urban Development. 165 pp.
Report which summarizes the natural resources of the NCFRPC. Major natural communities (uplands and wetlands) are described, mapped, and areal extent (acreage) determined for these communities. General summaries of the physiography, climate, geology and water resources of the area are presented. Species lists of vegetation and wildlife are presented.

_____. 1986. Coastal Hazard Mitigation and Resource Protection in the North Central Florida Region. Report prepared for the DER.

U. S. Dept of Agriculture. 1977. Northeast Gulf River Basins. Florida, Alabama and Georgia. Cooperative Survey. Volume 1 and Appendix to Volume 1. Report produced by the U.S.D.A. Soil Conservation Service in cooperation with the Fla. DER and the Alabama Development Office. Vol. 1. Numerous maps and plates.
General summary of the northeast Gulf of Mexico region (south Georgia, southeast Alabama, and northwest and north central Florida). Discusses in general fashion climate, physiography, geology, water resources, commercial and recreational resources, natural resources, and human use of and interest in the above resources. Maps are presented summarizing vegetative cover, soils, climate, forest types, watersheds (basins and sub-basins) and other information related to land planning and land use.

U. S. Dept. of the Interior. 1964. Suggested Suwannee National River, Florida and Georgia. Field Investigation Report. Prepared by the Southeast Region, National Park Service, U. S. Dept of the Interior, Richmond, VA.

U. S. Study Commission. 1963. Plan for Development of the Land and Water Resources of the Southeast River Basins. Appendix 5. Suwannee Basin.

Wolfe, S. H., J. A. Reidenauer, and D. B. Means. 1986 DRAFT. An ecological characterization of the Florida Big Bend.
A draft document. This document presents a fairly detailed discussion of the hydrology, geology, climatology, and particularly the ecology of the Florida Big Bend.

SPECIFIC STUDIES AND REFERENCES

Hydrology

Ceryak, R., M. S. Knapp, and T. Q. Burnson. 1983. The Geology and Water Resources of the upper Suwannee River Basin, Florida. Florida Department of Natural Resources, Bureau of Geology. Report of Investigation No. 87: 1-165.
This publication presented a summary of the stratigraphy, geologic setting and history, surfacewater hydrology and surface water chemistry of the upper Suwannee River Basin. Above White Springs, the river has the hydrological and water quality characteristics of a drainage-basin fed river (the Okefenokee Swamp being the drainage basin). Below White Springs, the connections between the river and subsurface aquifers contribute to an increasing contribution of groundwater input to the river's baseflow and water quality characteristics.

Corps of Engineers. 1974. Special Flood Hazard Information. Suwannee River Floods. Florida and Georgia. U. S. Army Corps of Engineers, Jacksonville District. A report prepared for the SRWMD.
This report presents a brief, general description of the Suwannee River watershed and presents flood stage graphs and data for the floods of record of April 1948, March 1959, and April 1973.

Crane, J. J. 1986. An investigation of the geology, hydrogeology, and hydrochemistry of the lower Suwannee River Basin. Florida Department of Natural Resources, Bureau of Geology. Report of Investigation No. 96: 1-205.

SRWMD. Date Unkn. HEC-II Model of the Suwannee River.

A hydrologic model of the Suwannee, with sub-basin hydrology modelled as well.

U. S. Geological Survey. 1987. Water Resource Data. Florida. Water Year 1986. Volume 4. Northwest Florida. Report prepared by the USGS in cooperation with other agencies. U. S. Geological survey Water-Data Report FL-86-4. Discharge and stage data are presented from six stations on the Suwannee. Periods of record of most of these are 50 years or greater. Data are reported for Water Year 1986.

Water Quality

Black, D. W. 1984. QUAL-II Model of the Suwannee River. Final Report to the Florida Department of Environmental Regulation. Contract CM-74. 92 pp.
This effort modeled the stream quality of the Suwannee River. The two major conclusions of the model were: that biological processes such as BOD, photosynthesis, and respiration were not major influences on water

chemistry in the Suwannee and that groundwater input was a significant factor influencing the chemistry of the Suwannee. Modeling efforts were complicated by ungauged inflows from and outflows to the Floridan Aquifer.

Ceryak, R., M. S. Knapp, and T. Q. Burnson. 1983. The Geology and Water Resources of the upper Suwannee River Basin, Florida. Florida Department of Natural Resources, Bureau of Geology. Report of Investigation No. 87: 1-165.
Partially reviewed above. Above the town of White Springs, the chemistry of the surface water of the river is characterized by low DO, low nutrients, slightly acidic pH and Na and Cl as the major cations and anions. Below White Springs, with the increasing influence of groundwater input from limestone aquifers, pH rises; and Ca, Mg and HCO3 become the dominant cations and anions due to groundwater input.

Coffin, J. E. 1981. Quality of Surface Waters at Selected Sites in the Suwannee River Basin, Florida, April 1978 to December 1979. U. S. Geological Survey Open-File Report 81-76.

_____. 1982, Quality of Surface Water at Selected Sites in the Suwannee River Basin, Florida, 1980. U. S. Geological Survey Open-File Report 82-103.

Florida Department of Environmental Regulation. STORET data files for water quality.

_____. 1985. Limnology of the Suwannee River, Florida. DER Biology Section, Division of Environmental Programs. March, 1985.
This report summarizes the results of a two-year sampling program conducted by DER in the upper Suwannee and upper portion of the Lower Suwannee River. Sampling was conducted in 1982 and 1983. One of the purposes of the project was to assess effects of discharge from the Occidental Chemical Co. in Swift Creek on the ecology of the river. Some data are presented in the appendices of this report. Water quality was sampled at 28 stations on the Suwannee, 1 station on the Santa Fe, 1 station each in Hunter and Roaring Creeks, 2 stations in Swift Creek and 1 station on the Withlacoochee. Water quality parameters sampled were pH, alkalinity, conductivity, color, temperature, DO, sulfate, fluoride, chloride, silica, turbidity, total phosphate, orthophosphate, NO3/NO2/NH3, TKN, chl a. Proceeding in a downstream direction, from the confluence of Hunter Creek with the Suwannee to Fowler Bluff, pH increases, DO decreases slightly, turbidity increases, nitrogen parameters increase in concentration, color decreases, total phophorus increases and fluoride increases. There was a "spike" of relatively high phosphorus, fluoride and nitrogen at the confluence of Swift Creek with the Suwannee.

_____. 1986b. 1986 Florida Water Quality Assessment. 305(b) Technical Report. Report by the Water Quality Monitoring and Quality Assurance Section, Bureau of Water Quality Management, Division of Environmental Programs. June, 1986.
Presents data from eight stations on the Suwannee. General water quality was classified as poor in Swift Creek, fair in Hunter Creek, Roaring Creek, and the Suwannee River between Swift Creek and the Alapaha River and good in the remaining portions of the Suwannee.

