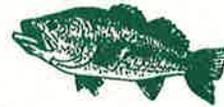


Lake Jackson Management Plan



Effective June 1994

Developed by

Lake Jackson Action Team

Northwest Florida Water Management District

under the auspices of the

Surface Water Improvement and Management (SWIM) Program

NWFWMD Program Development Series 94 - 2

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THE LAKE JACKSON MANAGEMENT PLAN

A comprehensive plan for the restoration and preservation of Lake Jackson

Developed by
the Leon County Lake Jackson Action Team
and
the Northwest Florida Water Management District
under the auspices of
the Surface Water Improvement and Management Program
and in cooperation with
the Florida Department of Environmental Protection

Prepared by
Tyler L. Macmillan, AICP and Craig Diamond

June 1994

The components of this plan that are recommended for funding through the Surface Water Improvement and Management (SWIM) Program constitute the Lake Jackson SWIM Plan, and have been reviewed pursuant to Sections 373.455 and 373.456, Florida Statutes. The SWIM plan was approved by the Governing Board of the Northwest Florida Water Management District on April 28, 1994 and was determined to be consistent with State Water Policy and the State Comprehensive Plan by the Florida Department of Environmental Protection on May 18, 1994.

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EXECUTIVE SUMMARY

Introduction

Polluted stormwater runoff; infestation of hydrilla; wetland and floodplain destruction; urbanization; septic tanks; decreased recreational value; ecosystem alteration; wildlife habitat loss; fishery decline. These problems are often cited in articles and discussions about Lake Jackson. Such discussions often ask the question: So what is being done to "fix" the lake, and who is doing it?

This document contains the answers to these critical questions. The Lake Jackson Management Plan was prepared to comprehensively address the problems which are currently threatening to change Lake Jackson as we know it. A thorough examination of this document will reveal that many activities are currently underway to "fix" the lake, and many agencies and individuals are involved in these efforts. Various governing bodies have realized the need to plan for the restoration and long-term preservation of Lake Jackson, and have directed their staff and citizen advisory committees to develop and implement a management plan for this important natural resource.

What is being done, who is doing it, and how it will be funded are all answered in Appendix 1; which contains the projects that implement the Lake Jackson Management Plan. These projects are viewed together in plan's goals, management strategies and priorities, which are found in the pages following this Executive Summary. Approximately one-third of the plan is dedicated to Appendices 2 through 7, which provide information about the ecology of Lake Jackson, historical management efforts, progress of the plan, and other reference items.

A major funding source which is used to implement the Lake Jackson Management Plan is the Surface Water Improvement and Management (SWIM) program, which is administered by the Florida Department of Environmental Protection (DEP) and implemented by the Northwest Florida Water Management District (NWFWMD). However, many of the projects in the plan are implemented by, or in coordination with, Leon County and the City of Tallahassee. Other state agencies such as the Florida Game and Fresh Water Fish Commission (FGFWFC) also fund projects for Lake Jackson.

Full implementation of this plan will require a considerable amount of funding in the short term, and a long term commitment toward ensuring that activities which have harmed the lake in the past are not repeated in the future. The success of restoration and preservation efforts must be measured regularly, and the public must remain involved in the management of their lake.

Background

Lake Jackson is a 4,000 acre lake in northwestern Florida that lies within Leon County just north of the City of Tallahassee (Figure 1). The lake is nationally famous for its trophy-size largemouth bass and is a favorite recreational resource for the growing population of Leon County. Unfortunately, urban and suburban development in the southern portion of the Lake Jackson watershed has resulted in significant degradation of the natural lake environment. The negative effects of urbanization and development on Lake Jackson were first documented in the early 1970s, and include poor water quality, increased sedimentation, contamination of bottom sediments by heavy metals and other pollutants, and increased nutrification of the lake as a result of stormwater runoff and accidental sewage spills. Suburban development, which often lacks central sewer services, is now eminent in the more pristine northern portions of the watershed.

The effects of stormwater runoff on Lake Jackson from development and construction in the watershed are evident. Lake Jackson became nationally famous as a trophy largemouth bass fishery following an extreme natural drawdown in the 1950s. However, Lake Jackson began to decline as a sport fishery in the mid-1970s, coincident with initial documentation of poor water quality, increased sedimentation and nutrient enrichment. The population of largemouth bass recovered somewhat after another natural drawdown in 1982, but the long-term viability of Lake Jackson as a trophy largemouth bass fishery is dependent upon restoring and preserving water and sediment quality throughout the lake. This is only one of many important reasons for developing and implementing a comprehensive, coordinated effort for long-term management of the Lake Jackson watershed.

There have been several major efforts to treat stormwater in the Lake Jackson watershed, the most significant of which is the Northwest Florida Water Management District's Megginis Arm Stormwater Treatment Facility and Artificial Marsh. This experimental project was completed in the early 1980s with state funds and a grant from the U.S. Environmental Protection Agency (EPA) Clean Lakes Program through the Florida Department of Environmental Regulation (now Department of Environmental Protection). The City of Tallahassee has also constructed two regional stormwater treatment facilities in the Megginis Arm subbasin, and in January 1993, the fourth regional stormwater treatment facility in this subbasin was completed through a cooperative effort of Leon County, the Florida Department of Transportation, and the District's SWIM program. These projects are all good examples of regional stormwater treatment facilities, and similar efforts should be implemented throughout the Lake Jackson watershed.

Lake Jackson has generated a great deal of interest over the last 25 years, primarily because of its reputation for trophy largemouth bass. As a result, there have been many studies and reports regarding the biology, water quality and management of the system. Appendix 5 provides an annotated bibliography of publications specific to Lake Jackson and, in its magnitude, illustrates the considerable interest in Lake Jackson. A review of the literature also indicates that the nature and causes of water quality degradation in Lake Jackson are known, and that now is the time for action to restore and preserve this valuable natural resource.

Priority Issues

In reviewing the history of development and management of the Lake Jackson watershed and the effects these activities have had on the lake and its natural resources, the following issues emerge for priority consideration in the Lake Jackson Management Plan.

Water Quality The major goal of the Lake Jackson Management Plan is to restore the water quality of Lake Jackson to meet or exceed the Class III and Outstanding Florida Water (OFW) water quality standards established by the Florida Department of Environmental Protection (DEP). Class III waters are designated for recreational activities and propagation and maintenance of a healthy, well-balanced population of fish and wildlife, and the DEP has established the water quality standards that are necessary to ensure that Lake Jackson is safe for these uses. In addition, Lake Jackson, being considered worthy of special protection because it is an Aquatic Preserve, was designated an OFW in 1979. The purpose of the OFW designation is to maintain ambient conditions by allowing no degradation of water quality beyond what existed at the time of designation, or beyond Class III standards, whichever is more conservative.

In spite of these designations, poor development practices, including inappropriate use and location of septic tanks, ineffective or nonexistent stormwater controls, and ineffective sediment control during construction have led to nutrient and sediment pollution that has degraded the water quality and had adverse impacts on the natural resources of the lake environment. As the greater Tallahassee area continues to grow, appropriate legal mechanisms and physical structures must be in place to prevent further water quality degradation.

Preservation of Natural Systems The Lake Jackson watershed has suffered considerable damage and degradation due to poor management practices. However, this watershed is a viable ecosystem that has many areas that should be preserved for water quality, fish and wildlife, aesthetic beauty and passive recreation. Preservation of upland areas, especially critical habitat, is as important as preservation of aquatic environments, and preservation of both is a major goal of the Lake Jackson Management Plan. Two major parcels of land (Elinor Klapp Phipps Park and the Overstreet Parcel) have recently been purchased in the Lake Jackson watershed by state and local government, securing over 1,500 acres of the watershed for preservation purposes. The SWIM program was directly involved in the initiation and completion of the Phipps acquisition and was supportive of the Overstreet property purchase. State and local government should continue to identify and acquire sensitive lands in the watershed for preservation purposes.

Restoration of Disturbed or Degraded Systems There has been significant degradation of natural systems both in the watershed and in the lake basin. Most notable are Megginis and Fords arms, which, due to poor upland management practices, have essentially served as sediment and nutrient traps for polluted stormwater runoff. Due to the severity of degradation, these two areas must first be restored so they no longer contribute to poor water quality. The \$1 million Megginis Arm Sediment Removal project which was completed by the SWIM program in 1992 was a major step toward implementing the plan's restoration goals, but the success of this effort must be measured

and further restoration needs must be evaluated. Upland areas in these two subbasins may also require restoration activities in order to prevent further degradation. Exotic plants and animals must be managed and historical hydrologic and fire regimes should be restored to enhance the lake's ecological functions. There is an immediate need for such restoration activities in the Lake Jackson watershed, and the Lake Jackson Management Plan takes an aggressive approach to this priority issue.

Recreation As the population of Leon County and the surrounding area grows, the demand for recreational opportunities will grow as well. Lake Jackson is the largest open-water recreational lake in Leon County and provides diverse recreational opportunities such as fishing, water skiing, sailing, sailboarding, personal watercraft (jet skis), rowing, hunting, and wildlife observation. Many land areas such as the Phipps-Overstreet Greenway and the landings and other parks around the lake also provide diverse recreational opportunities. However, recreational uses can conflict with sound lake and watershed management practices. Planning and management of recreational uses and activities must consider possible impacts to the lake ecosystem, and the Lake Jackson Management Plan includes a number of projects to address these issues.

Intergovernmental Coordination The need for intergovernmental coordination and cooperation in the management of the Lake Jackson watershed is paramount. Unifying leadership, strong local government commitment (especially financial), implementation schedules and monitoring, and clearly defined responsibilities for all management entities are necessary for an effective lake and watershed management program. The Lake Jackson Management Plan recognizes intergovernmental coordination as a priority issue and clearly identifies lead agencies and funding mechanisms (or lack thereof) for all activities.

Public Education and Awareness The current status of Lake Jackson is the result of the individual and collective acts of people, including recreational users, elected and appointed local government officials, local and out-of-town developers, and others. A major goal of the Lake Jackson Management Plan is to provide a new level of awareness among those using or making decisions that affect the natural resources, and to educate them in order to influence their behavior toward more preservation-oriented activities. An education program is vital for effective management of the watershed and is a major focus of the Lake Jackson Management Plan.

Local Government Responsibilities

The Lake Jackson watershed lies entirely within the boundaries of Leon County, and part of the watershed is within the limits of the City of Tallahassee. Therefore, local government, which controls all land use decisions within the watershed, will continue to have a profound impact on the water quality of Lake Jackson. One development practice that has probably caused the most serious adverse impacts to Lake Jackson is inadequate runoff and sediment controls during the construction process. This has occurred in spite of existing local regulations that require the use of sediment and runoff controls, and is, in large part, due to a general lack of enforcement that has rendered local regulatory efforts only partially effective.

In an effort to address these problems, Leon County and the City of Tallahassee have adopted more stringent environmental ordinances and made commitments to increase enforcement of these regulations. The new environmental ordinances include the following provisions: special development restrictions for zones adjacent to Lake Jackson; more stringent stormwater regulations; mandatory operating permits for on-site stormwater management systems; retrofit of stormwater management systems; increased sediment controls during construction; and increased restrictions for the development of environmentally sensitive areas such as wetlands, waterbodies, and steep slopes.

In addition, the Tallahassee-Leon County 2010 Comprehensive Plan contains objectives and policies which, when implemented, will help to preserve, restore, and manage Lake Jackson and its watershed. Provisions in the plan that are related to Lake Jackson include the following.

Establishment of a special "Lake Protection" land use category which includes most of the less developed areas of the watershed. This land use category allows one residential unit per two acres or one unit per one acre clustered, and, in the county, allows minor office and commercial land uses to be approved through the PUD process if stringent stormwater treatment guidelines are met.

Adoption of plans for retrofitting existing developments not in compliance with existing stormwater regulations.

Adoption of local government ordinances to restore and preserve Lake Jackson, specifically addressing stormwater quality, on-site sewage systems, connection to central sewers, and buffer zones.

Development and adoption of a plan for retrofit of the stormwater systems in the developed areas of the watershed. This plan must include priorities for implementation and must provide for funding of the necessary improvements.

The comprehensive plan also includes policies which provide for habitat protection; protection of endangered, threatened and species of special concern; acquisition of environmentally sensitive land; monitoring of surface water quality; environmental education; wetland protection; wildlife protection; and extensive inventories and mapping of environmental features.

It is imperative that these new ordinances and land use designations be stringently enforced during all phases of development to prevent problems of the past being repeated. Proper enforcement will reverse the current trend toward high density and intensity development in portions of the watershed, thereby guiding growth in such a way that the resources of Lake Jackson are preserved and protected. The City of Tallahassee and Leon County should coordinate all regulatory and planning efforts for the Lake Jackson watershed with the Lake Jackson Management Plan in order to achieve this goal.

Management Strategies

The Lake Jackson Management Plan addresses the five priority issues in the following four programs.

- 1) Water Quality Program
- 2) Preservation and Restoration Program
- 3) Watershed Management Program
- 4) Public Education and Awareness Program

Each of these programs has a goal and specific objectives that will be met through the implementation of various management strategies. The Water Quality Program has several initiatives, including water quality monitoring, regional stormwater treatment, on-site stormwater treatment and septic tanks and sewer systems. In addition, Pollutant Load Reduction Goals (PLRGs) for the lake are defined under this initiative. PLRGs set forth the quantities of nutrients and other pollutants that must be removed from inflows to the lake to maintain, restore or protect the lake's values and functions. State Water Policy requires the development of PLRGs for SWIM priority waterbodies. The Preservation and Restoration Program has a preservation initiative to address protection of existing critical habitat and natural systems, and a restoration initiative that includes strategies for correcting and restoring natural systems that have been disrupted and degraded. The Watershed Management Program includes research, management, regulatory and administrative initiatives. Finally, the Public Education and Awareness Program has several initiatives, including education, awareness, community involvement and research, all designed to meet the goal of providing opportunities for the public to learn about the lake and their role in protecting its valuable resources.

The Lake Jackson Management Plan presents a comprehensive approach to watershed management, as evidenced by the priority issues discussed above, and all aspects of the plan are vital components in the long-term preservation of Lake Jackson. However, there are certain activities that are essential to the overall goal of improving water quality. If these activities are not addressed on a priority basis, other components of the management plan will be extremely limited in their effectiveness. For example, the removal of contaminated sediments from Megginnis Arm would be ineffective if stormwater treatment facilities, such as berms and swales, marshes, wetlands and detention ponds, are not in place to prevent more contaminated sediments from being deposited in the arm. These essential activities are discussed below.

Removal of Contaminated Sediments Contaminated sediments have been documented in Megginnis Arm and preliminary assessments have been undertaken in Fords Arm. As long as these accumulated sediments are in place, they may release pollutants to the water column, thereby continually degrading water quality. For the Lake Jackson Management Plan to be effective in its goal of improving the water quality of Lake Jackson, it has been determined that contaminated sediments should be removed or treated. Upland controls, such as stormwater retrofit and land use regulations, are also essential to this goal, however, these strategies will not be fully effective at improving water quality if restoration of known degraded areas is not addressed. The SWIM program completed a major sediment removal project on Megginnis Arm in 1992,

and will be considering similar restoration efforts for other areas of the lake during the next three-year plan cycle.

Retrofit of Existing Development A second general area that must be addressed on a priority basis is stormwater retrofit of all existing development. Like contaminated sediments, this is an existing problem that currently contributes to water quality degradation in Lake Jackson, and it must be corrected for any other restoration or preservation efforts to be successful. This issue is addressed in the Lake Jackson Management Plan by providing for both on-site and regional stormwater treatment facilities. A regional retrofit plan was completed in 1992 and implementation of this plan is the highest priority of the Lake Jackson SWIM program. The Lake Jackson Regional Stormwater Retrofit Plan should be adopted by the City of Tallahassee and Leon County to ensure a coordinated approach to watershed stormwater retrofit.

Strict Stormwater Requirements for New Development In addition to contaminated sediments and adequate treatment for existing development, there must be implementation and enforcement of strict stormwater treatment requirements for new development in order to prevent the same problems from occurring again. Stormwater runoff from new development should be treated so that water quality and quantity are not altered beyond pre-development conditions.

The Lake Jackson Management Plan includes a number of action-oriented elements to address the five priority issues and three essential activities discussed above. The removal of contaminated sediments and retrofit of stormwater runoff from existing development represents the major focus of this plan, since they are the two most effective means of restoring and preserving the water quality of Lake Jackson. However, restoration and retrofit efforts of the type and magnitude required for Lake Jackson are expensive and will require funding from a combination of sources including the SWIM program, the City of Tallahassee, Leon County, and outside sources such as grants and special legislative appropriations. The Lake Jackson Management Plan charts a course of action that is designed to restore and preserve the lake. Implementation of specific activities, however, depends upon the level of funding made available by local government and, to a lesser degree, state and regional agencies.

Plan Implementation and Funding

The Lake Jackson Management Plan is a comprehensive program for the restoration and preservation of Lake Jackson, and, in addition to accomplishing the priority activities described above, should be implemented as a dynamic management tool that adjusts to meet the changing needs and conditions of the Lake Jackson watershed. The current plan has a three-year implementation schedule that is summarized in Table E-1.