Hull, R. W., J. E. Dysart, and W. B. Mann, IV. 1981. Quality of Surface Water in the Suwannee River Basin, Florida, August 1968 through December, 1977. U. S. Geological Survey, Water-Resources Investigations 80-110 (PB81 206591).

Seaburn and Robertson, Inc. 1985. SRWMD Surface Water Management Plan. Supporting Information. A report prepared for the SRWMD. Sept. 1985.
Presents water quality data from USGS computer files for the Suwannee River, Withlacoochee River, and Hunter, Swift, and Rocky creeks. Data are presented and graphed and general long-term trends discussed. In general, no major changes in water quality were observed for the period of record of the USGS station. Data from the USGS were chosen due to the long term of sampling (back to the early 1960's at some stations) and the standardization of sampling and analysis methods within one agency.

U. S. Geological Survey. 1987. Water Resource Data. Florida. Water Year 1986. Volume 4. Northwest Florida. Report prepared by the USGS in cooperation with other agencies. U. S. Geological Survey Water Data Report FL-86-4.
Discharge, stage and water quality data (temperature, pH, conductivity, DO, turbidity, nutrients, suspended sediment and dissolved solid loads, fecal coliform, streptococci, alkalinity, minerals, and metals) are presented. Discharge data are measured at six stations on the river. Water quality data are measured at five stations on the river. Discharge and water quality are also measured on Hunter and Swift Creeks (one station each) and the Withlacoochee River (one station). Discharge and data are recorded on two stations on the Alapaha.

Wieckowicz, R. 1984. Owens-Illinois. Withlacoochee River Intensive Survey Documentation. Hamilton County. DER. Water Quality Technical Series. Volume 1, Number 81.
Presents technical data (water quality, hydrology, and correspondence) relating to a study of paper mill effluent effects on the Withlacoochee River south of the Florida/Georgia State Line.

Productivity, Plankton, and Periphyton Studies

Florida DER. 1985. Limnology of the Suwannee River, Florida. DER Biology Section, Division of Environmental Programs. March, 1985.

Periphyton studies were performed at 11 stations using glass slides mounted in racks and suspended in the water column. A total of 356 taxa of algae were identified. Diatoms were the dominant group, composing 88% of the taxa. Stations on the upper river (above the Withlacoochee) were separated from those on the lower river by cluster analysis. A greater number of species were found downstream, on the lower river. Periphyton biomass (as measured by chlorophyll a) was higher in the lower river.

Vegetative Community Characterization and Mapping

Beccasio, A. D., N. Fotheringham, A. E. Redfield, et al. 1982. Gulf Coast Ecological Inventory: user's guide and information base. Biological Services Program, U. S. Fish and Wildlife Service, Washington, D. C.
This document and its associated maps inventory the ecology of the United States Gulf of Mexico coastline. Species lists, wetland habitats, commercial fishing areas, parks and preserves, endangered and threatened species and their breeding areas and general geography/geology are presented.

Florida Department of Natural Resources. 1986. Florida Aquatic Plant Survey. 1986. Report produced by the Bureau of Aquatic Plant Management.
(Also DNR 1985, 1984, 1983, 1982. Aquatic plant surveys for the respective years).
These reports, produced by the DNR Bureau of Aquatic Plant Research and Control, summarize, by county and by water management district, water bodies with known aquatic plant problems. Information on species composition and acreage of coverage is presented. 5.4 acres of *Hydrilla* and 15.5 acres of water hyacinth were reported to occur on the Suwannee.

North Central Florida Regional Planning Council. 1977b. Significant Natural Areas in Planning District 3. Report prepared for the Florida Dept. of Housing and Urban Development.
Descriptions of sixteen natural areas identified as being environmentally significant due to wildlife habitat values and/or the occurrence of unique or protected species and species associations. General prose descriptions of vegetation and wildlife in each area are given. The Suwannee River was identified as one of the top four areas of regional significance.

U. S. Fish and Wildlife Service. National Wetlands Inventory. Maps of emergent wetland habitat (freshwater, estuarine, and marine) at a scale of 1:24000.

Wharton, C. H., W. M. Kitchens, E. C. Pendleton, and T. W. Sipe. 1982. The ecology of bottomland hardwood swamps of the southeast: A community profile. U. S. Fish and Wildlife Service, Biological Services Program, Washington, D. C. FWS/OBS-81/37.

A summary of the structure, function and wildlife habitat value of southeastern U. S. bottomland hardwood swamps. Species lists and bibliography.

Substratum Characterization

Very few studies of substratum of the river bed of the Suwannee appear to have been performed.

Benthic studies

Bass, D. G., Jr. and V. G. Hitt. 1971. Sport fishery of the Suwannee River. Report I. Report by the FGFWFC. December, 1971.
Fishery survey on the Suwannee River conducted on the middle river between Luraville and Fanning Springs. Creel surveys, fish population studies (electroshocking), benthic studies (Eckman dredge and Surber stream bottom sampler) and general water quality were studied. Benthic communities were generally dominated by the bivalve *Corbicula manilensis*. Benthic "production" was characterized as low. The bivalve was fed upon by redear sunfish. Three main types of benthic invertebrate communities were identified with specific microhabitats--torrential fauna on shoals, mid-river fauna, and near-bank fauna.

Florida Department of Environmental Regulation. 1985. Limnology of the Suwannee River, Florida. DER Biology Section, Division of Environmental Programs. March, 1985.
Benthic communities were examined at eleven stations using Hester-Dendy settling racks. Dipterans were the most abundant group of aquatic invertebrates at all sites. Trichopterans (caddis flies) and Ephemeropterans (mayflies) were the next most abundant groups, in that order. Diversity, as measured by the Shannon-Wiener Index, increased downstream. Normal analysis delineated three groupings of stations; a single "upper river" station, three "mid river" stations and seven "lower river" stations. The general increase in diversity downstream was attributed to groundwater input and its effects on water quality.

Florida State Board of Health. 1966. Survey of Suwannee River. June-August 1965. FSBH Bureau of Sanitary Engineering, Jacksonville, Florida.
Presents Beck's Biotic Index values for several stations on the river from qualitative benthic sampling stations. Sampling methodology was not identified nor were species collected presented. The "health" of the river was identified as good.

US EPA 1982. An Environmental Assessment of the Impacts of Mine Drainage on Roaring and Hunter Creeks. White Springs, Florida. September, 1982. Report issued by the USEPA, Environmental Services Division, Athens, GA.