Since the Lake Jackson Management Plan is comprehensive, it requires the participation of all jurisdictional governments and agencies, including Leon County, the City of Tallahassee, the Northwest Florida Water Management District, the Florida Game and Fresh Water Fish Commission, the Florida Department of Environmental Protection, and others as needed. Specific

funding needs and resources have been identified for many of the activities in the plan, and these are summarized in Tables E-2A through E-2C.

Lake Jackson and the Surface Water Improvement and Management (SWIM) Act

A primary source of funding for implementation of the Lake Jackson Management Plan is the Surface Water Improvement and Management (SWIM) program, which is administered by the Florida Department of Environmental Protection and implemented primarily by the Northwest Florida Water Management District. The SWIM program focuses on the following general areas of concern: 1) point and nonpoint sources of pollution; 2) destruction of natural systems; 3) correction and prevention of surface water problems; and 4) research for better management of surface waters and associated natural systems. Table E-3 illustrates how the Lake Jackson Management Plan addresses the central concerns of the SWIM Act.

LAKE JACKSON WATERSHED

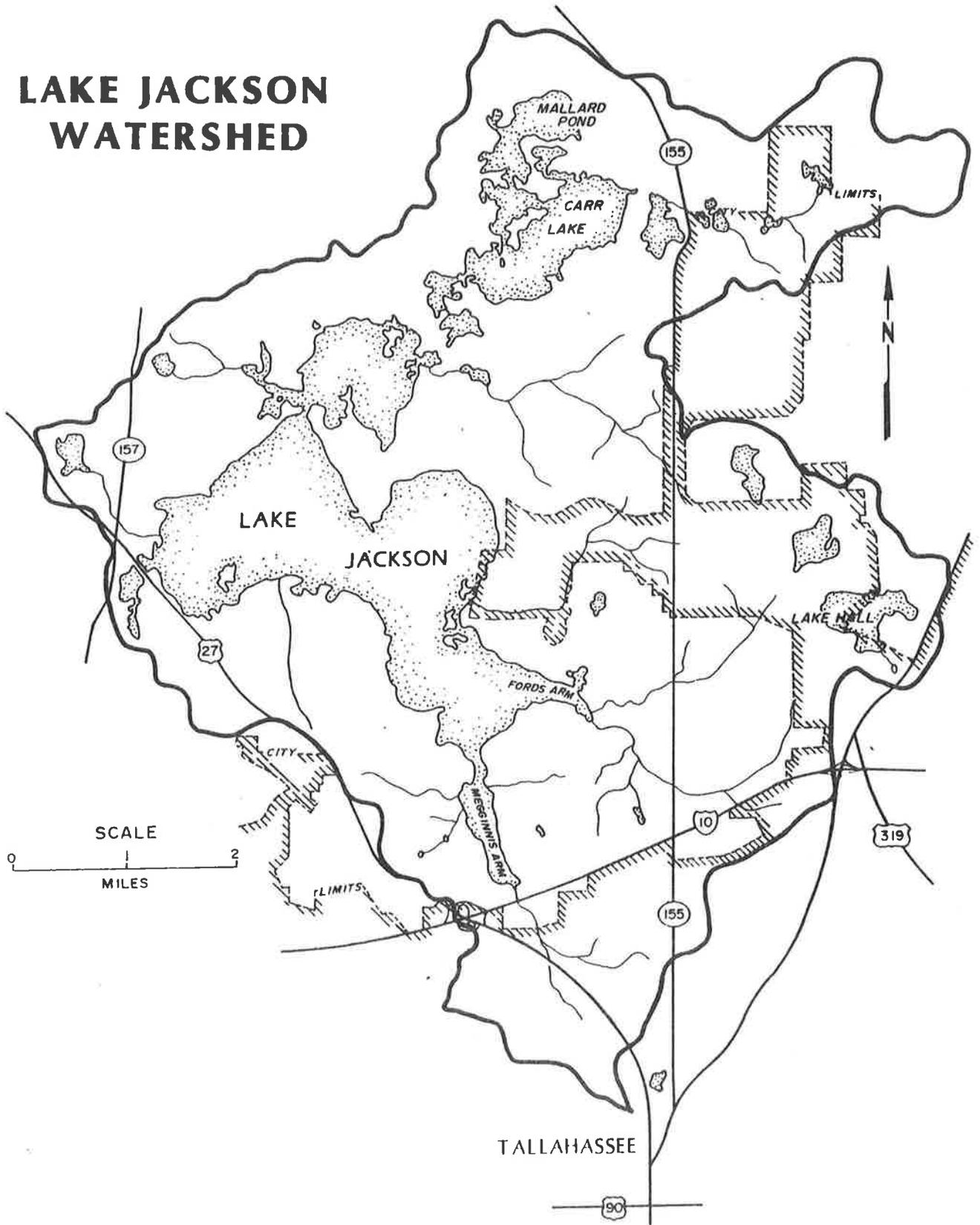


FIGURE 1. MAP OF THE LAKE JACKSON WATERSHED.

TABLE E-1. THREE-YEAR IMPLEMENTATION SCHEDULE FOR THE LAKE JACKSON MANAGEMENT PLAN

ID #	PROJECT	FISCAL YEAR		
		1993-1994	1994-1995	1995-1996
Q-1	Eval. & Application of Water Qual. Data	*	----->	
Q-1a	Dev. of Pollution Load Reduction Goals	*	----->	
Q-2	Long-Term Water Quality Monitoring	*	----->	
Q-4	Regional Stormwater Retrofit	*	----->	
Q-4b	Okeehoopkee Subbasin Stormwater Analysis	*	----->	
Q-4c	Megginnis Arm Creek Basin Diagnosis	*	-----*	
Q-5	Megginnis Arm Facility Improvement	*	-----*	
Q-6	Megginnis Arm Facility O & M	*	----->	
Q-7	On-site Design Criteria & Effectiveness			*-----*
Q-8	Retrofit of Nonconforming Sites	*	----->	
Q-9	Evaluation of Septic/Sewer Issues	*	----->	
Q-10	Agricultural Impacts			*-----*
Q-11	Recreational Impacts			*-----*
R-1	Long-Term Monitoring of Habitat	*	----->	
R-3	Additional Megginnis Arm Restoration	*	----->	
R-3a	Revegetation Of Megginnis Arm	*	-----*	
R-4	Fords Arm Restoration	*	----->	
R-5	Restoration of Upland & Aquatic Areas	*	----->	
R-7	Restoration of Yorktown Pond	*	-----*	
M-1	System Analysis of LJ Watershed			*----->
M-2	Land Acquisition	*	----->	
M-3	Park Design Committee	*	----->	
M-4	Aquatic Preserve Management	*	----->	
M-5	Fish & Wildlife Mgt & Research	*	----->	
M-6	Aquatic Plant Management	*	----->	
M-7	Regulatory Assessment & Coordination	*	----->	
M-8	Regulation of Recreational Uses	*	----->	
M-9	Ordinary High Water Line	*	----->	
M-10	Action Team as Over/Adv Committee	*	----->	
M-11	Develop & Update Management Plan	*	----->	
M-12	Contingency Mgt Plan for Nat Drawdown			*----->
E-1	Planning and Administration	*	----->	
E-2	Printed Materials	*	----->	
E-3	Media Relations	*	----->	
E-4	Corporate/Private Sponsorship	*	----->	
E-5	Miscellaneous Awareness Activities	*	----->	
E-6	School Programs	*	----->	
E-7	Educational Materials	*	----->	
E-8	Outdoor Educational Displays	*	----->	
E-8b	Megg Arm Facility Exhibit			*-----*
E-9	Community Activities	*	----->	
E-10	Citizen Water Quality Monitoring			*----->
E-11	Public Awareness Survey			*-----*
E-12	Lake User Survey	*	-----*	

Table E-2A Lake Jackson Management Plan Summary of Funding for Fiscal Year 1993-94

PROJECT	LEAD AGENCY	SWIM*	FUNDING AGENCIES				DEP	FGFWFC	FEDERAL	PROJECT TOTAL	NOTES:
			NWFWMD	CITY	COUNTY						
Q-1 Eval. & App. of Water Qual. Data	NWFWMD	\$6,000	*						\$6,000	C/C = Leon County and the City of Tallahassee COMM = Joint Intergovernmental Education / Awareness Working Group (see Project Description E-1) * Projects funded by SWIM in FY 93-94 required a 40% local match which was provided by the NWFWM and Leon County. Project Q-4b will require substantial additional local funding for land acquisition and facility construction. Implementation funding needs will be determined after Phase I (FY 93-94). Project R-7 funding is being shared by Yorktown Pond residents in the amount of \$104,000. SWIM funding for this project, in the amount of \$100,500, was provided in FY 92-93. Project E-4, Private/Corporate Sponsorship of Public Awareness/ Education projects, will be pursued. County funding for specific projects is subject to review and approval by the Board of County Commissioners. City funding for specific projects is subject to review and approval by the City Commission. DEP Aquatic Preserve Management funding is dependent upon annual legislative appropriation.	
Q-1a Development of PLRGs	NWFWMD	\$6,500	*						\$6,500		
Q-2 Long Term Water Qual Monitoring	COUNTY			\$50,000					\$50,000		
Q-4b Okeehee Basin Phase I	NWFWMD	\$100,000	*						\$100,000		
Q-4c Megginis Basin Diagnosis	NWFWMD	\$90,000	*						\$90,000		
Q-5 Megg Facility Improvement	NWFWMD	\$15,000	*						\$15,000		
Q-6 Megginis Arm Facility O&M	NWFWMD		\$20,000						\$20,000		
Q-8 Retrofit of Nonconforming Sites	C/C								\$0		
Q-9 Eval. of Septic / Sewer Issues	NWFWMD	\$120,000	*						\$120,000		
R-1 Long Term Monitoring of Habitat	C/C								\$0		
R-3 Add'l Megg Arm Restoration	NWFWMD	\$25,000	*						\$0		
R-3a Revegetation of Megg Arm	NWFWMD					\$300,000			\$300,000		
R-4 Fords Arm Restoration	NWFWMD	\$50,000	*						\$50,000		
R-5 Rest'n of Upland and Aq. Areas	C/C								\$0		
R-7 Yorktown Pond Restoration	COUNTY			\$260,500					\$260,500		
M-2 Land Acquisition	C/C								\$0		
M-3 Park Design Committee	C/C								\$0		
M-4 Aquatic Preserve Management	DEP					Requires \$			\$0		
M-5 Fish/Wildlife Mgt/Research	FGFWFC						\$83,000		\$83,000		
M-6 Aquatic Plant Management	DEP	\$5,000	*						\$5,000		
M-7 Regulatory Assess/Coordination	NWFWMD	\$5,000	*			\$18,750			\$5,000		
M-8 Regulation of Recreation Uses	C/C								\$0		
M-9 Ordinary High Water Line	DEP					Requires \$			\$0		
M-10 Action Team as Oversight Comm	COUNTY								\$0		
M-11 Coordinate/Update Mgt Plan	NWFWMD	\$30,000	*						\$30,000		
E-1 Planning and Administration	NWFWMD	\$3,000	*						\$3,000		
E-2 Printed Materials	COMM								\$0		
E-3 Media Relations	COMM	\$6,000	*						\$6,000		
E-4 Corporate/Private Sponsorship	COMM								\$0		
E-5 Misc Awareness Activities	COMM	\$6,000	*						\$6,000		
E-6 School Programs	COMM	\$10,000	*						\$10,000		
E-7 Educational Materials	COMM								\$0		
E-8 Outdoor Educational Displays	COMM	\$7,000	*						\$7,000		
E-9 Community Activities	COMM	\$2,000	*						\$2,000		
E-12 Lake User Survey	EPA / FSU							\$38,105	\$38,105		
AGENCY / PROGRAM TOTAL		\$469,000	\$20,000	\$0	\$366,750	\$18,750		\$338,105	\$1,295,605		

Table E-2B Lake Jackson Management Plan Summary of Funding for Fiscal Year 1994-95

PROJECT	LEAD AGENCY	SWIM*	NWFWMMD	FUNDING AGENCIES			FGFWFC	FEDERAL	PROJECT TOTAL	NOTES:
				CITY	COUNTY	DEP				
Q-1 Eval. & App. of Water Qual. Data	NWFWMMD	\$2,000	*	*	*			\$2,000	<p>NOTES:</p> <p>C/C = Leon County and the City of Tallahassee</p> <p>COMM = Joint Intergovernmental Education / Awareness Working Group (see Project Description E-1)</p> <p>* Projects funded by SWIM for FY 94-95 will require a 20% local match. Local match assistance is requested annually from Leon County, the City of Tallahassee and the Governing Board of the NWFWMMD.</p> <p>Project Q-4 SWIM total includes a request of \$1 million from discretionary funds for regional stormwater facility construction. If these funds are allocated by the DEP, a 20% local match will be required.</p> <p>Implementation of Project R-3a continues through FY 1994-95 via a one-time grant from EPA.</p> <p>Project R-7 will also require approximately \$104,000 from Yorktown residents.</p> <p>Project E-4, Private/Corporate Sponsorship of Public Awareness/ Education projects, will be pursued.</p> <p>County funding for specific projects is subject to review and approval by the Board of County Commissioners.</p> <p>City funding for specific projects is subject to review and approval by the City Commission.</p> <p>DEP Aquatic Preserve Management funding is dependent upon annual legislative appropriation.</p> <p>Project titles with ** indicate that the project will begin in FY 1994-95. All other projects are continued from FY 1993-94.</p>	
Q-1a Development of PLRGs	NWFWMMD	\$15,000	*	*	*			\$15,000		
Q-2 Long Term Water Qual Monitoring	COUNTY			\$50,000				\$50,000		
Q-4 Regional Stormwater Retrofit Plan	NWFWMMD	\$1,055,000	*	Requires \$				\$1,055,000		
Q-4b Okeehopee Basin Phase II	NWFWMMD	Eligible	*	Requires \$				\$45,000		
Q-4c Megginnis Basin Diagnosis	NWFWMMD	\$45,000	*	*				\$20,000		
Q-6 Megginnis Arm Facility O&M	NWFWMMD		\$20,000					\$0		
Q-8 Retrofit of Nonconforming Sites	C/C							\$0		
Q-9 Eval. of Septic / Sewer Issues	NWFWMMD	\$80,000	*	*				\$80,000		
R-1 Long Term Monitoring of Habitat	C/C							\$0		
R-3 Add'l Megg Arm Restoration	NWFWMMD	\$25,000	*	*				\$25,000		
R-3a Revegetation of Megg Arm	NWFWMMD		*	*				\$0		
R-4 Forts Arm Restoration	NWFWMMD	\$25,000	*	*				\$25,000		
R-5 Rest'n of Upland and Aq. Areas	C/C							\$0		
M-1 Ecol. Analysis of LJ Watershed**	C/C							\$0		
M-2 Land Acquisition	C/C							\$0		
M-3 Park Design Committee	C/C							\$0		
M-4 Aquatic Preserve Management	DEP			Requires \$				\$0		
M-5 Fish/Wildlife Mgt/Research	FGFWFC				\$83,000			\$83,000		
M-6 Aquatic Plant Management	DEP	\$10,000	*	\$56,250	\$18,750			\$85,000		
M-7 Regulatory Assess/Coordination	NWFWMMD	\$5,000	*	*				\$5,000		
M-8 Regulation of Recreation Uses	C/C							\$0		
M-9 Ordinary High Water Line	DEP			Requires \$				\$0		
M-10 Action Team as Oversight Comm	COUNTY							\$0		
M-11 Coordinate/Update Mgt Plan	NWFWMMD	\$30,000	*	*				\$30,000		
M-12 Contingency Plan for Drawdown**	NWFWMMD	\$25,000	*	*				\$0		
E-1 Planning and Administration	NWFWMMD	\$5,000	*	*				\$5,000		
E-2 Printed Materials	COMM							\$0		
E-3 Media Relations	COMM							\$0		
E-4 Corporate/Private Sponsorship	COMM							\$0		
E-5 Misc Awareness Activities	COMM	\$10,000	*	*				\$10,000		
E-6 School Programs	COMM							\$0		
E-7 Educational Materials	COMM							\$0		
E-8 Outdoor Educational Displays	COMM	\$5,000	*	*				\$5,000		
E-9 Community Activities	COMM	\$2,000	*	*				\$2,000		
E-11 Pub. Awareness Survey**	COMM	\$12,500	*	*				\$12,500		

This worksheet is for use as a general guideline for future budgeting and funding. All figures are subject to change depending upon appropriations from the Florida legislature, local governments and other sources.

Table E-2C Lake Jackson Management Plan Summary of Funding for Fiscal Year 1995-96

This worksheet is for use as a general guideline for future budgeting and funding. All figures are subject to change depending upon appropriations from the Florida legislature, local governments and other sources.

NOTES:

C/C = Leon County and the City of Tallahassee

COMM = Joint Intergovernmental Education / Awareness Working Group (see Project Description E-1)

* Projects funded by SWIM for FY 95-96 will require a 20% local match. Local match assistance is requested annually from Leon County, the City of Tallahassee and the Governing Board of the NWFWM.

Project Q-4 SWIM total includes a request of \$1 million from discretionary funds for regional stormwater facility construction. If these funds are allocated by the DEP, a 20% local match will be required.

Project E-4, Private/Corporate Sponsorship of Public Awareness/ Education projects, will be pursued.

County funding for specific projects is subject to review and approval by the Board of County Commissioners.

City funding for specific projects is subject to review and approval by the City Commission.

DEP Aquatic Preserve Management funding is dependent upon annual legislative appropriation.

Project titles with ** indicate that the project will begin in FY 1995-96. All other projects are continued from FY 1993-94.

PROJECT	LEAD AGENCY	SWIM*	FUNDING AGENCIES			DEP	FGFWFC	FEDERAL	PROJECT TOTAL
			CITY	COUNTY	NWFWMD				
Q-1 Eval. & App. of Water Qual. Data	NWFWMD	\$2,000	*	*				\$2,000	
Q-1a Development of PLRGs	NWFWMD	\$10,000	*	*				\$10,000	
Q-2 Long Term Water Quality Monitoring	COUNTY		\$50,000					\$50,000	
Q-4 Regional Stormwater Retrofit Plan	NWFWMD	\$1,100,000	*	*				\$1,100,000	
Q-4b Okecheepokee Basin Phase II	NWFWMD	Eligible		Requires \$				\$20,000	
Q-6 Megginnis Arm Facility O&M	NWFWMD		\$20,000					\$20,000	
Q-7 On-site Design Criteria & Effect**	C/C							\$0	
Q-8 Retrofit of Nonconforming Sites	C/C							\$0	
Q-9 Eval. of Septic / Sewer Issues	NWFWMD	\$80,000	*	*				\$80,000	
Q-10 Agricultural Impacts**	NWFWMD	\$20,000	*	*				\$20,000	
Q-11 Recreational Impacts**	DEP							\$0	
R-1 Long Term Monitoring of Habitat	C/C							\$0	
R-3 Add'l Megg Arm Restoration	NWFWMD	\$27,000	*	*				\$27,000	
R-4 Fords Arm Restoration	NWFWMD	\$25,000	*	*				\$25,000	
R-5 Rest'n of Upland and Aq. Areas	C/C							\$0	
M-1 Ecol. Analysis of LJ Watershed	C/C							\$0	
M-2 Land Acquisition	C/C							\$0	
M-3 Park Design Committee	C/C							\$0	
M-4 Aquatic Preserve Management	DEP					Requires \$		\$0	
M-5 Fish/Wildlife Mgt/Research	FGFWFC						\$83,000	\$83,000	
M-6 Aquatic Plant Management	DEP		\$56,250				\$18,750	\$75,000	
M-7 Regulatory Assess/Coordination	NWFWMD	\$5,000	*	*				\$5,000	
M-8 Regulation of Recreation Uses	C/C							\$0	
M-9 Ordinary High Water Line	DEP					Requires \$		\$0	
M-10 Action Team as Oversight Comm	COUNTY							\$0	
M-11 Coordinate/Update Mgt Plan	NWFWMD	\$30,000	*	*				\$30,000	
M-12 Contingency Plan for Drawdown	NWFWMD	\$20,000	*	*				\$20,000	
E-1 Planning and Administration	NWFWMD	\$5,000	*	*				\$5,000	
E-2 Printed Materials	COMM							\$0	
E-3 Media Relations	COMM							\$0	
E-4 Corporate/Private Sponsorship	COMM							\$0	
E-5 Misc Awareness Activities	COMM	\$10,000	*	*				\$10,000	
E-6 School Programs	COMM							\$0	
E-7 Educational Materials	COMM							\$0	
E-8 Outdoor Educational Displays	COMM	\$5,000	*	*				\$5,000	
E-8b Megg Arm Facility Exhibit	COMM	\$5,000	*	*				\$5,000	
E-9 Community Activities	COMM	\$2,000	*	*				\$2,000	
E-10 Citizen Water Qual. Monitoring**	COMM							\$0	

**Central Concerns
of SWIM**

		Point & Nonpoint Source Pollution	Destruction of Natural Systems	Correction and Prevention of Surface Water Problems	Research for Better Watershed Mgt.
PROGRAMS	INITIATIVES				
WATER QUALITY	QI-1: Water Quality Monitoring			X	X
	QI-2: Regional Stormwater Treatment	X		X	X
	QI-3: On-Site Stormwater Treatment	X		X	X
	QI-4: Sewer/Septic/Graywater	X		X	
	QI-5: Other Activities	X		X	
PRESERVATION & RESTORATION	RI-1: Preservation		X		X
	RI-2: Restoration	X	X	X	X
MANAGEMENT	MI-1: Research and Information				X
	MI-2: Management		X	X	X
	MI-3: Regulatory	X	X	X	X
	MI-4: Implementation & Admin.	X	X	X	
	MI-5: Contingency Plan		X		X
EDUCATION	EI-1: Coordination	X	X	X	
	EI-2: Public Awareness	X	X	X	
	EI-3: Education	X	X	X	
	EI-4: Community Involvement		X	X	X
	EI-5: Research				X

Table E-3

LAKE JACKSON MANAGEMENT PLAN

INTRODUCTION

The Lake Jackson Management Plan is a comprehensive program for coordinated management of the Lake Jackson watershed for the purpose of preserving and restoring habitat and natural systems and improving water quality. It has been developed through a cooperative effort between state and regional agencies and local government, and will likewise be implemented through the cooperation and coordination of the responsible parties. The development of the Lake Jackson Management Plan was accomplished through the cooperation of the Northwest Florida Water Management District (District) in revising its Surface Water Improvement and Management (SWIM) Plan for the Lake Jackson Watershed and the Leon County Lake Jackson Action Team (Action Team) in developing an implementation plan and schedule for restoration of Lake Jackson for approval by the Leon County Board of County Commissioners. This effort represents the level of commitment and cooperation that is necessary, along with adequate sources of long-term funding, for successful restoration and preservation of Lake Jackson.

The District developed and adopted the first Lake Jackson SWIM Plan in December 1988, and began implementation of specific preservation, restoration management and educational activities. In 1990, the District, in coordination with the Lake Jackson Action Team, revised the SWIM Plan and significantly expanded its scope to include projects outside of the SWIM program. The resulting document, renamed as the "Lake Jackson Management Plan", provided a comprehensive preservation and restoration program for the entire watershed. The 1990 Lake Jackson Management Plan had a three-year implementation timeframe, and thus was due for revision in 1993. The 1990 plan revision process involved extensive consideration of the many issues and problems and included an extensive coordination effort to address the identified needs. In the three years since development of the Lake Jackson Management Plan, much progress has been made (see Appendix 6), however, the major issues and needs have remained similar. For these reasons, the 1993 plan revision process has focused on relatively minor revisions and an overall update of the plan.

Although the Action Team and the District joined forces for the same purpose, the specific programs and charges guiding them were established separately. The following sections discuss the charge to the Action Team and the intent and focus of the SWIM program as they relate to the plan.

Charge to the Leon County Lake Jackson Action Team

In July 1989, the Leon County Board of County Commissioners sponsored a community colloquium on Lake Jackson in response to mounting public interest and scientific concerns about the continuing degradation of water quality and natural habitat in Lake Jackson. The lake has long been known for its outstanding fisheries and recreational opportunities, and has been designated an Aquatic Preserve and an Outstanding Florida Water by the State of Florida. As a result of the Lake Jackson Colloquium, the Leon County Commissioners appointed a joint task force, the Leon County Lake Jackson Action Team, consisting of seven citizen members and executives from three state and regional agencies including the Florida Department of Environmental Protection (DEP), the Florida Game and Fresh Water Fish Commission (FGFWFC), and the Northwest Florida Water Management District (NFWFMD).

The Action Team was formed in September 1989 to create a comprehensive and coordinated plan for the restoration of Lake Jackson. The Leon County Commissioners charged the Action Team with the following.

- 1) To recommend for approval by the Leon County Commissioners an implementation plan and schedule, including affordable financial strategies, which builds upon the findings and consensus from the Lake Jackson Colloquium and the actions and plans already developed by other agencies;
- 2) To facilitate, but not assume, the roles and responsibilities now held by state and regional agencies;
- 3) To monitor the plan; and
- 4) To keep the Leon County Commissioners, the public, and all those involved with the lake fully informed of the status of plan implementation.

The findings and consensus of the Lake Jackson Colloquium have guided plan development and will continue to guide plan implementation. The major findings were the following.

- 1) Primary responsibility for protecting Lake Jackson lies with local government. There must be accountability through land use regulations and zoning, on-site environmental controls, and intensified monitoring and enforcement during development.
- 2) Protection of Lake Jackson requires a basin-wide approach that includes land use planning, zoning codes and enforcement of the Environmental Management Act, improving existing conditions through retrofit programs, and an effective public education program.
- 3) A long-term commitment to funding is essential to an effective management plan. Both a dedicated local source of funding and an aggressive strategy to pursue and secure funding from other available sources are integral to plan implementation.

Pursuant to the charge of the Leon County Commissioners and the findings of the Colloquium, the Action Team has been instrumental in coordinating state and regional agencies and local government for the purpose of developing an integrated comprehensive plan for the preservation and restoration of Lake Jackson. In addition, a significant byproduct of the Action Team research and process has been the creation of a "Lake Protection Zone" category in the land use element of the proposed Tallahassee-Leon County 2010 Comprehensive Plan, and special protection for Lake Jackson in the Leon County Environmental Management Act adopted in December 1989.

Intent and Focus of the Surface Water Improvement and Management Act

The Surface Water Improvement and Management Act (SWIM) was passed by the Florida Legislature in 1987. It directed each water management district to design and implement plans and programs for the improvement and management of surface waters in cooperation with state agencies and local governments. Several concerns prompted passage of the SWIM Act. The Legislature found that many surface waters in the state had been degraded or were in danger of becoming degraded. Furthermore, natural systems associated with many surface waters have been altered so that they no longer perform important functions such as providing aesthetic and recreational pleasure, providing habitat for native plants, fish and wildlife, providing safe drinking water, attracting visitors and accruing other economic benefits. Therefore, it is the intent of the Legislature and the SWIM Act to correct and prevent surface water problems through the development and implementation of SWIM Plans in order to enhance the environmental and aesthetic value of surface waters so that the public may derive benefit and enjoyment from them.

The SWIM Act focuses on the following general areas of concern: 1) point and nonpoint sources of pollution; 2) destruction of natural systems; 3) correction and prevention of surface water problems; and 4) research for better management of surface waters and associated natural systems. How the Lake Jackson Management Plan addresses each of these concerns is discussed below.

The most significant source of pollution in the Lake Jackson watershed is from nonpoint sources, -- primarily stormwater runoff from urban and suburban areas. Fortunately, Lake Jackson does not have any point source discharges. The Lake Jackson Management Plan addresses nonpoint source pollution in several ways. First, there is a need for both regional and onsite stormwater treatment facilities in the watershed, and a major component of the Lake Jackson Management Plan is to develop and implement a comprehensive regional stormwater retrofit plan. Second, with respect to onsite stormwater treatment facilities, the plan stresses development and enforcement of adequate design and construction criteria as well as appropriate monitoring and maintenance. In addition, the Lake Jackson Management Plan provides for assistance in the development and enforcement of land development regulations and encourages implementation of all elements of the Tallahassee-Leon County 2010 Comprehensive Plan. Other sources of nonpoint source pollution addressed by the Lake Jackson Management Plan include septage and graywater discharges from faulty septic tanks, and recreational and agricultural activities.

Destruction of natural systems is a central concern of the Lake Jackson Management Plan from both preservation and restoration perspectives. Natural systems in the northern portion of the watershed are relatively undisturbed and growth in these areas will require careful planning in order to preserve the lake. The remainder of the watershed is in various stages of development and urbanization, and in some areas, such as Megginnis and Fords arms, natural upland and aquatic systems have been severely disrupted. Preservation strategies have been developed for habitats throughout the watershed, and restoration strategies have been developed for the Megginnis and Fords arms subbasins.

The primary goal of the Lake Jackson Management Plan is to correct and prevent surface water problems through a comprehensive, coordinated effort that involves Leon County, the City of Tallahassee, the NFWFMD, state agencies and local citizens. Recent and past studies indicate that both preservation (prevention) and restoration (correction) activities are necessary to fully address the problems facing Lake Jackson. Therefore, development of the Lake Jackson Management Plan has been guided by the following four objectives.

- 1) To immediately address specific areas that have been identified by state and local government as requiring restoration activities;
- 2) To research and further diagnose problems and/or areas suspected of needing restoration or other corrective activities;
- 3) To protect and preserve critical habitats and other areas vital to the health of the lake; and
- 4) To implement an active public education and awareness program to ensure that this and future generations will adopt a preservation-oriented attitude toward using and enjoying Lake Jackson.

Research for better watershed management is a vital aspect of the Lake Jackson Management Plan. Some of the planned research activities are project-specific and designed to answer particular management questions. Other research-type projects, for example the long-term, lake-wide water quality monitoring program, will be applicable to many watershed management activities.

A major component of the Lake Jackson Management Plan is intergovernmental cooperation. The plan itself was developed by a specially appointed committee that includes local government, regional and state agencies and citizens who live in the watershed. It will likewise be funded and implemented by local, regional and state entities, with substantial financial and technical cooperation, particularly between the District and local government. Implementation of the plan will be overseen by the Lake Jackson Action Team, which is funded and staffed by Leon County. Many activities and projects are designed to coincide with requirements of the Tallahassee-Leon County 2010 Comprehensive Plan so that efforts will not be duplicated.

Priority Issues and Analysis

Historically, land use in the Lake Jackson watershed has been forestry and agriculture, dating 1,000 years back to the Apalachee Indians who cultivated the land in corn and other crops. When Leon County was first settled by white men in the early 19th century, Lake Jackson bordered some of the best farmland in the area. The Lake Jackson watershed remained essentially undeveloped until the mid-twentieth century when residential and eventually urban development began to encroach as Tallahassee experienced accelerated growth toward the north.

Substantial land use changes in the Lake Jackson watershed in the last 25 years, especially in the Megginnis and Fords arms' subbasins, have resulted in extensive urban and residential development and a corresponding increase in impervious surface area. The negative effects of urbanization and development on Lake Jackson were documented in the early and mid 1970s (Bishop 1973; Rivers and Allen 1974; Harriss and Turner 1974; Schamel 1974; Smith 1974, Burton et al. 1976; Babcock 1977; Dobbins and Rousseau 1982), and include poor water quality, increased sedimentation, contamination of bottom sediments by heavy metals and other pollutants, and increased nutrification of the lake as a result of stormwater runoff and accidental sewage spills. Development has continued unabated, and now threatens to invade the more pristine, northeastern portions of the watershed.

In addition to residential and urban development, a major federal highway, Interstate-10, was constructed across the Megginnis and Fords arms subbasins in 1972-73. During construction, excessive rainfall coupled with inadequate sediment controls resulted in a large, highly turbid plume of water extending over approximately the southern third of the lake (Rivers and Allen 1974; Schamel 1974). Subsequent methods to prevent sediments from reaching the main body of the lake effectively turned Megginnis and Fords arms into sediment traps, allowing deposition of approximately 50,000 cubic yards of sediment in Megginnis Arm and an undetermined amount in Fords Arm (Schamel 1974). Resuspension of the nutrient-laden sediments has been directly linked to degraded water quality in Megginnis Arm, and is suspected of contributing to degraded water quality in Fords Arm as well (Wanielista et al. 1984). Post-construction stormwater management for this stretch of highway is virtually non-existent and the area continues to contribute runoff to the lake without the benefits of treatment.

The effects of pollution on Lake Jackson from development and construction in the watershed are evident. The exotic plant hydrilla has been present, but not abundant, in most of Lake Jackson for more than a decade. In 1986, however, nutrient levels reached a critical threshold, causing an explosion of hydrilla which threatened recreational use in the entire southern half of the lake (Van Dyke, personal communication). In 1987, 1990, 1992, and 1993 the hydrilla was treated with herbicides, thereby preventing further increases of this exotic species. However, the continued proliferation of both native and exotic plants in Lake Jackson since 1986 indicates a serious problem with nutrient loading, and ongoing treatment with herbicides, while preserving some level of recreational value, tends to mask the more serious underlying problem of nutrient enrichment.

The effects of pollution on Lake Jackson are also evident in the bass fisheries. Lake Jackson became famous as a trophy largemouth bass fishery following an extreme natural drawdown in the 1950s. However, as a sport fishery Lake Jackson began to decline in the mid-1970s, coincident with initial documentation of poor water quality, increased sedimentation, sediment contamination and nutrient enrichment (Dobbins and Rousseau 1982). The population of largemouth bass recovered somewhat after another natural drawdown in 1982, but the long-term viability of Lake Jackson as a trophy largemouth bass fishery is dependent on restoring and preserving water and sediment quality throughout the lake. This is only one of many important reasons for developing and implementing a comprehensive, coordinated effort for long-term management of the Lake Jackson watershed.