Fisheries Studies

Bass, D. G., Jr. and V. G. Hitt. 1971. Sport fishery of the Suwannee River. Report I. Report by the FGFWFC. December, 1971.
Fishery survey on the Suwannee River conducted on the middle river between Luraville and Fanning Springs. Creel surveys, fish population studies (electroshocking), benthic studies (Eckman dredge and Surber stream bottom sampler) and general water qualtiy were studied. A qualitatively good sport fishery on the Suwannee in the study area was identified. Abundance generally increased downstream. Redbreast sunfish were the dominant species. Harsh physical conditions (lack of a littoral shelf, strong currents, and rapid changes in water quality) provided little suitable fish habitat for spawning. Most of the fish reproduction appeared to occur in the tributary streams.

_____. 1973. Sport fishery ecology of the Suwannee and Santa Fe rivers, Florida. Report I. Fish population sampling of the lower Suwannee and lower Santa Fe rivers. Report by the FGFWFC, Northeast Region. 187 pp.

_____. 1973. Sport fishery ecology of the Suwannee and Santa Fe Rivers, Florida. Report II. Distribution and life history aspect of the Suwannee Bass, *Micropterus notius*, Bailey and Hubbs. Report by the Florida Game and Freshwater Fish Commission, Northeast Region, December, 1973. 54 pp.

Florida DER. 1985. Limnology of the Suwannee River, Florida. DER Biology Section, Division of Environmental Programs. March, 1985.
Fish electroshocking surveys were performed at eight stations on the Suwannee. Fish abundance increased downstream. It was hypothesized that poor fisheries habitat (lack of emergent vegetation and other microhabitats), variable river flows and low pH, fertility and high color contributed to the lower biomass of fishes in the upper river. Fish community composition was altered by the discharge of phosphate mine effluent into Swift Creek. the river supported a high-quality sport fishery.

Florida Game and Freshwater Fish Commission. 1987 and 1988. Northeast Florida Region. 1985-1986 and 1986-1987 Fish Management Reports. Reports produced by the FGFWFC. vii, 107 pp. (85-86) and vii, 107 pp (86-87).
These reports summarize the activities of the Northeast Region FGFWFC Fisheries Laboratory for the indicated year. As part of the statewide stream electroshocking survey, four stations are sampled on the Suwannee. These data were not reported. Data were presented from electroshocking surveys conducted on Rocky, Hunter, Roaring, and Swift creeks and Jerry Branch. Numbers of species in collected from each creek in 1986-1987 were; Rocky (5), Hunter (20), Roaring (17), Swift (11) and Jerry Branch (9).

Huff, J. A. 1975. Life history of the Gulf of Mexico sturgeon, *Acipenser oxyrhyncus desotoi*, in the Suwannee River. Fla. Mar. Res. Publ. No. 16: x-xx.

Wildlife Resource Studies (including endangered species)

FGFWFC. Ongoing study being conducted by the Nongame Wildlife Program surveying wading bird colonies over a five year period in the North Florida Region.

Nesbitt, S. A., J. C. Ogden, H. W. Kale, II, B. W. Patty, and L. A. Rowse. 1982. Florida Atlas of breeding sites for herons and their allies: 1976-1978. U. S. fish and Wildlife Service, Office of Biological Services. FWS/OBS-81/49. Presents maps and census data (species composition and breeding pair abundance) from aerial censuses of wading bird rookeries conducted in 1976-1978. Eight colonies were identified within the Suwannee River Basin.

Pritchard, P. C. H. (Series Editor). 1979-1982. Rare and Endangered Biota of Florida. Volumes 1-6:

Volume 1. Mammals. Edited by J. N. Lane.
Volume 2. Birds. Edited by H. W. Kale, II.
Volume 3. Amphibians and Reptiles. Edited by R. W. McDiarmid.
Volume 4. Fishes. Edited by C. R. Gilbert
Volume 5. Plants. Edited by D. B. Ward.
Volume 6. Invertebrates. Edited by R. Franz.

Series produced by the Florida Committee on Rare and Endangered Plants and Animals. University Presses of Florida, Gainesville, Florida.

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Bartram, William. 1791. Travels of William Bartram. Mark Van Doren, ed. Dover Publications, Inc. New York, New York.

BEBR. 1988. Florida Statistical Abstract. Bureau of Economic and Business Research, College of Business Administration, University of Florida. University Presses of Florida.

Blake, Nelson M. Land Into Water - Water Into Land. A History of Water Management in Florida. Florida State University, University Presses of Florida. 1980.

Bureau of Outdoor Recreation, U. S. Department of the Interior. Suwannee River, Florida - Georgia, National Wild and Scenic River Proposal. March 1971.

Ceryak, Ron, M. S. Knapp, and T. Burnson. The Geology and Water Resources of the Upper Suwannee River Basin, Florida. Report of Investigation No. 87. Florida DNR, Bureau of Geology. 1983.

Cohen, A. D. Ed. The Okefenokee Swamp: Its Natural History, Geology, and Geochemistry. Wetlands Surveys, Loa Alamos, New Mexico. 1984.

Dames and Moore. 1988. Final Report. SRWMD 1988 SWIM Priority List. Report submitted to the SRWMD. March, 1988.

DER. 1985. Limnology of the Suwannee River. Report by the Florida DER, Biology Section, Division of Environmental Programs. March, 1985.

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Florida Department of Transportation. 1985. Second Edition. Florida Land Use, Cover and Forms Classification System. Florida Department of Transportation, State Topographic Bureau, Thematic Mapping Section. Procedure No. 550-010-001-A.

Fernald, Edward. Ed. 1984. Water Resources Atlas of Florida. Florida State University.

Fernald, Edward. Editor. 1981. Atlas of Florida. Florida State University.

FGFWFC. 1988. Northeast Florida Region. 1986-1987 Fish Management Report. Report prepared by the FGFWFC.

Gaufin, A. R. 1973. Use of aquatic invertebrates in the assessment of water quality. Pp. 96-116 IN: J. Cairns, Jr. and K. L. Dickson (eds.) Biological Methods for the Assessment of Water Quality. ASTM Special Technical Publication No. 528.

Hooks, T. A., K. L. Heck, and R. J. Livingston. 1976. An inshore marine invertebrate community structure and habitat association in the northeastern Gulf of Mexico. Bull. Mar. Sci. 26(1): 99-109.

J. R. Sedell, C. E. Cushing, and R. L. Vannote. 1983. Interbiome comparison of stream ecosystem dynamics. Ecol. Monographs 53(1): 1-25

Krummrich, J. Personal Communication, telephone conversation August 1988.