There have been many federal, state and, more recently, local efforts to manage all or part of the Lake Jackson watershed. Lake Jackson lies entirely within the boundaries of Leon County, and part of the watershed is within the limits of the City of Tallahassee. In addition, Lake Jackson has received perhaps more than its fair share of attention from state environmental agencies because of its location proximate to the state capitol. Nevertheless, water quality in Lake Jackson, especially the southern portion, has continued to deteriorate. The history and varying successes of management efforts in the Lake Jackson watershed are discussed at length in Appendix 4, "Lake Jackson Management Efforts," which clearly identifies the need for coordination between local, regional and state government entities in the development and implementation of plans and for the establishment of funding responsibilities and time schedules for implementation.

In reviewing the history of development and management of the Lake Jackson watershed, and the effects these activities have had, or not had, on the lake and its natural resources, several issues emerge for priority consideration in the Lake Jackson Management Plan. These priority issues are discussed below.

Water Quality The major goal of the Lake Jackson Management Plan is to restore water quality to more acceptable standards for the preservation of Lake Jackson. Poor development practices in the watershed have led to nutrient and sediment pollution that has degraded the water quality in Lake Jackson and had an adverse impact on the natural resources of the lake environment. This trend must be reversed, and appropriate legal and physical structures must be in place to prevent further deleterious effects to the lake as the greater Tallahassee area continues to grow.

Preservation of Natural Systems The Lake Jackson watershed has suffered considerable damage and degradation due to poor management practices, however it is a viable ecosystem that has many areas yet to be preserved for fish and wildlife, aesthetic beauty and low-impact recreation. Preservation of upland areas, especially critical habitat, is as important as preservation of aquatic environments, and preservation of both is a major goal of the Lake Jackson Management Plan.

Restoration of Disturbed or Degraded Systems There has been significant degradation of natural systems both in the watershed and in the lake basin. Most notable are Megginnis and Fords arms, which due to poor upland management practices have essentially served as sediment and nutrient traps for pollutants carried in stormwater runoff. Areas in which the original ecology is most disturbed must be restored if ecological functions and values can be substantially improved and thereafter sustained. The \$1 million Megginnis Arm Sediment Removal project, which was completed by the SWIM program in 1992, was a major step toward implementing the plan's restoration goals, but the success of this effort must be measured and further restoration needs must be evaluated. Upland areas in these two subbasins may also require restoration activities in order to prevent further degradation. There is an immediate need for restoration activities in the Lake Jackson watershed, and the Lake Jackson Management Plan takes an aggressive approach to this priority issue.

Intergovernmental Coordination The need for intergovernmental coordination and cooperation in the management of the Lake Jackson watershed is paramount. Appendix 4 describes the limited successes of various management efforts, which typically seem to have lacked unified leadership, strong local government commitment (especially financial), implementation schedules and monitoring, and clearly defined responsibilities for all management entities. The Lake Jackson Management Plan recognizes intergovernmental coordination as a priority issue and devotes an entire program to addressing comprehensive watershed management.

Public Education and Awareness The current status of Lake Jackson is the result of individual and collective acts of people, including recreational users, elected and appointed government officials, local and out-of-town developers, and others. A major goal of the Lake Jackson Management Plan is to provide a new level of awareness among those using or making decisions that affect the natural resources, and to educate them in order to change their behavior toward more preservation-oriented attitudes and activities. An education program is vital for effective management of the watershed and is a major focus of the Lake Jackson Management Plan.

The Lake Jackson Management Plan addresses these priority issues in the following four programs.

- 1) Water Quality Program.
- 2) Preservation and Restoration Program.
- 3) Watershed Management Program.
- 4) Public Education and Awareness Program.

Each of these programs has a goal and specific objectives that will be met through the implementation of various management strategies. The Water Quality Program has several initiatives, including water quality monitoring, regional stormwater treatment, on-site stormwater treatment and septic tanks and sewer systems. The Preservation and Restoration Program has a preservation initiative to address protection of existing critical habitat and natural systems, and a restoration initiative that includes strategies for

correcting and restoring natural systems that have been disrupted and degraded. The Watershed Management Program includes research, management, regulatory and administrative initiatives. Finally, the Public Education and Awareness Program has several initiatives, including education, awareness, community involvement and research, all designed to meet the goal of providing opportunities for the public to learn about the lake and their role in protecting its valuable resources. These four programs are summarized in the next section on Management Strategies, and detailed project descriptions are presented in Appendix 1.

The Lake Jackson Management Plan presents a comprehensive approach to watershed management, as evidenced by the priority issues discussed above, and all aspects of the plan are vital components in the long-term preservation of Lake Jackson. However, there are priority activities that are essential to the overall goal of improving water quality. If these activities are not addressed on a priority basis, other components of the management plan will be extremely limited in their effectiveness. For example, the removal of contaminated sediments from Megginnis Arm would have been ineffective if stormwater treatment facilities, such as berms and swales, marshes, wetlands and regional detention ponds, were not in place to prevent more contaminated sediments from being deposited in the arm. These essential activities are discussed below.

Removal of Contaminated Sediments Contaminated sediments have been documented in Megginnis Arm and preliminary assessments have been undertaken in Fords Arm. As long as untreated sediments are in place, they can release pollutants to the water column, thereby continually degrading water quality. For the Lake Jackson Management Plan to be effective in its goal of improving the water quality of Lake Jackson, contaminated sediments should be removed or treated. As mentioned above, the Megginnis Arm sediment removal undertaken through the SWIM program was a substantial step toward restoration, however, further work may be warranted in Megginnis Arm and removal of sediments in Fords Arm may also be necessary. Upland controls, such as stormwater retrofit and land use regulations, are also essential to this goal, however, these strategies will not be fully effective at improving water quality if restoration of known contaminated areas is not addressed. If adequate upland stormwater controls are in place, sedimentation will be greatly reduced and the historical sediment loading problems are not likely to be repeated.

Retrofit of Existing Development A second general area that must be addressed on a priority basis is stormwater retrofit of all existing development. Like contaminated sediments, this is an existing problem that currently contributes to water degradation in Lake Jackson, and it must be corrected for any other restoration or preservation efforts to be successful. This issue is addressed in the Lake Jackson Management Plan by providing for both on-site and regional stormwater treatment facilities. A regional retrofit plan was completed in 1992 and implementation of this plan is the highest priority of the Lake Jackson SWIM program. The Lake Jackson Regional Stormwater Retrofit Plan should be adopted by the City of Tallahassee and Leon County to ensure a coordinated approach to watershed stormwater retrofit.

Strict Stormwater Requirements for New Development In addition to contaminated sediments and adequate treatment for existing development, there must be implementation and enforcement of strict stormwater treatment

requirements for new development in order to prevent the same problems from occurring again. Stormwater runoff from new development should be treated so that water quality and quantity are not altered beyond pre-development conditions.

Pollutant Load Reduction Goals (PLRGs)

Pursuant to Florida law, and as part of the planning process for Lake Jackson, interim PLRGs and a schedule for the development of final PLRGs must be established. PLRGs are defined as those quantities of pollutants which must be removed so that the uses and ecosystem values of a waterbody can be maintained or restored. PLRGs therefore relate closely to the priority issues identified for Lake Jackson, in particular, water quality, preservation of natural systems and restoration of degraded systems. PLRGs also affect the retrofit of existing development and the establishment of stringent stormwater management requirements for new development as discussed previously.

Through the quantification of load reductions for water quality parameters of concern for the lake, all projects and programs necessarily become viewed in terms of how each action helps achieve the interim or final goal. The PLRG itself serves as one means of evaluating the compliance or success of a project. For example, because they characterize the effectiveness of pollution control measures at the ecosystem and use level, PLRGs can provide a context for implementing the various programs required under a federal National Pollution Discharge Elimination System (NPDES) permit. In addition, projects can be compared in terms of cost effectiveness (e.g., dollars per pound of pollutant removed), which in turn may affect the prioritizing of future projects. In sum, PLRGs may define much of what the Management Plan is about by quantifying and making more measurable the output of each program in the Plan in the context of restoring lake ecosystems and preserving its uses.

Interim PLRGs: Interim PLRGs are to reflect the anticipated reductions in loadings for various water quality parameters resulting from the implementation of projects and programs within the Management Plan. Projects in the Plan that are expected to produce tangible reductions in loadings include projects Q-4 through Q-8, Q-10 and R-7. Because detailed sub-basin by sub-basin analyses for all pollutants has not been performed, interim PLRGs are set forth here for total suspended solids (TSS) and total phosphorus (TP). Interim PLRGs for other parameters will be established as additional data becomes available.

Current lakewide stormwater loads for TSS and TP are 494,630 kg and 5,370 kg, respectively. Implementation of the stormwater retrofit plan (including the restoration of Yorktown Pond, project R-7) will affect about 52% of the stormwater entering the lake. Based on design considerations and the experience of similar facilities elsewhere, removal efficiencies for wet detention stormwater treatment facilities are expected to average about 96% for TSS and 67% for TP. Total removal by these facilities is then expected to be 241,880 kg of TSS and 1,840 kg of TP.

Another major contributor to stormwater loading to the lake is from non-urban nonpoint sources, including forestry and improved and unimproved pasture. Six sub-basins on the north side of Lake Jackson comprise

approximately 10,600 acres, or 45% of the entire drainage basin. While pollutant loads per acre are low in these areas, the total acreage results in significant stormwater loads to the lake. An estimated 25.7% of all TSS entering the lake arises in these lands as does about 24.9% of all TP.

Project Q-10 is intended to address agricultural nonpoint sources. Experience in Florida and nationally indicates that minimum reductions in loads from the implementation of Best Management Practices is about 35% for TSS and 15% for TP, where application of manure is involved. For the purposes of establishing interim PLRGs, a reduction of 10% and 5% are proposed for TSS and TP, respectively. These smaller reductions reflect the possibility that some BMPs may already be in effect, that much of the land is forested and not in active agriculture and that manure application is not used extensively throughout this acreage. Anticipated reductions in loadings attributable to the implementation of BMPs are 12,700 kg of TSS (about 2.6% of the total TSS load) and 67 kg of TP (0.6 percent of the total TP load).

Thus, Interim PLRGs for TSS and TP entering Lake Jackson are 254,580 kg of TSS and 1,910 kg of TP. These PLRGs will be revised as more data regarding District, City, County and privately maintained stormwater facilities become available.

Final PLRGs: The schedule for the development of final PLRGs must reflect the need for an assessment of all applicable water quality data, an evaluation of all stormwater treatment facilities, and the health of the lake itself. Final PLRGs must also account for changes in land use and related impacts to stormwater flow and the effectiveness of city and county stormwater management plans.

There are several projects in the Management Plan that address these subjects. Most of these projects are anticipated to be funded and carried out in FY 94-95, suggesting that the establishment of final PLRGs must occur after that time. In addition, ample time is needed to compile the results of the projects. Consequently, the schedule for establishing final PLRGs for Lake Jackson is as follows:

- | | |
|----------------|--|
| October 1994 | - Receive and input 2nd year data from Leon County lake monitoring project |
| December 1994 | - Conclude lake ecosystem model |
| June 1995 | - Calibrate model using all water quality data |
| September 1995 | - Receive results from the Megginnis Arm Basin Diagnosis |
| | - Develop and revise as necessary estimates of load reductions attributable to any new stormwater facilities |
| | - Conclude analysis of septic tank impacts |
| October 1995 | - Receive information from city and county regarding growth in watershed and changes in land use (1994-95) |
| December 1995 | - Assess first year effectiveness in meeting interim PLRGs |

- June 1996 - Analyze all available data from the above tasks and projects; begin workshops to establish draft final PLRGs for nutrients, total suspended solids and heavy metals sampled in the monitoring project
- September 1996 - Receive information regarding effectiveness of city and county design criteria for onsite systems
- December 1996 - Conclude analysis of agricultural and silvicultural BMPs
- December 1996 - Assess second year effectiveness in meeting interim PLRGs
- June 1997 - Revise draft final PLRGs to reflect the findings of the three previous tasks
- October 1996 - Conclude workshops and peer review process for establishing final PLRGs
- December 1997 - Adopt final PLRGs for Lake Jackson

MANAGEMENT STRATEGIES

The Lake Jackson Management Plan has a number of strategies for preserving and restoring the Lake Jackson watershed. These strategies are organized into four programs, Water Quality, Preservation and Restoration, Watershed Management, and Public Education and Awareness, each of which has a set of goals, issues and objectives to guide implementation. The four programs are further organized into major initiatives, which consist of one or more strategies (projects) that address a particular objective of the overall program. The plan includes activities for the current and next two fiscal years, which are October 1993 - September 1994, October 1994 - September 1995, and October 1995 - September 1996. The following pages identify goals, issues, objectives and initiatives for the four programs. Descriptions of specific projects to be implemented by the District, state agencies and local government can be found in Appendix 1. A three-year implementation summary is included in Table 1 at the end of this section. Table 2 illustrates the relationships between programs, projects, and objectives of the plan.

Water Quality Program

Goal To improve and maintain the water quality of Lake Jackson for preservation of environmental values, fisheries and recreational activities.

Issues The water quality in the southern portion of the lake has been degraded due to stormwater runoff from developed areas. The stormwater is laden with sediments, nutrients and other pollutants that adversely impact the water quality of the lake.

The relatively good water quality in the northern portion of the lake may be threatened due to increasing development.

There is a potential threat to water quality due to agricultural activities.

There is a potential threat to water quality due to recreational activities.

There is a need for continuous, long-term, lakewide water quality data.

There are septic tank failures and graywater discharge in various parts of the watershed, which may be adversely affecting water quality.

Establishment and tracking of water quality and pollutant reduction goals is necessary to measure success of water quality improvement strategies.

Objectives Reduce the amount of nutrients, sediments and other pollutants entering the lake.

Establish target water quality standards and pollutant load reduction goals (PLRGs) and monitor the water quality of the lake to measure the success of the Water Quality Program and the Lake Jackson Management Plan.

Eleven specific projects and four sub-projects make up the Water Quality Program. These projects are categorized under the following initiatives.

Water Quality Monitoring Initiative

The purpose of the water quality monitoring initiative is to establish scientifically acceptable baseline and ongoing data by which the success of the Lake Jackson Management Plan, including the Water Quality Program, restoration activities and local ordinances, can be measured. This initiative includes projects Q-1 through Q-3.

Interim and final PLRGs are established under projects Q-1 and Q-1a. PLRGs quantify the reduction in pollutant loads needed to restore and preserve the lake's environmental and recreational values. Establishing PLRGs will guide the content and priority of projects addressed by the following initiatives.

Regional Stormwater Treatment Initiative

The primary purpose of this initiative is to reduce the amount of nutrients, sediments and other pollutants entering the lake through the use of regional stormwater treatment facilities. Also included are projects which measure the progress of the regional stormwater treatment initiative and projects which address management of regional stormwater treatment facilities. This initiative includes projects Q-3 through Q-6.

On-Site Stormwater Treatment Initiative

The purpose of this initiative is to achieve effective on-site stormwater treatment throughout the watershed in order to reduce the amount of nutrients, sediments and other pollutants entering Lake Jackson. Projects include a research effort to determine the effectiveness of on-site facilities (project Q-7) and a program to retrofit sites which have no existing on-site stormwater treatment (project Q-8).

Sewer Services/Septic Tanks/Graywater Initiative

The purpose of this initiative is to reduce the amount of nutrients entering the lake because of septic tank failure and graywater discharge. This will be accomplished through project Q-9, which includes a survey to quantify the extent of problems caused by septic systems and graywater discharges, followed up with an assessment of alternatives and recommendations for addressing documented problems.

Other Activities Which May Impact Water Quality Initiative

The purpose of this initiative is to address activities that may have a significant adverse impact on the water quality of Lake Jackson. The overall intent is to reduce the amount of nutrients, sediments and other pollutants entering the lake. The projects in this initiative (projects Q-10 and Q-11) focus on possible impacts which result from agricultural and recreational activities in the watershed and the lake.

Preservation and Restoration Program

Goal To preserve and restore the Lake Jackson ecosystem to maintain and improve water resources within the lake basin and biodiversity original to natural areas.

Issues Sediments accumulated in Megginnis Arm have significantly altered the natural system. Success of the SWIM Megginnis Arm restoration (sediment removal) effort needs to be determined.

Fords Arm may be degraded due to accumulation of sediments.

Shoreline habitats may be in need of preservation or restoration, especially near boat landings.

There are tributary or upland environments that have been altered and may be in need of restoration.

Endangered species and their habitats should be adequately protected.

Exotic vegetation may have an adverse impact on water quality, fish and wildlife.

Objectives Restore Megginnis and Fords arms to improve water quality and native biodiversity.

Preserve and restore critical habitats and environments for fisheries, wildlife and water quality.

Seven projects and one sub-project make up the Preservation/Restoration Program. These projects are categorized under the following two initiatives.

Preservation Initiative

The purpose of the preservation initiative is to protect habitat throughout the watershed, including wildlife and fisheries as well as endangered and threatened species and species of special concern. Project R-1 is the only project in this initiative.

Restoration Initiative

The purpose of the restoration initiative is to restore Megginnis Arm, Fords Arm, upland/wetland and aquatic areas to reverse the effects of nutrient, sediment and pollutant loadings and to improve fish and wildlife habitat. Projects R-2 through R-7 are included under this initiative.

Watershed Management Program

Goal To provide comprehensive, coordinated management of the watershed in order to preserve and protect the lake environment.

Issues There are multiple governmental entities responsible for managing the lake.

There is a need to apply existing research and define data gaps for further research to guide management strategies and decisions.

Proper land use management is essential to protecting and preserving the lake environment.

Recreational use of Lake Jackson must be compatible with protecting and preserving the lake.

Lake Jackson periodically drains, creating a distinct set of management issues that should be addressed before the next natural drawdown.

Lake Jackson was designated an Aquatic Preserve in 1973, and an Aquatic Preserve Management Plan was adopted by the Governor and Cabinet in 1991, but funding has not been provided for implementation of the plan.

Objectives Implement and update as necessary a coordinated, comprehensive plan for the watershed and provide the research necessary to guide the management program.

Manage the watershed to protect and preserve the lake as well as providing recreational opportunities for a variety of interests.

Ensure that proper regulations and enforcement policies are in place to protect and preserve the lake.

Twelve specific projects make up the Watershed Management Program. These projects are categorized under the following initiatives.

Research/Information Initiative

The purpose of the research/information initiative is to provide for the ecological information and research necessary to guide the management program. Project Q-1 falls under this initiative.

Management Initiative

The purpose of this initiative is to ensure that management of Lake Jackson and its watershed will protect and preserve the lake, as well as provide recreational opportunities for a variety of interests. Projects under this initiative are M-2 through M-6, which address land acquisition and management, park design, Aquatic Preserve management, fish and wildlife research, and aquatic plant management.

Regulatory Initiative

The purpose of the regulatory initiative is to ensure that proper regulations and enforcement policies are in place to protect and preserve the lake, to protect the health and welfare of citizens and to enhance recreational activities. Projects M-7 through M-9 make up this initiative.

Implementation and Administration Initiative

The purpose of this initiative is to provide the framework for the development, coordination and implementation of the Lake Jackson Management Plan. This initiative includes projects M-10 and M-11, which address the Lake Jackson Action Team and the administration of the management plan.

Contingency Management Initiative

The purpose of this initiative is to ensure that an approved management plan is in place and can be quickly implemented contingent upon natural drawdown of the lake. This initiative will be implemented through Project M-12.

Public Education and Awareness Program

Goal To promote better management of the lake and its watershed by providing for public educational opportunities to make the public aware of the problems and issues associated with Lake Jackson.

Issues There is a need for a more coordinated, cooperative approach to educating the general public and creating public awareness about the lake as a natural resource and the activities which influence the lake's water quality.

The general public may not understand the importance of watershed management to the health of the lake.

The general public may not be aware that there are simple, inexpensive, effective methods of on-site stormwater treatment.

The general public may not understand that there are simple behavioral and activity changes which can be made to help improve the water quality of Lake Jackson. There is a need to know the public's level of awareness and knowledge of these issues.

The various regulatory and management programs affecting the lake may not be well known or well understood by the general public.

Users of the lake may not be aware of responsible recreational behavior.

Educators may not know the level of public knowledge about lake issues.

Educators may not know the impact or effectiveness of various educational and awareness activities that can be used in the Lake Jackson watershed.

Objectives Improve public education and awareness about the lake and its watershed, including basin habitats and natural resources, stormwater treatment, watershed management and responsible recreational behavior.

Determine the current status of public knowledge regarding Lake Jackson and watershed management in order to develop effective education and awareness activities.

Twelve specific projects and three sub-projects make up the Public Education and Awareness Program. These projects are categorized under the following initiatives.

Coordination Initiative

The purpose of the coordination initiative is to provide a cooperative, integrated approach for implementation of the Lake Jackson Public Education and Awareness Program. This initiative is implemented through project E-1.

Public Awareness Initiative

The purpose of this initiative is to create public awareness about the lake and watershed management. This will be done by disseminating information through a variety of mechanisms, including publications, radio and television, public speaking, audiovisual materials and school programs. This initiative is comprised of projects E-2 through E-5.

Education Initiative

The purpose of the education initiative is to educate the general public about the lake and its watershed through the public school system and the use of publications, audiovisuals, outdoor displays and other educational activities. This initiative includes projects E-6 through E-8.

Initiative for Community Involvement

The purpose of community involvement is to provide educational opportunities to the general public through participation in lake management activities. This initiative includes projects E-9 and E-10.

Research Initiative

The purpose of the research initiative is to determine public education and awareness needs in order to design more effective programs which will lead to greater knowledge about the issues affecting management of Lake Jackson and the role of individuals in preserving and restoring the system. This initiative includes projects E-11 and E-12.

TABLE 1. THREE-YEAR IMPLEMENTATION SCHEDULE FOR THE LAKE JACKSON MANAGEMENT PLAN

ID #	PROJECT	FISCAL YEAR		
		1993-1994	1994-1995	1995-1996
Q-1	Eval. & Application of Water Qual. Data	*		
Q-1a	Dev. of Pollution Load Reduction Goals	*		
Q-2	Long-Term Water Quality Monitoring	*		
Q-4	Regional Stormwater Retrofit	*		
Q-4b	Okeehoopkee Subbasin Stormwater Analysis	*		
Q-4c	Megginnis Arm Creek Basin Diagnosis	*	*	
Q-5	Megginnis Arm Facility Improvement	*	*	
Q-6	Megginnis Arm Facility O & M	*		
Q-7	On-site Design Criteria & Effectiveness			*
Q-8	Retrofit of Nonconforming Sites	*		
Q-9	Evaluation of Septic/Sewer Issues	*		
Q-10	Agricultural Impacts			*
Q-11	Recreational Impacts			*
R-1	Long-Term Monitoring of Habitat	*		
R-3	Additional Megginnis Arm Restoration	*		
R-3a	Revegetation Of Megginnis Arm	*	*	
R-4	Fords Arm Restoration	*		
R-5	Restoration of Upland & Aquatic Areas	*		
R-7	Restoration of Yorktown Pond	*	*	
M-1	System Analysis of LJ Watershed		*	
M-2	Land Acquisition	*		
M-3	Park Design Committee	*		
M-4	Aquatic Preserve Management	*		
M-5	Fish & Wildlife Mgt & Research	*		
M-6	Aquatic Plant Management	*		
M-7	Regulatory Assessment & Coordination	*		
M-8	Regulation of Recreational Uses	*		
M-9	Ordinary High Water Line	*		
M-10	Action Team as Over/Adv Committee	*		
M-11	Develop & Update Management Plan	*		
M-12	Contingency Mgt Plan for Nat Drawdown		*	
E-1	Planning and Administration	*		
E-2	Printed Materials	*		
E-3	Media Relations	*		
E-4	Corporate/Private Sponsorship	*		
E-5	Miscellaneous Awareness Activities	*		
E-6	School Programs	*		
E-7	Educational Materials	*		
E-8	Outdoor Educational Displays	*		
E-8b	Megg Arm Facility Exhibit		*	*
E-9	Community Activities	*		
E-10	Citizen Water Quality Monitoring			*
E-11	Public Awareness Survey		*	*
E-12	Lake User Survey	*	*	

REVIEW REQUIREMENTS AND FUNDING ISSUES

The development and implementation of the Lake Jackson Management Plan is a joint effort of the NFWMD, Leon County and the City of Tallahassee, with assistance from the Department of Environmental Protection (DEP), Florida Game and Fresh Water Fish Commission (FGFWFC), Department of Agriculture and Consumer Services (DACS) and Department of Community Affairs (DCA). The District's participation is through the Surface Water Improvement and Management Program (SWIM), while local government and citizen participation during plan development has been through the Lake Jackson Action Team. All of the interests identified above participate by reviewing the draft plan and through membership in the Lake Jackson SWIM Technical Advisory Committee (TAC).

There are several review procedures for the Lake Jackson Management Plan. First, the plan is submitted to the DEP pursuant to Chapter 373, Florida Statutes, for review and approval of selected projects for funding by the SWIM program. Other participating state agencies and local government agencies also review the plan in accordance with the SWIM requirements in Chapter 373, F.S., and there is at least one public workshop and one public hearing. In addition to the SWIM review, the Leon County Board of County Commissioners and the City of Tallahassee Board of City Commissioners review the plan for adoption and implementation. The city and county review processes may include one or more workshops and hearings before final adoption. The Lake Jackson Action Team also reviews the plan and may make recommendations to local government concerning plan adoption and participation in implementation of the plan.

SWIM Review Requirements

The Lake Jackson Management Plan has been developed in cooperation with local government in order to produce a comprehensive, coordinated plan that has an ongoing commitment for implementation. It has also been developed to meet the specific requirements of the SWIM program as administered by the DEP. Therefore, the plan is subject to the review criteria set forth in the DEP's "SWIM Review Procedures Manual," which requires preliminary reviews by the DEP, other participating agencies and local government prior to adoption by the District's Governing Board and final review by DEP.

DEP Preliminary SWIM Review

The DEP's preliminary SWIM review of the Lake Jackson Management Plan precedes official action by the District Governing Board. Referred to as the "455 review" (from its legislative origins in Chapter 373.455, F.S.), this preliminary assessment of the draft plan concentrates on three important issues: 1) internal program consistency, 2) relative importance of the projects to each other, and 3) reasonableness of cost estimates to implement the projects. The DEP has 45 days to review and comment on the draft plan, after which the District makes final revisions for approval by the Governing Board.

Internal Program Consistency

The DEP examines internal program consistency to determine the likelihood of the projects resulting in significant improvements in water quality. In particular, the review centers on two concerns: 1) projects in each program should clearly address the management objectives for that program, and 2) research projects or activities should clearly relate to strategies for improving watershed management.

Projects and Management Objectives Table 2 at the end of this section illustrates how the projects in each program of the Lake Jackson Management Plan address the stated objectives, which in turn are directly related to the management issues identified for each program. Clearly, there is a high level of internal consistency in that all the projects in a program address specific objectives of that program.

Research and Management Strategies A number of projects are either research-oriented or have a diagnostic research component. In all cases the research is designed to identify or further diagnose specific management issues that should be addressed by this plan for the purpose of improving management of the watershed. The projects listed in Table 3 are proposed for funding in whole or in part (less the 40 percent match) by the SWIM program, with completion and/or implementation within the next three fiscal years ending June 1993. Descriptions of the projects listed below can be found in Appendix 1.

TABLE 3. Projects with a research component that will be funded in whole or in part by SWIM

Research Project	Funding Source
Q-4c Megginnis Arm Basin Diagnosis	District - SWIM
Q-9 Evaluation of Septic Tank and Sewer Issues	District - SWIM
R-4 Fords Arm Restoration	District - SWIM City/County
M-7 Regulatory Assessment and Coordination	District - SWIM City/County
M-12 Contingency Management Plan for Natural Drawdown	District - SWIM
E-11 Public Awareness Survey	District - SWIM

Research projects not funded by SWIM are also designed to address specific management issues and strategies; please see individual project descriptions in Appendix 1 for specific project information.

Relative Importance of Projects to be Funded by SWIM

In order to allocate available revenues in the SWIM Trust Fund, the DEP must have an understanding of the relative importance of the proposed programs and projects. In Table 4 below, the projects to be funded by SWIM monies are ranked within each program. The programs themselves are also ranked in importance as indicated by their order of appearance in the table. These priorities were determined early in the 1990 plan development process by members of the Lake Jackson Technical Advisory Committee (TAC), the Lake Jackson Action Team and the Plan Development Committee (PDC). The relative importance of programs and projects has not changed significantly in the past three years. Table 5 at the end of this section summarizes the proposed allocation of SWIM funds for Fiscal Years 1990-93.

TABLE 4. Relative importance of projects to be funded initially or primarily by SWIM

Program	Priority	Project
Water Quality	1	Q-4 Regional Stormwater Retrofit (Including Projects Q-4b and Q-4c)
	2	Q-9 Evaluation of Septic/Sewer Issues
	3	Q-1 Evaluation and Application of Water Quality Data
Preservation and Restoration	1	R-3 Additional Megginnis Arm Restoration
	2	R-4 Restoration of Fords Arm
	3	R-7 Restoration of Yorktown Pond
Watershed Management	1	M-7 Regulatory Assessment and Coordination
	2	M-12 Contingency Management Plan for Natural Drawdown
	3	M-11 Coordinate and Update Management Plan
Education and Awareness	1	E-1 Planning and Administration
	2	E-3 Media Relations
	3	E-6 School Programs
	4	E-11 Public Awareness Survey
	5	E-7 Educational Materials

Reasonableness of Cost Estimates

Initial cost estimates have been assigned to SWIM projects based on the following factors: 1) importance of the project in satisfying plan and program objectives, 2) known or estimated costs of implementing project components, 3) responsibilities of the participants, and 4) specific budget requirements. Budget estimates and discussions of specific funding issues are included in the individual project descriptions in Appendix 1.

Review by Other Agencies

At the same time the DEP begins the preliminary 455 review, the Lake Jackson Management Plan is submitted to participating agencies and local government for review and comment within 45 days. The responsibilities of the agencies and local government in reviewing the draft plan are summarized below.

Florida Game and Fresh Water Fish Commission Determine if the plan has adverse impacts on wild animal life and fresh water aquatic life and their habitats. The Commission will also judge the plan on whether it adequately ensures the restoration and preservation of the lake's resources.

Department of Community Affairs Determine if the plan has adverse impacts on the State Comprehensive Plan.

Department of Agriculture and Consumer Services Determine if the plan has adverse impacts on the agricultural resources of the area or the state.

Local Government Determine if the plan has adverse impacts on local resources.

Final Review by the DEP

The DEP's final review of the Lake Jackson Management Plan is referred to as the "456 review" (Chapter 373.456, F.S.), and is subsequent to adoption by the District Governing Board. The purpose of the 456 review, which is no more than 30 days, is to determine consistency with the State Water Policy and the State Comprehensive Plan and to determine if all previous Department and other agency concerns have been addressed. Upon final DEP approval, funds may be withdrawn from the SWIM Trust Fund to implement specific projects.

Table 2

Internal Consistency: Relationship of Projects to Program Objectives

PROGRAMS	PROJECTS	PROGRAM OBJECTIVES		Water Quality Objectives			Rest./Pres. Objectives		Watershed Objectives		Educ./Aware. Objectives	
		Reduce Nutrient and Other Hazardous Pollutants Entering the Lake	Establish and Maintain Water Quality Monitoring Programs	Restore May-Game and Fords Arms	Restore May-Game and Fords Arms	Coordinate, Comprehensive Plan Supported by Research	Manage that Protects and Preserves the Lake	Adequate Regulations and Enforcement Policies	Improve Public Education and Awareness	Determine Current Status of Public Knowledge		
W	Q-1: Evaluation and Application of Water Quality Data		X									
A	Q-2: Long-Term Water Quality Monitoring (E-10)		X									
T	Q-3: Citizen Water Quality Monitoring (E-10)		X									
E	Q-4: Regional Stormwater Retrofit	*										
R	Q-5: Improvement of Maginnis Arm Facility	X										
Q	Q-6: Maginnis Arm Facility Operation & Maintenance	X										
U	Q-7: On-site Design Criteria & Effectiveness	X										
A	Q-8: Retrofit of Nonconforming Sites	X										
L	Q-9: Evaluation of Septic Tank and Sewer Issues	X										
I	Q-10: Agricultural Impacts	X										
T	Q-11: Recreational Impacts	X										
R	R-1: Long-Term Monitoring of Habitat			X								
E	R-2: Maginnis Arm Sediment Removal (COMPLETE)			X								
S	R-3: Additional Maginnis Arm Restoration			X								
O	R-4: Fords Arm Restoration			X								
A	R-5: Restoration of Upland & Aquatic Areas			X								
A	R-6: Timberlane Creek Beem Removal (COMPLETE)			X								
T	R-7: Yorktown Pond Restoration			X								
O	M-1: Ecological Analysis of Lake Jackson Watershed											
N	M-2: Land Acquisition											
M	M-3: Park Design Committee											
M	M-4: Aquatic Preserve Management											
A	M-5: Fish and Wildlife Management and Research											
T	M-6: Aquatic Plant Management											
E	M-7: Regulatory Assessment & Coordination											
R	M-8: Regulation of Recreational Uses											
S	M-9: Ordinary High Water Line											
H	M-10: Action Team as an Oversight/Advocacy Committee											
E	M-11: Coordinate & Update Management Plan											
D	M-12: Contingency Mgt. Plan for Natural Drawdown											
F	E-1: Planning and Administration											
U	E-2: Printed Materials											
B	E-3: Media Relations											
E	E-4: Corporate/Private Sponsorship											
I	E-5: Miscellaneous Awareness Activities											
U	E-6: School Programs											
C	E-7: Educational Materials											
A	E-8: Outdoor Educational Displays											
T	E-9: Community Activities											
I	E-10: Citizen Water Quality Monitoring (Q-3)											
O	E-11: Public Awareness Survey											
N	E-12: Lake User Survey											

X = Primary Objective Satisfied by Project
 * = Project Contributes to Satisfaction of Objective
 There are one or more sub-projects associated with each project highlighted by a dashed line under the project name.