Mahadevan, S. K. 1985. Benthic Infauna. Pp. 6-18 to 6-42 IN: FPC. Final Report. Crystal River Units 1, 2 and 3. 316 Demonstration. Report issued by the Florida Power Corporation.

Minshall, G. W., R. C. Petersen, K. W. Cummins, T. L. Bott, Oxy, 1988. Letter from R. E. McNeill, August 9, 1988.

National Park Service. Suwannee National River - Field Investigation Report. U. S. Department of the Interior, May 1964.

Patrick, R. 1973. Use of algae, especially diatoms, in the assessment of water quality. Pp. 76-95 IN: J. Cairns, Jr. and K. L. Dickson (eds.) Biological Methods for the Assessment of Water Quality. ASTM Special Technical Publication No. 528.

Suwannee River Task Force. Report to Governor Bob Martinez. November 15, 1989. Executive Order 90-14, January 17, 1990.

SRWMD. 1982. Technical Report 82-3. Hydrogeologic Overview.

_____. 1988. Falling Creek SWIM Plan.

SRWMD. 1988. Lower Suwannee River SWIM Plan.

SRWMD. 1988. Upper Suwannee River SWIM Plan.

U.S. Army Corps of Engineers, Final Survey Review Report, Suwannee River Georgia and Florida. July 1989.

U.S. General Accounting Office, Wild and Scenic Rivers - Certain Rivers Not In National System Generally Retain Original Values. Report to the Chairman, Subcommittee on National Parks and Recreation, Committee on Interior and Insular Affairs, House of Representatives. December 1986.

Wharton, C. H., W. M. Kitchens, E. C. Pendleton, and T. W. Sipe. 1982. The ecology of bottomland hardwood swamps of the southeast: A community profile. U. S. Fish and Wildlife Service, Biological Services Program, Washington, D. C. FWS/OBS-81/37.

Williams, B. K. 1983. Some observations on the use of discriminant analysis in ecology. Ecology **64**(5): 1283-1291.

Wolfe, S. H. and L. E. Wolfe. 1985. The Ecology of the Suwannee River Estuary. An analysis of ecological data from the SRWMD study of the Suwannee River estuary, 1982-1983. Report submitted to the Florida DER.

Zar, J. H. 1974. Biostatistical Analysis. Prentice-Hall, Inc., Englewood Cliffs, N. J.

D. Restoration and Conservation Projects Initiated Prior to July 1, 1987

CARL Program. The Conservation And Recreational Lands Program (CARL) was created to purchase environmentally and recreationally valuable lands. The program is funded by legislative appropriations and is administered by the Florida DNR.

Save Our Rivers Program. The Save Our Rivers Program, as it is popularly known, was created in 1981 as the Water Management Lands Trust Fund (Ch. 373.59, F.S.). It is funded from a portion of the documentary stamp tax placed on all real estate transactions conducted in the State of Florida. The monies from the fund are allocated to the five water management districts to be used for the purchase of lands considered necessary for water management, water supply and/or for the protection of water resources within the districts. To date, the SRWMD has purchased a number of tracts of land on the Suwannee, and is negotiating purchase of additional land on the Suwannee as well as on the Alapaha and Withlacoochee rivers.

Suwannee River Management Plan. In 1980 Governor Bob Graham established the Suwannee River Resource Planning and Management Committee. The purpose of this group was to develop a set of management guidelines and policies for the Suwannee River and its 100-year floodplain. Ultimately, the goal was "to develop and implement a resource management plan which will provide.....protection for the land and water resources located within the identified study area of the Suwannee River Basin." The end result of this group's efforts was the Suwannee River Management Plan (SRMP). The SRMP detailed 32 recommendations, covering data collection, monitoring, flood forecasting, zoning, and floodplain ordinances. A review of the extent and effectiveness of implementation of these recommendations was conducted by DER.

Wild and Scenic Rivers Study. In 1968 initial attempts were made to have the Suwannee River designated as a National Wild and Scenic River. This attempt was defeated in the U. S. Congress, based on a report issued by the General Accounting Office and on local opposition to this designation.

Outstanding Florida Waters Program. By the early 1980's, the entire Suwannee River and certain tributary streams were declared as an OFW. DER rule provisions applicable to OFW's are found in Chapters 17-3, 17-4 and 17-6, F.A.C. These rules establish special protection for waters regarded as "of exceptional recreational or ecological significance." The rules state that no DER permit shall be issued for an installation which is determined to "significantly degrade" the ambient water quality of an OFW (from discharge upstream or in a tributary to the OFW) or which discharges directly to the OFW. The principle purpose of the OFW program has been to maintain the water quality and associated ecological and recreational values of the water bodies designated within the program.

E. Suwannee River Coordination Committee Work Plan

SUWANNEE RIVER COORDINATION COMMITTEE

Work Plan for the Implementation of Suwannee River Task Force Recommendations

INTRODUCTION

Executive Order 88-246, signed by Governor Bob Martinez, established the Suwannee River Task Force, a 21-member committee charged with assessing the existing planning and management framework as it applies to the protection of the Suwannee River system. The Task Force met during 1989 and issued a final report containing 44 recommendations for the various parties involved with the river system. Governor Martinez then issued Executive Order 90-14 on January 17, 1990 modifying several of the recommendations and requesting the participation of all involved agencies, units of local government, and industries along the river system in implementing the 44 recommendations.

One of the important factors in the successful implementation of the recommendations is the establishment of an oversight committee as described in the Task Force Report. This committee is comprised of representatives of the original 21 participating entities, as well as other agencies and local governments that were not included. The Suwannee River Coordination Committee was formed in March 1990 to fulfill this capacity.

In order for the Committee to successfully oversee the implementation of the recommendations, an overall work plan must be developed which can be used to gauge and monitor the implementation efforts of the agencies. This plan should not be considered as a static, binding document--rather, it is a general outline of activities intended to be undertaken by the agencies and government units responsible for implementing the recommendations.

The implementation activities and schedules may change over time in response to changing conditions. There are a number of complexities involved with the many layers of governmental agencies, private groups and industries, and other actors involved with the river system. Most of the recommendations and their resulting implementation activities are highly interdependent and rely on federal, state, and local legislation, programs, and budgets that cannot be accurately predicted. Similarly, there are any number of unforeseen actions or activities that can have a significant affect on implementing one or more of the recommendations--all the agencies involved experience staff and resource constraints which must be factored into an overall evaluation of how well the plan is implemented. The implementation dates included represent the best estimate of the timeframe within which the different activities will be completed, not a definitive set of deadlines.