TABLE 5. SUMMARY OF SWIM-FUNDED PROJECTS FOR FISCAL YEARS 1993-94, 1994-95 AND 1995-96

PROJECT	FUNDING \$\$		
	FY 93-94	FY 94-95*	FY 95-96*
Q-1 Evaluation & App of WQ Data	6,000	2,000	2,000
Q-1a Development of PLRGs	6,500	15,000	10,000
Q-4 Regional Stormwater Retrofit		1,055,000	1,100,000
Q-4b Okecheepkee Basin	100,000	*	*
Q-4c Meg Arm Basin Diagnosis	90,000	45,000	
Q-5 Meg Arm Facility Improv	15,000		
Q-9 Eval Septic/Sewer Issues	120,000	80,000	80,000
Q-10 Agricultural Impacts			20,000
R-3 Add. Meg Arm Restoration	25,000	25,000	27,000
R-4 Fords Arm Restoration	50,000	25,000	25,000
M-6 Aquatic Plant Management		10,000	
M-7 Reg Assess/Coordination	5,000	5,000	5,000
M-11 Coordinate Management Plan	30,000	30,000	30,000
M-12 Contingency Mgmt Plan		25,000	20,000
E-1 Planning & Administration	3,000	5,000	5,000
E-3 Media Relations	6,000		
E-5 Misc Activities	6,000	10,000	10,000
E-6 School Programs	10,000		
E-8 Outdoor Education Displays	7,000	5,000	5,000
E-8b Megginnis Arm Facility Exhbt			5,000
E-9 Community Activities	2,000	2,000	2,000
E-11 Public Awareness Survey		12,500	
TOTALS	\$ 481,500	\$1,351,500	\$1,346,000

NOTES:

* Funds for FY 1994-95 and 1995-96 are preliminary estimates only. In some cases (noted by *) it is not yet possible to make even a preliminary estimate.

Program totals for FY 1994-95 and FY 1995-96 are conservative estimates; it is likely that additional funds will be required. Project estimates for Public Education and Awareness projects are suggestions; funding may be provided for other projects in the plan on an as-needed basis, subject to prior approval by the DEP.

For FY 1994-95 and 95-96, the Project Q-4 estimate includes a \$1 million request for SWIM discretionary funding to pay for stormwater facility construction and land acquisition.

LAKE JACKSON MANAGEMENT PLAN

APPENDIX 1

Project Descriptions

Developed by

Lake Jackson Action Team and Northwest Florida Water Management District

in cooperation with

Leon County

City of Tallahassee

Florida Department of Environmental Protection

Florida Game and Fresh Water Fish Commission

Florida Department of Community Affairs

and

Florida Department of Agriculture and Consumer Services

WATER QUALITY PROGRAM

Water Quality Monitoring Initiative

Q-1, Evaluation and Application of Water Quality Data

Q-1a, Development of Pollutant Load Reduction Goals

Q-2, Long-Term Water Quality Monitoring

Q-3, Citizen Water Quality Monitoring

Regional Stormwater Treatment Initiative

Q-4, Regional Stormwater Retrofit Plan and Implementation

Q-4a, I-10/Megginnis Creek Stormwater Treatment Facility

Q-4b, Okeehoopkee Subbasin Stormwater Analysis

Q-4c, Megginnis Arm Creek Basin Diagnosis

Q-5, Improvement of the Megginnis Arm Facility

Q-6, Operation and Maintenance of the Megginnis Arm Facility

On-Site Stormwater Treatment Initiative

Q-7, Evaluation of Design Criteria and Effectiveness

Q-8, Retrofit of Nonconforming Sites

Sewer/Septic/Graywater Initiative

Q-9, Evaluation of Septic Tank and Sewer Issues

Other Activities Affecting Water Quality Initiative

Q-10, Agricultural Impacts

Q-11, Recreational Impacts

Project: Q-1, EVALUATION AND APPLICATION OF WATER QUALITY DATA

Issues Addressed: Application of data to management issues

Lead Agency: NFWMD

Participants: NFWMD, City of Tallahassee, Leon County, DEP

Funding: SWIM - \$6,000 (FY 1993-94)
- \$2,000 (FY 1994-95)
- \$2,000 (FY 1995-96)

Implementation: FY 1993-94 --->

Introduction

The overall goal of the Lake Jackson Management Plan is to improve the water quality of Lake Jackson to preserve, and restore where possible, the environmental, aesthetic and recreational values that make it special. Project Q-2, long-term monitoring of the lake, will provide the necessary water quality data to ascertain whether significant water quality changes occur over time. This project, a companion to Q-2, will evaluate these data to determine the relative success or failure of the Lake Jackson Management Plan, and other management programs, in achieving this goal.

Strategies

The purpose of this project is to measure the relative success of the Lake Jackson Management Plan and other programs in improving the water quality of Lake Jackson. The long-term water quality monitoring program, which was initiated by Leon County in FY 1991-92, will provide continuous, regular and reliable data for documenting changes in water quality (see Project Q-2). These changes will be evaluated annually, giving consideration to the following issues: management efforts in the watershed, especially implementation of the Lake Jackson Management Plan; natural occurrences such as drawdown, excessive rainfall and extreme temperatures; implementation and enforcement of local environmental management ordinances; and mismanagement in the watershed such as sewage spills and improper construction or development practices. Based on this evaluation, the management strategies of state, regional and local government will be reviewed to make recommendations for continuance of existing programs or changes that will better address the issue of improving water quality.

As a standard of reference, water quality data will be compared to the standards set by the DEP for Class III and OFW waters. The initial goal for improving water quality will be to meet or exceed these standards. Ultimately, the data will be used to establish pollution load reduction goals (PLRGs) for the lake (see Project Q-1a). PLRGs are quantitative standards designed such that the nonpoint loadings to the lake will allow all restoration and preservation objectives to be met.

Scope of Work

This project was begun in FY 1992-93 with the transfer of water quality data from FSU's Dept. of Oceanography which had compiled, summarized and graphically analyzed data from studies of the lake as far back as 1971. Additional data from studies conducted in 1991 and 1992 have been added to the database which is maintained by the NFWFMD. Work begun by the NFWFMD in FY 1992-93 includes a spatial and temporal analysis of water quality for the period between 1971 and 1991. Work to be concluded by the NFWFMD in FY 1993-94 includes a statistical evaluation of changes in water quality over time and an assessment of the effectiveness of the Lake Jackson Management Plan.

The long-term responsibilities of this project will include the following activities:

- Refinement of the current method for storing, updating and retrieving the already acquired data. The information shall remain available in a format accessible to users of personal computers as well as the District's GIS.
- Input all new and acquired water quality and lake ecosystem data into the storage/update system as it is collected by and received from the county and other sources. Any original data that is collected under this project will be made available to the DEP for entry into STORET, which is the primary means of storing water quality data.
- Annually, prepare an evaluation of the water quality data and report to local government, the Action Team and the TAC on water quality changes and what has caused them, if known. The evaluation will include displays in a form easily understood by the general public, such as bar graphs, maps and other explanatory figures. The timing and release of the annual reports will be dependent upon the availability of the data from the monitoring program funded by Leon County and the reports will reflect only those water quality parameters sampled for and analyzed under the monitoring program.
- Based on the annual reports, evaluate the effectiveness of this and other management programs in improving the water quality of Lake Jackson. Make recommendations for changes in management activities and approaches.
- Based on water quality trends and the degree of success of the various management projects in the Plan, define PLRGs that reflect the long-term water quality, habitat and ecological objectives for the lake (see Project Q-1a).
- Using the compiled data, develop an ecological model that incorporates the relationships and exchange of nutrients among the water column, sediments and vegetation in the lake. The model will be a predictive tool capable of estimating long-term effects of changes in nutrient loading as a result of implementation of PLRGs and other management efforts.

Products

A final report will be available by October 1994 which will include a spatial and statistical analysis of water quality for eight parameters for the period covering 1971 to 1991.

Annual reports incorporating all newly collected water data and evaluating the success of this and other management programs based on water quality changes as documented by the county's long-term water quality monitoring program.

PLRGs for Lake Jackson and strategies to achieve these goals in a cost-effective and timely fashion (Project Q-1a).

A mathematical model of the lake's ecology which will respond to season and climate and be capable of predicting the effects of changes in nutrient loading on water quality, vegetation, and sediment storage. The model will run on a p computer and is anticipated to be completed by December 31, 1994.

Funding

Following the initial funding for assembling and evaluating the existing data, this project will require SWIM funds for continued staff support and computer time in the amount of approximately \$2,000 per year beginning FY 1994-95.

Sub-project: Q-1a, DEVELOPMENT OF POLLUTANT LOAD REDUCTION GOALS (PLRGs)

Issues Addressed: Application of data to management issues, stormwater runoff, stormwater impacts to the lake

Lead Agency: NFWMD

Participants: NFWMD, DEP, City of Tallahassee, Leon County

Funding: SWIM - \$ 6,500 (FY 1993-94)
- \$15,000 (FY 1994-95)
- \$10,000 (FY 1995-96)

Implementation: FY 1993-94 --->

Introduction

Water quality in Lake Jackson is linked to the quality of its inflows. Water quality standards or pollutant limits for these inflows are needed to maintain all existing uses of the lake and to keep it healthy. Existing standards and past designations for the lake (such as Outstanding Florida Water) may be inadequate to meet or reflect the various restoration objectives outlined in the Management Plan.

Under Florida's proposed State Water Policy (Chapter 17-40, F.A.C.), pollutant load reduction goals (PLRGs) are defined to be those numerical reductions in pollutant loadings which are required to preserve or restore the designated uses of receiving waters and to maintain water quality that is consistent with all applicable state water quality standards. Thus, PLRGs are a water-quality based means of determining pollutant reduction, and they are to be defined according to how well or how poorly the waterbody is meeting or supporting the uses for which it has been designated. For Lake Jackson, PLRGs will need to reflect the lake's special environmental, recreational and aesthetic values.

Under proposed Rule 17-40.432(5), F.A.C., watershed specific PLRGs are to be developed on a priority basis for older stormwater management systems. Because the SWIM plan for the lake was adopted prior to January 1992, interim PLRGs are to be adopted and a schedule for the development of final PLRGs shall be established by December 31, 1994. Interim PLRGs are intended to be estimates of the pollutant reduction that is expected to occur from planned corrective actions (i.e., implementation of the Plan), and are thereby interim steps toward the final goal of protecting or restoring the designated uses of the receiving waters. Both the interim PLRGs and the schedule for the development of final PLRGs are included in the Lake Jackson Management Plan.

Strategies

The purpose of this sub-project is to establish and adopt interim PLRGs (and eventually final PLRGs) for Lake Jackson and to establish a schedule for the

development of final PLRGs by December 31, 1994. The interim PLRGs reflect predicted improvements in water quality from the existing projects in the plan in the context of the evaluation of water quality data (Project Q-1).

The schedule for the final PLRGs should reflect: 1) the time required to more accurately define long-term restoration objectives in terms of pollutant load reductions; 2) the time needed to evaluate the benefits of other stormwater-related activities undertaken by the District, Leon County and the City of Tallahassee; and 3) the time needed to predict the impacts from continued growth and land use alteration in the watershed.

Scope of Work

Interim PLRGs incorporate the predicted effects of and the degree of success of the various management projects in the Plan. These interim PLRGs are dependent primarily upon the pollutant removal estimates of the Lake Jackson Stormwater Retrofit Plan (Project Q-4). Interim PLRGs have been established only for Total Phosphorus (TP) and Total Suspended Solids (TSS) (see page 29). Interim PLRGs will be revised and defined for other parameters as stormwater facility removal data and other information related to other watershed management projects become available.

At a minimum, final PLRGs will be such that they meet the standards set by the DEP for Class III and OFW waters. However, to meet the long-term water quality, habitat and ecological objectives for the lake, the schedule for the development of final PLRGs should incorporate the following:

- An evaluation of all available relevant water quality data to date;
- Any statistically significant trends or changes in water quality parameters since 1971.
- The broader, ecosystem restoration needs of the lake, particularly as they relate to changes in organic sediment volumes, the mass of submerged aquatic vegetation and the growth of noxious species;
- An evaluation of the effectiveness of all existing stormwater facilities;
- A prediction of the impact on stormwater loading to the lake from any facilities proposed for construction;
- An evaluation of Leon County's and the City of Tallahassee's proposed stormwater management plans, including programs contained in the city and county applications for MS4 NPDES permits;
- A prediction of stormwater loading based upon anticipated growth and proposed land uses in the watershed.; and
- A determination whether PLRGs should be established by zones within the lake or for the entire waterbody.

Products

Revised interim PLRGs for TP and TSS and interim PLRGs for other parameters as data becomes available.

An estimation of the water quality and related loadings for nutrients that will be required to restore and protect the lake's designated uses.

Documentation of any disparities between existing lake water quality and that needed to restore and protect the lake's designated uses.

The development of final PLRGs that reflect the above disparities.

A coordinated effort to implement pollutant reduction strategies which meet the established goals.

Funding

SWIM funding for the development and adoption of interim PLRGs will be through Project Q-1 in FY 1993-94. Additional SWIM funding of \$15,000 during FY 1994-95 and \$10,000 in FY 1995-96 will be requested for the development and scheduling of final PLRGs for Lake Jackson.

Project: Q-2, LONG-TERM WATER QUALITY MONITORING

Issues Addressed: Need for continuous, long-term, lakewide water quality data

Lead Agency: Leon County

Participants: Leon County, NFWMD

Funding: Leon County - \$ 50,000 (FY 1993-94) (Countywide Funding)
- \$ 50,000 (FY 1994-95) (Countywide Funding)
- \$ 50,000 (FY 1995-96) (Countywide Funding)

Implementation: FY 1993-94 --->

Introduction

The water quality of Lake Jackson has been monitored sporadically over the past 20 years, resulting in large amounts of data gathered for various specific purposes but which did not provide an adequate long-term view of water quality trends. To address this situation, the SWIM program contracted with Florida State University in 1989 to compile the existing water quality data and statistically "smooth" the data to enable an accurate determination of historical trends. This report, concluded in 1990, provided linkages between water quality, particularly in Megginis Arm, and specific events in the history of the lake and its watershed. The report included extensive graphic presentations of the concentrations of various water quality parameters over time but did not, however, identify significant trends.

While the summation of past studies provides a rough picture of how the lake has responded to major impacts, there remains a need for ongoing water quality monitoring to provide the information necessary for the development, implementation and evaluation of management strategies that will prevent activities that might lead to water quality degradation. A policy in the Conservation Element of the Tallahassee-Leon County 2010 Comprehensive Plan requires the development and implementation of an ongoing surface water quality monitoring program by 1992. Beginning in FY 1991-92, Leon County funded a comprehensive water quality and ecological analysis of several lakes in Leon County, including Lake Jackson. The program is now in its second year, and in the beginning of this year, frequency of monitoring was reduced from monthly to quarterly.

Strategies

This project is designed to ensure that long-term water quality monitoring needs for Lake Jackson are fulfilled. A systematic program of water quality sampling is necessary for determining the overall health of the lake and for identifying general trends as well as specific problems which need to be addressed by the lakewide management strategies. It is important that the

water quality monitoring program be designed as a long-term effort and that recurring funds for such an effort be secured.

Under the existing contract with Florida State University Center for Aquatic Research and Resource Management (CARRMA), the following water quality parameters are being monitored at numerous stations around the lake:

Secchi Depth (field)	Conductivity (field)
Temperature (field)	Dissolved Oxygen (field)
pH (field)	Water Depth (field)
Color	Turbidity
Alkalinity	Chlorophyll <u>a</u>
Ammonia	Total Organic Nitrogen
Nitrite	Total Kjeldahl Nitrogen
Nitrate	Total Nitrogen
Orthophosphate	Total Phosphorous
Particulate Organic Carbon	Dissolved Organic Carbon
Total Organic Carbon	Silicon
Particulate Organic Matter	Particulate Inorganic Matter
Total Suspended Solids	

The lake's trophic status is being calculated using the water quality data; bacteria are not currently being sampled. The following parameters are being monitored in the upper 5 cm of the lake's sediments:

Total Nitrogen	Total Phosphorus
Chromium	Lead
Zinc	Copper
Aluminum	Iron
Polynuclear Aromatic Hydrocarbons, including	
Acenaphthylene	Anthracene
Benzo(a) anthracene	Benzo(g,h,i) perylene
Benzo(b,k) fluoranthene	Benzo(a) pyrene
Chrysene	Dibenzo(a,h) anthracene
Fluoranthene	Fluorene
Indeno(g,h,i) pyrene	Napthalene
Phenanthrene	Pyrene

Lake fauna, including benthic macroinvertebrates and fish species, also are being sampled. Lake flora are being addressed primarily through coarse estimates of acreage covered by submerged aquatic vegetation and dominance by hydrilla. (This information is also gathered through annual review by DEP's Bureau of Aquatic Plants.)

The lake water quality monitoring program should be expanded to include monitoring of key tributaries to the lake. This expansion of work would need to be addressed by a revision to the County's existing monitoring contract. Data obtained by tributary sampling would need to be integrated with the in-situ lake data to provide a more comprehensive view of the lake's water quality dynamics.

As part of its NPDES Part 2 permit, the County (and perhaps the City) will be required to perform extensive sampling of streams discharging to federal waters (for screening) and to commit to a long-term sampling schedule to

monitor the effectiveness of the county's stormwater management programs. Sampling of tributaries to the Lake, including sampling to address the effects of seasons and various sized storm events, may be required under the permit. These monitoring efforts should be integrated with this project.

Scope of Work

The objective of this project is to continue long-term water quality monitoring. Leon County will be primarily responsible for the monitoring effort, with the District assisting in technical matters and program development as necessary. The following tasks will be undertaken to attain this objective:

- Coordinate the various elements of the long-term monitoring program for Lake Jackson to measure the success of various management strategies which are being implemented and to determine the need for new or improved management strategies;
- Share with all interested parties all available water quality data for the lake. This will require that the collecting agency enter the data into a STORET compatible format. Data will also be stored in format that is accessible to users of personal computers.
- Secure long-term funding commitments for the water quality monitoring program and investigate the possibility of a citizen based program providing assistance (such as Lakewatch--see Project E-10); and
- Provide technical support as necessary.

Products

A continuous long-term water quality database which can be used to assess current management efforts and to extend the basis for revising these or developing new strategies.

A comprehensive database including sediment characteristics, floral and faunal assessments, and other ecological parameters which reflect water quality conditions.

Funding

Leon County allocated \$50,000 for both FY 1991-92 and FY 1992-93. These funds support research throughout Leon County, although Lake Jackson (in part because of its size and the number of sampling stations) receives the largest share of effort. In addition, these funds are furthered through indirect expenditures from FSU via class projects, administrative overhead, etc.

It remains the county's intent to continue supporting the long-term monitoring program; however, no commitments have been made beyond the current fiscal year. A secure funding source will be required to maintain this project.

Project: Q-3, CITIZEN WATER QUALITY MONITORING (also Project E-10,
Public Education and Awareness Program)

Issues Addressed: Lake resources, community involvement, lack of long-term
water quality monitoring data

Lead Agency: Leon County and City of Tallahassee

Participants: Leon County, City of Tallahassee, Action Team, NFWMD, DEP

Funding: Undetermined

Implementation: See Project E-10

This project has been removed from the Water Quality Program because it is
more appropriate to be implemented through the Public Education and Awareness
Program. See Project E-10.

Project: Q-4, REGIONAL STORMWATER RETROFIT
Issues Addressed: Stormwater runoff from developed areas
Lead Agency: NFWMD
Participants: NFWMD, Leon County, City of Tallahassee
Funding: SWIM - \$ 190,000 FY 1993-94 (for Project Q-4b & Q-4c)
- \$1,100,000 FY 1994-95 (includes \$45,000 for Q-4c)
- \$1,100,000 FY 1995-96 (request)
Save Our Rivers/Preservation 2000*
Leon County*
City of Tallahassee*

* Funding required from the SWIM program, local government, SOR/P2000, and other sources to fully implement the Regional Stormwater Retrofit Plan to be determined on a project-by-project basis.

Implementation: FY 1993-96 (Plan Implementation)

Introduction

Stormwater runoff from the developed areas of the Lake Jackson watershed has been directly linked to the degraded water quality conditions in the southern portions of the lake, especially Megginis and Fords arms. The purpose of the Regional Stormwater Retrofit project is to reduce nutrient/pollutant loading to Lake Jackson and restore conditions in the lake through the implementation of upland alternatives for treating stormwater runoff generated within the developed portions of the watershed. The facilities and efforts proposed in this project are intended to address only stormwater pollution problems resulting from existing development, rather than to provide treatment capacity for future development.

Utilizing SWIM program funding, the District completed the Lake Jackson Regional Stormwater Retrofit Plan (Retrofit Plan) (Bartel et al. 1992) in 1992. The emphasis of this project has now shifted from planning to implementation. It should be noted however, that during the planning phase considerable implementation work was performed utilizing funds from SWIM and Leon County, including the construction of one regional stormwater treatment facility and commencement of design and permitting for a second facility. In addition to these SWIM/Leon County accomplishments, two regional stormwater treatment facilities have been constructed by the City of Tallahassee and a large shopping mall has been retrofitted as part of an expansion project. With the exception of Yorktown Pond (see project R-7), all of the facilities completed to date are located in the Megginis Arm subbasin.

The Retrofit Plan was developed using available information from the City of Tallahassee and Leon County Stormwater Management Plan (TLCSMP)(Bartel et al.

1991), developed by the District's Bureau of Surface Water Management. The TLCSMP provided extensive background information which was needed to develop the Retrofit Plan, including subbasin nutrient/pollutant loading rates, runoff statistics, land use data, and fully calibrated hydrologic models that were used to develop designs and specifications for proposed improvements and treatment facilities. The Retrofit Plan recommends development of three new regional treatment facilities, redesign and retrofitting of two existing ponds to enhance water quality treatment, and preservation of existing natural areas associated with the tributaries of Lake Jackson. The modeling performed as part of this project predicts that implementation of the Retrofit Plan will result in removal of 49% of total suspended solids (TSS) and 34% of total phosphorous (TP) loadings currently entering the lake. These parameters are considered to be "targets" for restoring the water quality of Lake Jackson.

The Retrofit Plan identifies specific sites for the proposed facilities; however extensive site evaluations have not performed for the purposes of detailed design. Prior to land acquisition for any facility, additional site evaluations will need to be performed and permitting constraints identified. If any constraint precludes use of a particular site for development of a regional stormwater treatment facility, other alternatives will need to be investigated for the subbasin.

Strategies

The purpose of this project is to develop regional stormwater treatment facilities consistent with the Lake Jackson Regional Stormwater Retrofit Plan. This entails performing detailed site evaluations, consultation with permitting agencies, acquisition of land for the facilities, completion of detailed designs, revision of construction cost estimates, securing necessary permits, and securing funds for construction through the SWIM program, local governments and other sources. While the development of new regional stormwater management facilities is the primary emphasis of this project, utilization of existing features (both natural and manmade) to effectively treat stormwater runoff is also emphasized. Given the documented problems and increasing density in the southern portion of the watershed, the primary geographic focus of this project is in the Megginnis and Fords arms' sub-basins, although rehabilitation of existing stormwater management systems elsewhere in the watershed are also considered.

Scope of Work

As mentioned previously, completion of the Retrofit Plan has shifted the emphasis of this project from planning to implementation. Implementation of the Retrofit Plan basically entails development of regional stormwater retrofit facilities, according to the implementation tasks identified in the plan. Since none of the sites recommended for new treatment facilities are currently in public ownership, the initial steps are to perform detailed site evaluations, consult with permitting agencies, and acquire land needed for the regional facilities. Various methods of acquiring land, such as use of eminent domain; fee simple acquisition; gifts from property owners; and density exchanges will be explored.

Since the design and construction of regional stormwater treatment facilities will be quite expensive, substantial local matching funds will be required for

all SWIM funds expended. The SWIM program can provide up to 80% funding for engineering, administrative, and construction oversight services and facility construction for facilities identified as high priorities in the Retrofit Plan.

A number of sub-projects (Q-4a, Q-4b, and Q-4c) have been developed under the Regional Stormwater Retrofit project to support specific components of the retrofit effort. As progress is made on specific facilities, new sub-projects will be created so project funding can be tracked in detail.

Products

This project will result in regional stormwater treatment facilities for developed portions of the watershed. Full implementation of the Retrofit Plan is anticipated to result in the removal of approximately 34% of total phosphorous currently entering the lake.

Funding

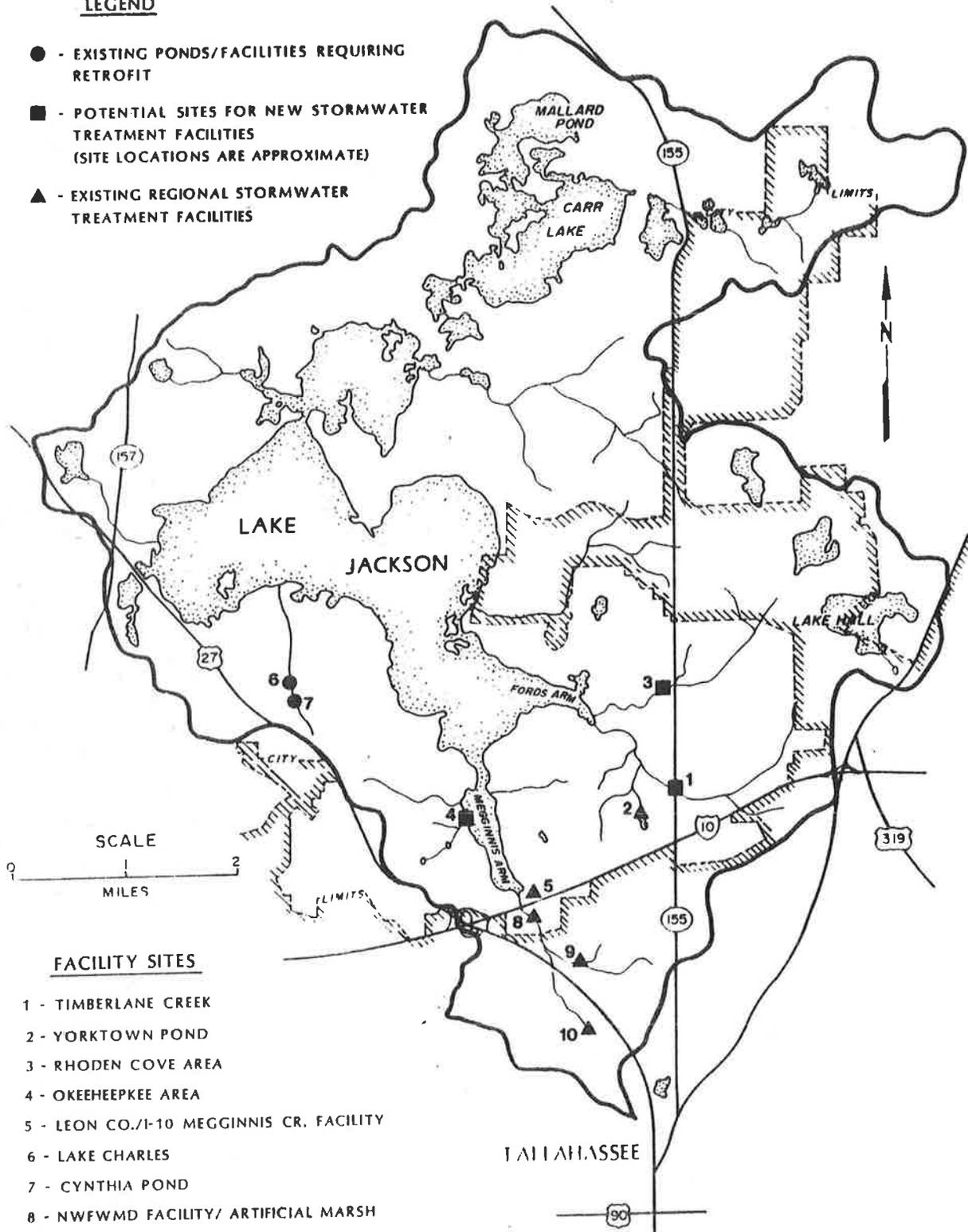
In FY 1993-94, the SWIM Program will provide \$100,000 for sub-project Q-4b (Okeehoopkee Subbasin Analysis) and \$90,000 for sub-project Q-4c (Megginnis Arm Creek Basin Diagnosis). In FY 1994-95, the District will request \$45,000 of SWIM funds for completion of Project Q-4c, and \$55,000 for retrofit planning, design and administration, some of which may be necessary to help implement Project Q-4b. In FY 1995-96, the District will request \$100,000 of SWIM general funding for retrofit planning, design and administration associated with sub-projects. In FY 1994-95 and FY 1995-96, the District will request \$1,000,000 per year of SWIM discretionary funding for land acquisition and facility construction. All SWIM discretionary funding is subject to local government providing matching funds totalling at least 20% of the cost for construction and the land acquisition portion of the project. Land acquired by local government for development of regional retrofit project facilities can be used as match.

Funding for facility land acquisition will also be sought from the Save Our Rivers and Preservation 2000 programs as well as from local government and other possible sources such as other agencies and various state and federal grant programs. Grants available for other components of facility development will also be sought.

Any facility which reaches the design/construction phase will require significant local match for construction. Local match will be requested from the City of Tallahassee and/or Leon County, depending upon the specific project. The projects recommended by the Lake Jackson Regional Stormwater Retrofit Plan are identified on Figure Q-4. Both of the stormwater treatment facilities recommended for Fords Arm (#1 and #3 on the map) would treat stormwater runoff from areas within the Tallahassee city limits. The three remaining recommended facilities would serve areas that are completely outside of the city limits. Thus, when construction planning for either of the Fords Arm facilities begins, the City of Tallahassee will be asked to participate as a partner in the development of these ponds. The City of Tallahassee will not be asked to participate in the development of stormwater treatment facilities which serve areas that are completely outside of the city limits.

LEGEND

- - EXISTING PONDS/FACILITIES REQUIRING RETROFIT
- - POTENTIAL SITES FOR NEW STORMWATER TREATMENT FACILITIES (SITE LOCATIONS ARE APPROXIMATE)
- ▲ - EXISTING REGIONAL STORMWATER TREATMENT FACILITIES



FACILITY SITES

- 1 - TIMBERLANE CREEK
- 2 - YORKTOWN POND
- 3 - RHODEN COVE AREA
- 4 - OKEEHEEPKEE AREA
- 5 - LEON CO./I-10 MEGGINNIS CR. FACILITY
- 6 - LAKE CHARLES
- 7 - CYNTHIA POND
- 8 - NWFWM FACILITY/ ARTIFICIAL MARSH
- 9 - CITY OF TALLAHASSEE-JOHN KNOX RD. FACILITY
- 10 - CITY OF TALLAHASSEE-BOONE BLVD. FACILITY

FIGURE Q-4. SITES FOR STORMWATER TREATMENT FACILITIES.

Project: Q-4a, I-10/MEGGINNIS CREEK STORMWATER TREATMENT FACILITY

Issues Addressed: Stormwater runoff from developed areas

Lead Agency: NFWFMD

Participants: NFWFMD, Leon County, Department of Transportation

Funding: SWIM.....\$208,277
DOT.....\$288,260
Leon County...\$125,255
Leon County...\$ 10,000/year (monitoring)

Implementation: PROJECT COMPLETED IN 1993

In a coordinated effort to continue implementation of the Lake Jackson Management Plan, the Florida Department of Transportation (DOT), Leon County and the Northwest Florida Water Management District constructed a regional stormwater treatment facility in the Megginnis Arm subbasin. This retrofit facility is located at the intersection of Lakeshore Drive and Megginnis Arm Road. The DOT acquired approximately 4.75 acres of land for the facility and transferred the land to Leon County. The District's SWIM program funded the design, permitting and administration of the project and one-half of the construction cost. Leon County funded one-half of the construction cost and, as owner of the facility, is responsible for its operation, maintenance and monitoring.

This component of the Regional Stormwater Retrofit Project (Q-4), was completed in 1993. A detailed description of the facility and the development, funding, and implementation of this project can be found in the NFWFMD publication: I-10/Megginnis Creek Stormwater Treatment Facility: Project Completion Report (Macmillan 1993).

The only ongoing activities associated with this project are routine maintenance and monitoring. An aggressive monitoring program was required for this facility as a condition of the Leon County Environmental Management Permit issued for construction of the pond. Leon County has contracted with the District to perform this monitoring at a cost of approximately \$10,000 annually. The Leon County Public Works Department maintains the pond as part of its overall stormwater management system maintenance program.

Project: Q-4b, OKEEHEEPKEE SUBBASIN STORMWATER ANALYSIS

Issues Addressed: Stormwater runoff from developed areas

Lead Agency: NFWFMD

Participants: NFWFMD, Leon County, DEP

Funding: SWIM.....\$100,000 FY 1993-94
Leon County...In-Kind FY 1993-94

Implementation funding needs will be determined during the FY 1993-94 period and funding for future years will be requested from SWIM, Leon County, and other appropriate sources.