Given the above, there exists a need for a single document that establishes a baseline implementation schedule and work responsibilities. This enables the Committee, the agencies and governments involved with implementing the recommendations, and the public to understand who is involved, what they are doing, and when it is being done. This document is intended to fulfill that need.

PARTICIPATING AGENCIES, LOCAL GOVERNMENTS, INDUSTRIES, AND INTEREST GROUPS

SUWANNEE RIVER COORDINATION COMMITTEE (SRCC)

Local Governments (LG)

Alachua County
Bradford County
Branford
Columbia County
Dixie County
Fanning Springs
Gilchrist County
Hamilton County
Lafayette County
Levy County
Madison County
Suwannee County
Union County
White Springs

State Agencies

Florida Department of Agriculture and Consumer Services, Division of Forestry (DOF)
Florida Department of Community Affairs (DCA)
Florida Department of Environmental Regulation (DER)
Florida Department of Health and Rehabilitative Services (HRS)
Florida Department of Natural Resources (DNR)
Florida Game and Fresh Water Fish Commission (FGFWFC)

Federal Agency

United States Fish and Wildlife Service (USF&WS)

Regional Agencies

North Central Florida Regional Planning Council (NCFRPC)
Suwannee River Water Management District (SRWMD)
Withlacoochee Regional Planning Council (WRPC)

Industry and Interest Groups

Florida Defenders of the Environment (FDE)
Florida Forestry Association (FFA)
Occidental Chemical Corporation (Oxy)
The Nature Conservancy (TNC)

TASK FORCE RECOMMENDATIONS AND IMPLEMENTATION AGENCIES, ACTIVITIES, AND SCHEDULES

RECOMMENDATION #1

The 100-year floodplains of the Suwannee, Santa Fe, Alapaha, Ichetucknee, and Withlacoochee rivers should be designated and considered as special planning areas in local government comprehensive plans and their implementing land development regulations.

RPC: • Designated in Regional Policy Plan.

LG: • Designate in Comprehensive Plans. Include implementing provisions in adopted Land Development Regulations (10/90 through 7/92).

WMD: • Designate in SWIM Management Plan. Ensure consistency between District rules and local Land Development Regulations (9/90).

RECOMMENDATION #2

Development within the special planning areas should be limited to public recreational uses, forestry, low intensity agricultural uses, low-density rural residential development, and limited commercial development (limited to existing urbanized areas within the special planning area or limited to water-dependent commercial development). New industrial, high intensity/high density agricultural and moderate to high-density residential uses should be prohibited. Existing industrial, high intensity/high density agricultural and moderate to high-density residential uses should be considered non-conforming uses.

SRCC: • Develop consistent definitions for land uses listed (10/90).

LG:
- Land Development Regulations prohibit high intensity uses (10/91 through 7/92).
- Identify non-conforming uses in Comprehensive Plan (10/90 through 7/91).
- Include provisions for reduction of non-conforming use in Land Development Regulations (10/91 through 7/92).

RECOMMENDATION #3

Local governments should work closely with the Department of Community Affairs technical assistance staff for guidance on designation of appropriate rural densities and resource-based non-residential development along the Suwannee River in their comprehensive plans. The Department of Community Affairs should provide its evaluations of the earlier comprehensive plans in the Suwannee basin (Levy and Dixie counties) as guides for the remaining counties in the development of their plans for protecting the Suwannee River and its tributaries.

DCA:
- Provide assistance to local governments on designating rural densities (7/91).
- Report on content and evaluation comments of Dixie and Levy Comprehensive Plans (6/90).

RECOMMENDATION #4

Contingent upon an adequate source of funding, the Suwannee River Water Management District and the two regional planning councils should create a GIS inventory of parcel ownership linked to county property appraisers' databases. The District and the regional planning councils, in cooperation with local, state, and federal agencies, should develop a procedure to ensure the timely update of the parcel ownership inventory (at least annually), including an update of permitting activity and enforcement actions.

WMD:
- Develop parcel ownership data base (1/91).
- Define contents of permit data base and establish procedures for interagency sharing of permit data (1/91).
- Integrate permitting tracking system with parcel ownership data base (7/91).
- Workshops required with agencies and with property appraisers (3/90, ongoing).

RECOMMENDATION #5

The regional planning councils should advise local governments of the existence, number, and configuration of nonconforming lots prior to completion of the local governments' comprehensive plans, with recommendations for treatment of such nonconforming lots. Each local government comprehensive plan should address the issue of non-conforming lots/parcels and provide for vacating plats of unsold/undeveloped subdivision lots or provide for specific terms of variances or grandfathering for lots for specific forms of development which occurs by a certain time (e.g., within one year).

RPC:
- Provide definition of non-conforming lots (7/90).
- Develop model procedures for vacating plats, variances, and grandfathering (7/90).

RPC/
WMD:
- Identify location of non-conforming lots as part of parcel ownership data base (6/91).

SRCC:
- Review definitions and procedures related to non-conforming lots (9/90-3/91).

LG:
- Develop timetable and procedures in Comprehensive Plans for vacating plats where appropriate (1/91-7/92).
- Establish variance and grandfathering procedures as appropriate in Land Development Regulations (1-7/92).

RECOMMENDATION #6

Where ownership patterns allow it, platted unimproved subdivisions with undersized lots along the Suwannee River and its tributaries should be replatted to reflect acceptable lot sizes. If necessary, some sort of land authority should be created to purchase undersized lots and replat them for resale.

WMD:
- As part of parcel ownership data base, determine location of subdivisions with undersized lots (6/91).
- Recommend replatting strategies (7/91).

LG:
- Provide for replatting of undeveloped subdivisions to provide adequately sized lots (8/91).

SRCC:
- Evaluate alternatives and make recommendations for developing and maintaining a Land Authority (1/91).

RECOMMENDATION #7

Incentives should be encouraged to ensure that the substantial lands in the Suwannee basin devoted to forestry are not converted to more intensive uses. The Division of Forestry should be the lead agency for this. Forestry interests should continue to use Best Management Practices and to manage their lands in a manner that is most compatible with preserving significant natural resources in the basin.

DOF:
- Report on status of forestry within the basin (number of acres, types of forests, uses, conversion trends in the 80's and anticipated trends in the 90's) (9/90).
- Report on incentives used to prevent Forest conversion in Florida and other parts of the nation (9/90).
- Recommend incentives to reduce conversion to more intensive uses (9/90).
- Report on BMP's within the basin, including Georgia (contact Georgia counterpart and invite to make a presentation to SRCC) (9/90).
- Review BMP's (ongoing).

RECOMMENDATION #8
Development along the Suwannee River and its tributaries should occur outside the 100-year floodplain wherever possible and should be concentrated as far from any water bodies as practicable.

This recommendation can be largely addressed through recommendations #1, #2, and #3.

RECOMMENDATION #9
The thresholds for developments of regional impact (DRI's) should be reduced by fifty percent for any project whose lands are located wholly or partially within the 100-year floodplain of the Suwannee River or its tributaries.

DCA: • Prepare legislation for consideration of Legislature (3/90).

RECOMMENDATION #10 (Per Governor's Executive Order 90-14)
Recognizing that local government planning, zoning, and land development regulation enforcement is a local responsibility, the Suwannee River Water Management District and the Regional Planning Councils are requested to provide technical assistance to local governments to the extent feasible, and as provided for in other recommendations of the Task Force.

WMD: • Provide technical planning assistance to local units of government in accordance with Chapter 373.0391, F.S. (7/91), and in other areas of District expertise at the request of local units of government (ongoing).

RPC: • Provide technical planning assistance at the request of local units of government to the extent feasible (ongoing).

DNR: • Staff to provide monitoring of development activity on the river based on information from permit data maintained by WMD (ongoing).

GFC: • Staff to provide monitoring of development activity on the river based on information from permit data maintained by WMD (ongoing).

SRCC: • Receive regular monitoring reports from agencies and make recommendations for corrective actions as needed (ongoing).

RECOMMENDATION #11
The Suwannee River Water Management District should develop a river bank stabilization erosion control design, operation, and maintenance manual with particular emphasis on river bank stabilization erosion control methods that could be implemented by residential owners along the river system.

WMD: • Develop manual, demonstration projects and workshops for landowners on the river (3/91, ongoing).

RECOMMEDANTION #12
Local governments in the Suwannee River Basin should amend their floodplain ordinances to be consistent with the newly amended Rule 40B-4, F.A.C., requiring buffers greater than 75 feet where development is more intense than a single family residence. The North Central Florida Comprehensive Regional Policy Plan should also be amended to reflect this variable buffer.

WMD: • Workshop to explain buffer standards (9/90).
• Prepare model language on how to integrate buffer standards into local ordinances (9/90).

RPC: • Amend Regional Policy Plan to include buffer policy based on WMD rule (2/91).

LG: • Amend Floodplain Ordinances or Land Development Regulations to include WMD buffer standards (1-7/92).

RECOMMENDATION #13
The North Central Florida Regional Planning Council and the Suwannee River Water Management District, in cooperation with the Florida Game and Fresh Water Fish Commission, should identify areas where additional setbacks should be implemented to ensure adequate habitat for wildlife dependent on the Suwannee River, its tributaries, springs, spring runs and associated wetlands. Local governments should use the results of this study in their development of comprehensive plans to identify areas along the Suwannee River and its tributaries that should be maintained as conservation areas for the protection of riparian wildlife habitat. The identification of areas where additional setbacks are necessary should be completed by June, 1990, to ensure sufficient time for local governments to consider the results in development of their comprehensive plans.

GFC: • Prepare map showing areas where additional setbacks are needed to protect wildlife habitat (ongoing to 7/92--based on habitat project currently underway).

WMD: • Provide land cover and hydrography (including springs) in digitized format to GFC for use in setback evaluation. Compare needed setback areas with Land Acquisition and Management Plan (LAMP) (8/90 and ongoing).

RPC: • Prepare recommendations on the use of conservation designations in local plans for setback areas (ongoing to 9/92).

LG: • Include appropriate setbacks in comprehensive plans and Land Development Regulations (through 7/92).

RECOMMENDATION #14

Wherever possible, undisturbed setbacks from the river should be adequate to maintain the aesthetic quality of the wilderness experience for those people using the river or its tributaries for recreational purposes.

WMD: • Implement LAMP (ongoing).

DNR: • Prepare report on setbacks required to maintain aesthetic quality (1/91).

LG: • Include appropriate setbacks in Comprehensive Plans and Land Development Regulations (through 7/92).

RECOMMENDATION # 15

Local governments and the Suwannee River Water Management District should ensure that all development within the 100-year floodplain complies with existing buffer requirements and with the minimum standards and requirements of the FEMA model ordinance provisions or the applicable city or county floodplain ordinances adopted pursuant thereto.

LG: • Adopt and enforce minimum FEMA standards (1/90 and ongoing).

DCA: • Provide triennial report on compliance with FEMA standards within the basin (ongoing).

WMD: • Enforce SWM/WOD rule. Provide annual implementation report to SRCC (ongoing).

RECOMMENDATION #16

Where safety or erosion concerns warrant, the counties, DNR, and GFC should cooperate to establish <u>and enforce</u> boating restricted areas. There does not appear to be a need for a riverwide recommendation on this issue. Boating problems should be addressed on a case-by-case basis with closer coordination among the responsible agencies.

DNR/
GFC:
- Map erosion problem areas (1/91).
- Map areas with boating safety concerns (1/91).
- Adopt boating standards by rule (1/91).
- Coordinate effort between agencies (ongoing).

LG:
- Adopt boating safety zones/areas along river system where conditions warrant (7/91).

RECOMMENDATION #17
The Task Force recommends that the Department of Natural Resources designate appropriate parts of the Suwannee River as slow speed zones to protect the West Indian Manatee.

DNR:
- Map and designate speed zones to protect Manatees (1/91).

RECOMMENDATION #18 (Per Governor's Executive Order 90-14)
The need for and impact of closing all spring runs to motorboats should be assessed before such action is taken. Solutions necessary for the maximum protection of the springs and spring runs are very important and therefore, the Department of Natural Resources and the Florida Game and Fresh Water Fish Commission are requested to conduct an assessment of the spring resources as stated in Recommendation #42.

DNR/
GFC:
- Provide an assessment of the measures available to protect springs, runs, and associated uplands (1/91).
- Determine need for and impact of closing individual springs to motorboats. Work in cooperation with other agencies (1/91).

RECOMMENDATION #19
The Task Force recommends that signage regarding regulation of boating restrictions be the responsibility of the State, not local governments.

DNR:
- Develop a signage policy and plan for the river system (1/91).

RECOMMENDATION #20:
Given the broader interests of the CARL program, the recent acquisitions by government agencies, and the recent developments along the Suwannee River, the Task Force recommends that CARL staff reanalyze the basin to determine if land acquisition projects and programs currently in place are adequate for the long-term protection and conservation of this important river system. This could be

accomplished through the CARL program, as was done for the Apalachicola River and Bay and is being attempted for the Wekiva River system, and should be coordinated with the District's Save Our Rivers program.

DNR: • Develop an overall acquisition evaluation and plan for the Suwannee River Basin within Florida (1/91).

WMD: • Coordinate LAMP with the CARL planning effort (11/90 and ongoing).

RECOMMENDATION #21
The Task Force recommends that the Department of Natural Resources conduct a study to determine how a local government's loss of ad valorem tax revenues through land acquisition can be offset by payment in lieu of taxes.

DNR: • Conduct study on how to offset local government ad valorem tax losses (7/90).

WMD: • Investigate strategies to offset tax losses from land purchases (7/90).

RECOMMENDATION #22
Given the limited funding available for the number of CARL and Save Our Rivers projects statewide, the Task Force recommends that state, regional, and local government agencies establish joint participation in land acquisition programs and encourages the development of alternative funding sources for land acquisition and management in the Suwannee basin. Existing sources of funding for land acquisition need to be augmented to the greatest extent practicable.

WMD/
DNR: • Develop report on joint acquisition programs with local governments and between agencies and private groups (12/90).
• Investigate and report on alternative funding sources (12/90 and ongoing).

RECOMMENDATION #23 (Per Governor's Executive Order 90-14)
The Suwannee River Water Management District should vigorously pursue implementation of its Surface Water Improvement and Management Plans for the Suwannee River Basin. The Department of Environmental Regulation is directed to give serious consideration to the Suwannee River SWIM plan implementation needs in preparing its annual budget requests for the Water Management Districts.

WMD: • Develop and implement SWIM plan for Suwannee system in cooperation with federal and state agencies and local governments (9/90 and ongoing).

RECOMMENDATION #24 (Per Governor's Executive Order 90-14)
In order to afford better water quality protection, the Environmental Regulation Commission is requested to classify Jumping Gulley Creek a Class III water body.

DER/ERC: • Designate Class III (by 1/91).

RECOMMENDATION #25
The Task Force recommends that significant degradation of the water quality for the Suwannee River and its OFW tributaries be defined as any unnatural variation from ambient water quality; that FDER use the existing studies performed by State and federal agencies as defining ambient water quality; and that FDER perform studies to provide information not presently available. In summary, there is to be no further degradation of water quality in the Suwannee River and its OFW tributaries.

WMD: • Develop standards for specified water quality parameters for the Suwannee system through the SWIM program. Monitor standards once adopted (7/92, ongoing).

DER: • Adopt standards through the ERC (7/92).

RECOMMENDATION #26
The source of high levels of mercury in fish from the Suwannee River should be identified and measures taken to stop its bioaccumulation in the river's biota.

DER/
WMD: • Investigate potential sources of mercury and alternative measures to stop bioaccumulation (ongoing).

RECOMMENDATION #27
Nekoosa Packaging and Occidental Chemical Corporation have both made strides in reducing their impacts on surface waters of the Suwannee River Basin. All industrial dischargers along the Suwannee River and its tributaries should share their long-range plans at appropriate time frames for further reduction of their impacts with local governments as a model for dealing with water quality in their comprehensive plans.

DER: • Identify all industries that discharge in the basin and coordinate a schedule of presentations to the SRCC (9/90).
• Seek overall reduction of pollutants from industry (ongoing).
• Coordinate effort with Georgia (ongoing).

RECOMMENDATION #28

The Florida Department of Environmental Regulation with the cooperation of the Suwannee River Water Management District should develop and implement (by rule) a permitting system for high intensity/high density agricultural operations based on best management practices or other criteria specific to the agricultural industries (e.g., specific criteria for permitting dairies) and specific to the Suwannee River Basin within one year. The specific criteria or best management standards should ensure that such operations will be in full compliance with state water quality standards and other criteria established as part of a SWIM plan. Until that time, the FDER's current policy of review of such agricultural operations under a test of "reasonable assurance of no significant impact" should continue. The permitting program should provide for upgrade and permitting of existing high intensity/high density agricultural operations within three years of rule implementation.

DER:
- Presentation to SRCC on Dairy study (9/90).
- Develop agricultural discharge rule in cooperation with WMD (8/91).
- Delegate agricultural discharge rule implementation to WMD (8/91).

WMD:
- Presentation on VISA program (9/90).
- Implement agricultural discharge rule as delegated from DER (ongoing).

RECOMMENDATION #29

Occidental Chemical Corporation should continue its land reclamation in a manner that provides sufficient wetlands and vegetative cover necessary for cleansing water runoff prior to entering the Suwannee River or its tributaries and should continue to protect existing wetlands. Restoration of wetlands should approximate the type, nature, and function of premining conditions.

DNR:
- Annual report to SRCC on progress and effectiveness of mine reclamation effort (ongoing).

RECOMMENDATION #30

Areas of high residential density within the 100-year floodplain should be encouraged to plan, develop, and implement a stormwater management system through the development of "Stormwater Utilities" with the intention of providing existing and proposed development with sound stormwater/surfacewater management in accordance with the rules of the Department of Environmental Regulation and the Suwannee River Water Management District.

WMD:
- Identify high density areas for stormwater management (9/90).
- Develop stormwater management plans for high density residential areas (9/91).

- Assist local governments in obtaining funds from the Legislature for implementation of stormwater management plans (ongoing).

LG:
- Cooperate with WMD in development of stormwater management plans. Implement stormwater utilities in accord with plans and the availability of funding (ongoing).
- Integrate stormwater plans into comprehensive plans (ongoing).

RECOMMENDATION #31
The Task Force endorses the changes proposed for Rule 10D-6, F.A.C., that would require repair permits for any modifications to septic tank systems, prohibit septic tanks in hydric soils or where the high water table is at ground level, and prohibit mounding in floodways.

HRS:
- Report on progress in revising 10D-6 (ongoing).

RECOMMENDATION #32
The Florida Department of Health and Rehabilitative Services should phase out the vested rights provisions for permitting of pre-1972 undersized plats.

HRS:
- Report on vested rights and schedule for phasing them out (ongoing).

RECOMMENDATION #33
The Task Force recommends that the Florida Department of Health and Rehabilitative Services and local government health departments assess whether septic tanks along the Suwannee River and its tributaries are operating as permitted, or whether enforcement actions need to be taken to ensure that septic tanks are functioning properly.

HRS:
- Perform septic tank survey to determine the number that are not operating properly (8/90 and ongoing).
- Provide plan on how to address septic tanks that are not operating properly (8/90).

WMD:
- Assist HRS in septic tank survey (8/90 and ongoing).

RECOMMENDATION #34 (Per Governor's Executive Order 90-14)
The Florida Department of Health and Rehabilitative Services should take the steps necessary to identify the numbers and locations of lots which do not meet the minimum requirements of Rule 10D-6, F.A.C.

HRS: • Report on steps to be taken to identify lots that do not meet the requirements of 10D-6. Should coordinate with WMD/RPC land ownership mapping effort (ongoing through 8/91).

WMD: • Assist HRS with computerized soils and topography data (ongoing).

RECOMMENDATION #35

Urban, high, and moderate residential density areas and all commercial development within the 100-year floodplain should be served with central wastewater collections, treatment, and disposal systems. Two areas in particular, the Lower Suwannee-Fanning Springs/Old Town to Suwannee area (Old Town and Fanning Springs between the Suwannee River and SR 349 in Dixie County and Fanning Springs south to Manatee Springs State Park and Fowler's Bluff in Levy County) and the Three Rivers area (Santa Fe and Ichetucknee confluence area, including the town of Fort White, the area adjacent to and south of CR 238, the area east of CR 137, Ichetucknee Springs State Park, Three Rivers Estates and other subdivided areas) should be served by central sewage systems and a public water system. All existing septic tanks should be abandoned in those areas. A feasibility study of regional wastewater utilities and public water supply systems for these areas should be funded and completed by the Florida Department of Environmental Regulation within one year.

DER: • Complete study for areas named and present report to SRCC (12/90).

RECOMMENDATION #36

On-site sewage disposal systems, private wells and central wastewater facilities should be prohibited within the 10-year floodplain and should otherwise be in compliance with applicable rules and regulations. All residential lots outside the 10-year floodplain proposing to use septic tanks should have at least 10,000 square feet of unobstructed area containing moderately limited or better soils to a minimum depth of 60 inches.

WMD: • Provide map of 10-year floodplain (8/90).
- Provide map showing areas outside 10-year floodplain that may be unsuitable for septic tanks (1/91).
- Revise water well rule to prohibit the construction of wells in 10-year floodplain (8/90).

HRS: • Issue no variances for septic tanks within 10-year floodplain (ongoing).
- Ensure that recommended square footage and soil requirements are consistent with 10D-6 revisions (6/90).

RECOMMENDATION #37

The Task Force endorses and supports the concept of Development Review Committees outlined in the 1988-89 SWIM plans. These committees should be a primary instrument for implementing Task Force recommendations and SWIM programs during the local development review process. Such committees, one for each county or in reasonable aggregations as situations warrant, should meet frequently with local officials to review development proposals. Support should be permanently dedicated to the Suwannee River Water Management District, the North Central Florida and Withlacoochee regional planning councils and the Department of Community Affairs for staff and resources to assist and participate in the review committees.

WMD: • In cooperation with RPC and DCA establish a DRC for each county to review proposed developments in the 100-year floodplain, or within the basin that may impact the Suwannee River system. Use existing DRC if operational (12/90).

• Provide quarterly report to SRCC on permitted development activity in the 100-year floodplain (12/90 and ongoing).

WMD/
RPC/
DCA • Provide assistance to local governments on request in reviewing development proposals.

RECOMMENDATION #38

Governor Bob Martinez should contact Governor Joe Frank Harris of Georgia to initiate an interstate effort for long-term protection of the Suwannee River at all levels of government. Interstate cooperation should eventually result in coordinated efforts by Florida's state and regional agencies with Georgia's Department of Natural Resources and regional planning agencies.

DER: • Work through Governor's office to establish a formal coordination process with Georgia. Request the attendance of the Georgia representative on at least a quarterly basis (ongoing).

RPC/
WMD: • Establish formal coordination program with regional agencies within the Georgia portion of the basin (1/91).

RECOMMENDATION #39

The Secretary of the Department of Environmental Regulation, in coordination with the Governor's office, should request the U.S. Fish and Wildlife Service, managers of the Okefenokee Swamp National Wildlife Refuge, to develop and implement a management scheme for the Suwannee River discharge control

structure at the southwestern boundary of the Okefenokee Swamp National Wildlife Refuge. The management scheme should provide specifically for the return of pre-impoundment hydrology, frequency distribution and periodicity of discharges to the Suwannee River and provision for base-flow augmentation of Suwannee River discharges.

USF&W: • Report on pre-impoundment hydrology. Request federal funding to do this work (2/91).

• Request report on procedures for and impacts of modifying existing management schedule for the Okefenokee Swamp (2/91).

RECOMMENDATION #40 (Per Governor's Executive Order 90-14)
The Department of Natural resources is requested to hold public meetings in the Suwannee basin to assess the feasibility and benefits of, and public opinion about Wild and Scenic river designation.

DNR: • Conduct educational workshops on Wild and Scenic River Program and alternative management programs under the program (6-9/90).

RECOMMENDATION #41
The Florida Department of Natural Resources, Division of Recreation and Parks, should prepare a regional recreational development and management plan for the publicly owned lands within the study area. The plan should include one or more elements identifying the economic benefits of recreational use and development within the study area. The plan should be prepared in close cooperation with the ownership agencies and should recognize individual limitations as to recreational use of lands with sensitive environmental resources.

DNR: • Prepare recreational development and management plan (1/91).

RECOMMENDATION #42 (See RECOMMENDATION #18)
An assessment should be made of the spring resources of the Suwannee basin to determine what measures are needed to protect the spring runs, springs, and their associated uplands. Protection options might include land acquisition, conservation easements, local spring protection ordinances and restriction of access.

DNR: • Recommend protection options for springs to SRCC (1/91).

RECOMMENDATION #43 (Per Governor's Executive Order 90-14)
The Department of Natural Resources is requested to develop an outline of the management concept and submit it to the Governor and Cabinet for consideration. The outline should include benefits and costs of implementing the concept.

DNR: • Proceed with plan development in cooperation with other agencies (4/90--presented to Governor and Cabinet 2/90).

RECOMMENDATION #44
The Game and Fresh Water Fish Commission should assess wildlife habitat needs in the Suwannee basin to determine which areas in the basin need to be protected for conservation purposes. This assessment should be used as a basis for determining priority upland areas to be targeted for land acquisition by the Conservation and Recreational Lands (CARL) and Save Our Rivers (SOR) programs and for designation of significant natural areas in local and regional comprehensive plans for special consideration in reviews of large-scale developments such as developments of regional impact (DRI's), subdivisions or Planned Unit Developments.

GFC: • Assess wildlife habitat needs in the basin for use in CARL and SOR land acquisition planning as well as for development reviews and local comprehensive planning (7/92).

SECTION 2 OF EXECUTIVE ORDER NUMBER 90-14

WMD:
- Create the Suwannee River Coordination Committee (2/90).
- Serve as lead agency (ongoing).
- Administer the Committee (ongoing).
- Prepare annual report to Governor and Cabinet (ongoing).

RPC/
DCA: • Provide assistance to WMD and SRCC as needed (ongoing).