Implementation: FY 1993-94 Planning Analysis and Plan Development
FY 1994-95--->Implementation

Introduction

The Okeeheepkee subbasin is an approximately 400-acre drainage area in the southern portion of the Lake Jackson watershed just north of the U.S. 27/I-10 interchange. This area has a long history of stormwater management problems and is one of the major watersheds targeted for retrofit in the Lake Jackson Regional Stormwater Retrofit Plan (Bartel et al. 1992). In August 1993, the Leon County Board of County Commissioners (BCC) held a public workshop to discuss the stormwater management issues in the Okeeheepkee subbasin and consider alternative strategies for solving the problems. The BCC subsequently directed staff to, among other tasks, initiate a stormwater treatment plan and present the financial implications of such a plan for this area. The BCC requested that the planning effort focus on an area-wide solution and cost sharing mechanisms, including an analysis of various stormwater treatment alternatives, and including involvement of area residents in the process.

Strategies

A group of professionals was assembled to act as the "Okeeheepkee Design Team", which would oversee the planning process and other aspects of the project. Leon County Lake Jackson Action Team staff is coordinating the Design Team, which includes representatives of the DEP, NFWFMD, DOT, and Leon County Public Works, Growth and Environmental Management, and Legal Departments.

The Design Team has worked with the District to develop a scope of work for the first phase of this project, which basically involves a detailed subbasin analysis to determine the most feasible alternative for basinwide stormwater retrofit. This phase of the project will be implemented in FY 1993-94 using funding from the SWIM Retrofit Project (Project Q-4) and in-kind services from

Leon County. The second phase of the project will involve completion of detailed designs and permits for the retrofit alternative selected by the BCC and construction of basinwide retrofit projects.

Scope of Work

Phase I

- Identify existing problems using previous reports, permit files, interviews, public meetings, and other methods;
- Compile subbasin land use information including topography, soil and land use distribution, subwatershed boundaries, and existing stormwater management controls;
- Assemble pertinent available hydrologic information and collect additional data as necessary;
- Perform stormwater quality analysis to estimate pollutant loading from existing and future development conditions;
- Apply existing hydrologic model to the area for analysis of alternative retrofit strategies;
- Survey channels for modeling purposes;
- Select critical design storms;
- Analyze problem area alternatives;
- Prepare report which discusses the methods used, alternatives analyzed, findings of the analysis, and includes recommendations of technical staff
- Meet throughout the study period with the design team, the BCC, and interested citizens; and
- Present report and recommendations to the BCC for direction on future implementation steps.

Phase II

- Secure funding for implementation of selected alternative;
- Acquire land or easements needed for improvements;
- Prepare detailed designs;
- Prepare all necessary permits;
- Contract for construction work; and
- Operate, monitor, and maintain completed facilities.

Products

Phase I will produce a comprehensive subbasin stormwater retrofit plan for the Okeeheepkee area which will be used in the final design of the retrofit projects. Phase II will result in retrofit of the stormwater system to improve water quality in Megginis Arm and Lake Jackson.

Funding

SWIM funding in the amount of \$100,000 has been secured for completion of Phase I during FY 1993-94. Leon County staff will also provide in-kind services during Phase I. Funding for Phase II will be requested from the SWIM program, Leon County and other sources including affected landowners, and state and federal grants. Land acquisition funding for construction of new stormwater treatment facilities may be requested from SWIM, Save Our Rivers and/or Preservation 2000.

- Perform a review of current technologies, focusing on new and innovative methods of treating stormwater and maintaining stormwater treatment systems;
- Develop site descriptions for each of the ponds to be monitored and develop a monitoring network design;
- Implement a field sampling program;
- Reduce and analyze data;
- Analyze facility treatment effectiveness;
- Identify possible stormwater management system improvements and estimate water quality benefits which would result from improvements; and
- Prepare final report and implement recommendations.

Products

- A sampling protocol and monitoring strategy for regional stormwater treatment facilities and system-wide evaluation in the Megginnis Arm Basin;
- A report on the effectiveness of existing regional stormwater treatment facilities used to retrofit the urban areas of the Megginnis Arm Basin;
- A database of the existing regional facilities, including location map, as-built surveys, capacities, and detailed operational elements which may effect treatment effectiveness;
- A report identifying possible facility improvements and alternative watershed management strategies based on facility monitoring results and applicability to the Lake Jackson Basin; and
- Improved water quality upon implementation of recommendations.

Funding

SWIM funding of \$90,000 has been allocated for FY 1993-94, and the District will request \$45,000 of SWIM funds for FY 1994-95. Funding needs for implementation of the project recommendations will be addressed in the final report.

Project: Q-5, IMPROVEMENT OF THE MEGGINNIS ARM FACILITY
Issues Addressed: Stormwater runoff in the southern portion of the basin
Lead Agency: NFWMD
Participants: NFWMD, DEP, Leon County, City of Tallahassee
Funding: SWIM - Approximately \$15,000 remaining from previous fiscal year allocation
Implementation: FY 1993-94

Introduction

The Lake Jackson Megginnis Arm Stormwater Treatment Facility was completed in 1983 and consists of a 20-acre wet detention pond, a 4.5-acre intermittent sand and fabric filter inside the pond, and a 6-acre artificial marsh. Sedimentation and filtration takes place in the wet detention pond and nutrient uptake occurs in the marsh.

Overall, the facility has been very successful at reducing the pollutant load discharge into Lake Jackson. However, due to lack of funds for proper operation and maintenance during a time of increased urbanization in the Megginnis Arm subbasin, the facility has been in need of major upgrading and improvements in order to function effectively. A large portion of the necessary upgrade has been accomplished through the SWIM program. These efforts have involved a major expansion of detention capacity and the refurbishing of the sand filter and irrigation system.

The purpose of this project is to 1) provide for the minor upgrading that remains following previous major upgrading activities and improvement of the facility to increase its effectiveness, and 2) provide for the implementation of regular operation, maintenance and monitoring through District efforts and coordination with local government.

Strategies

A feasibility study completed by the District in August 1990 considered various alternatives for improving the operation and effectiveness of the stormwater treatment facility. Following discussions with FDEP nonpoint section staff, the District addressed numerous improvement strategies and attempted implementation for several alternatives.

The major improvement alternative addressed was accomplished through a related SWIM project in constructing the I-10/Megginnis Creek stormwater treatment facility (see Project Q-4a) which relieved overloading of the artificial marsh system with untreated stormwater. Other improvement alternatives implemented by this project have included enlargement of the wet detention pond,

refurbishment of the sand filter and underdrain system and restoration of pumping to the filter system.

Additional improvement alternatives were initiated and subsequently determined inadequate or infeasible for further efforts. These included vegetating the sand filter and many of the other improvement items previously listed for this project. Further alteration to the existing system was deemed beyond the financial scope of this project and/or inappropriate to pursue until an adequate operation and maintenance effort had been developed and implemented for a reasonable period of time.

Since the majority of necessary improvements have been implemented, the District must now ensure that the facility is properly maintained and operated. In order to establish a source of funding for these activities, pursuant to the DEP's recommendations the District will complete investigation of the following options:

- 1) The City of Tallahassee and/or Leon County could assume ownership and responsibility for operation and maintenance of the facility. The city could utilize existing stormwater utility funds or initiate a special Megginnis Arm basin stormwater utility fee to obtain the funds necessary to pay for operation and maintenance of this facility. The City of Tallahassee has two other regional facilities in this subbasin, and the Megginnis Arm facility could possibly become part of an overall operation and maintenance program.
- 2) The District has designated the facility a Work of the District and, as provided by section 373.084, F.S., could enter into an agreement with the City of Tallahassee to operate and maintain the facility using stormwater utility fees as discussed above.
- 3) Pursuant to sections 373.416, F.S., and 40A-6.041, F.A.C., the District could establish an operation and maintenance permit for anyone whose stormwater drains to the facility and include a permit condition that an annual fee necessary to cover operation and maintenance costs be charged and paid to the District.

The District may also consider other funding options.

Scope of Work

In order to complete implementation of this project, the District will undertake the following activities:

- Further evaluate several alternatives or combinations of alternatives for improving the effectiveness of the facility. This may include those suggested by the DEP, as well as other alternatives;
- Complete analyses associated with flow monitoring of the facility for the purpose of completing an operation and maintenance procedures manual;
- Prepare and submit an application for an operating permit to the DEP; and

- Evaluate various funding options for operation and maintenance of the facility.

Products

Identification of funding mechanism(s) for operation and maintenance, including contracts, permits and agreements.

Completion and submittal of an operation and maintenance procedures manual.

Operating permit.

Funding

SWIM has funded the following activities:

- Expansion of the detention pond - Approximately \$150,000 matched with United States Environmental Protection Agency funds (completed March 1990).
- Feasibility study on alternatives for improving the facility - \$15,500 (completed August 1990).
- Filter/Irrigation System Retrofit \$126,000 - (Completed fall 1991).

Currently, approximately \$15,000 in SWIM funds has been retained from the FY 1992-93 allocation and completion of this project, including the operation and maintenance manual and operating permit application is anticipated prior to the close of FY 1993-94.

Project: Q-6, OPERATION AND MAINTENANCE OF THE MEGGINNIS ARM FACILITY

Issues Addressed: Stormwater runoff in the southern developed portion of the basin

Lead Agency: NFWFMD

Participants: NFWFMD, DEP

Funding: NFWFMD - Up to \$20,000 annually (as needed from the District's contingency funds, if available)

Implementation: FY 1993-94 --->

Introduction

The Lake Jackson Megginnis Arm Stormwater Treatment Facility was completed in 1983 and consists of a 20-acre wet detention pond, a 4.5-acre intermittent sand and fabric filter inside the pond, and a 6-acre artificial marsh. Sedimentation and filtration takes place in the wet detention pond and nutrient uptake occurs in the marsh. Periodic operation and maintenance is required for the facility to function properly.

Strategies

The responsibilities of the District with respect to the maintenance and operation of the Megginnis Arm facility were set forth in a contract with the DER (now DEP) in 1982. Briefly, they are as follows.

- 1) Basic upkeep (mowing, light erosion control, debris removal);
- 2) Maintenance of the pumping equipment;
- 3) Maintenance of valves and accessories;
- 4) Repairs and maintenance to the stop-log weirs and other minor structures throughout the project;
- 5) Removal of sediment as required;
- 6) Weeding, sediment and debris removal from the filter and marsh;
- 7) Maintain and read monitoring devices;
- 8) Establish proper settings on all valves and optimum levels on all stop-log weirs and adjust as required; and
- 9) Set and adjust pumping levels.

Annual costs for routine operation and maintenance were estimated at a maximum of \$20,000 annually.

A number of factors have prevented the District from operating and maintaining the facility as originally planned, including overloading of the facility due to increased urbanization immediately upstream and throughout the subbasin, unanticipated repairs, pump operation costs that were considered excessive, and financial restrictions of the District related to economic factors. However, with the implementation of Project Q-5, Improvement of the Megginnis Arm Facility, the system has been upgraded to a point that it can be operated and maintained as planned and designed.

Until a more reliable source of funding is implemented, the District will operate and maintain the facility according to the guidelines set forth in the contract with DEP and above with contingency monies as they may become available.

Scope of Work

The District will provide necessary operation and maintenance of the facility as required in the operating and maintenance procedures manual and in accordance with the operating permit.

Products

An operational facility which effectively and efficiently treats stormwater that eventually enters Megginnis Arm and Lake Jackson.

Funding

The District will perform operation and maintenance activities as funds allow until a more reliable source of funding is identified or established.

Project: Q-7, EVALUATION OF DESIGN CRITERIA AND EFFECTIVENESS
Issues Addressed: Stormwater impacts to the lake
Lead Agency: City of Tallahassee, Leon County
Participants: NFWMD, DEP
Funding: Growth Management Departments or Stormwater Utility Programs
Implementation: FY 1995-96

Introduction

In response to continuing water quality problems resulting from inadequate on-site control of stormwater runoff, Leon County upgraded its stormwater regulations under the Leon County Environmental Management Act (effective January 15, 1990). The City of Tallahassee has also developed and adopted its own environmental management ordinance (the City of Tallahassee Environmental Management Act effective October 1, 1990) that has stormwater regulations similar to those adopted by the county.

While it is well documented that the past stormwater regulatory program was not performing adequately with regard to on-site stormwater systems (Leon County Department of Public Works, 1987), the new regulations and enforcement programs have the potential to reverse this trend. This project will determine the effectiveness of the county and city acts in relation to regulation of on-site stormwater management systems. The purpose of this effort is to determine whether changes to the ordinances or the enforcement programs are necessary and to recommend such changes if needed. The project should not be initiated until a sufficient time period (3-5 years) has passed to enable the regulations to take effect.

The city initiated a program to survey and inspect on-site stormwater management systems in 1992. The program was supported directly by one full-time employee and indirectly by five other environmental inspectors. The majority of inspections accomplished to date were performed on newly permitted facilities and those within the city's priority basins. While it remains the city's intent to complete the inspection program, the balance of these efforts have been postponed.

Strategies

The project should consider the model provided in the Stormwater Management Facility Maintenance Report which was undertaken in 1987 by the Leon County Department of Public Works, Environmental Management Section. On-site and regional stormwater facilities and conveyance systems that have been permitted since the implementation of the county and city acts will be inspected to determine whether the acts were closely adhered to and a report summarizing

the results will be developed. Because the acts contain requirements that these facilities obtain operating permits which will only be granted if the system is being adequately operated and maintained, this project should also consider inspecting facilities that were permitted prior to the implementation of the acts. The project will be coordinated with the local stormwater operation/maintenance permitting programs, possibly using staff and records from these programs for implementation purposes. Since relatively few new private stormwater systems have been constructed in the Lake Jackson watershed since the ordinances were revised, it may be desirable to delay implementation of this project until 1995 or 1996.

Scope of Work

The objective of this project is to achieve effective on-site stormwater treatment throughout the watershed in order to reduce the amount of nutrients, sediments and other pollutants entering Lake Jackson. The following tasks will be carried out to implement the project.

- Design study which may be similar to the 1987 Stormwater Management Facility Maintenance Report which was undertaken by the Leon County Department of Public Works, Environmental Management Section. The study should be specific to the Lake Jackson watershed and should consider (and possibly compare) the implementation of both the county and the city ordinances. The focus of the study will be facilities that have been permitted after January 15, 1990. Consideration should be given to adherence to design during construction, apparent overall effectiveness of the facility in treating stormwater, and maintenance of the facility;
- Implement the study;
- Analyze results and prepare report; and
- Implement recommendations of report--may include revision of ordinances and/or improvement of enforcement programs.

Products

Facility maintenance survey report with recommendations to improve on-site management of stormwater runoff

Funding

This project should be funded by the city and county Growth and Environmental Management Departments and/or the city and county Stormwater Utility Divisions in Fiscal Year 1995-96.

Project: Q-8, RETROFIT OF NONCONFORMING SITES
Issues Addressed: Stormwater impacts to the lake
Lead Agency: Leon County and City of Tallahassee
Participants: Leon County, City of Tallahassee, NFWMD
Funding: City/County - Growth Management
Implementation: FY 1993-94 --->

Introduction

This project will be implemented in accordance with Policy 1.4.3 of the Tallahassee-Leon County 2010 Comprehensive Plan Stormwater Management Element. This policy requires existing developed sites that do not achieve the level of stormwater treatment required by the comprehensive plan for new development to have a retrofit plan in accordance with the adopted stormwater management plan. The comprehensive plan sets a 1995 completion date for the retrofit plans but sets no date for the actual implementation of these individual retrofit plans. Since treatment of stormwater runoff is essential to the success of the overall Lake Jackson Management Plan, this project calls for plan completion by 1995 and plan implementation at the time that regional treatment capacity is provided. If regional treatment is not an option for a particular site (no regional treatment planned), an on-site stormwater retrofit plan should be implemented immediately following approval of the site-specific retrofit plan. As one option available to landowners may be the purchase of capacity in a regional treatment facility, this project should be closely coordinated with the stormwater management programs of Leon County and the City of Tallahassee.

Strategies

The documented problems regarding untreated stormwater runoff from developed sites in the Lake Jackson watershed justifies the immediate implementation of this program in the Lake Jackson watershed. The program should not only require the development of plans for on-site retrofit--it should also require prompt implementation of the plans. The intent of this project is to ensure that sites lacking adequate stormwater treatment in the Lake Jackson watershed are retrofitted immediately. The project will be implemented by the City of Tallahassee and Leon County as stated in the local comprehensive plan.

Scope of Work

The following tasks should be undertaken to implement of this project.

- By 1995, inventory all existing on-site stormwater treatment facilities;
- Identify sites currently in need of but lacking stormwater treatment and require that site-specific retrofit plans be developed by 1995;
- Identify existing on-site stormwater treatment systems that do not meet current approved stormwater treatment requirements and require development and implementation of retrofit plans;
- Coordinate with the implementation of local stormwater management programs to determine which nonconforming sites may have the option of purchasing capacity in regional stormwater treatment facilities;
- Require periodic (every two or three years) certification and annual inspection of on-site stormwater treatment facilities and public posting of compliance with current regulations; and
- Monitor compliance with retrofit plans developed for non-conforming sites.

Products

Implemented retrofit plans for sites in the Lake Jackson watershed which do not currently achieve the treatment standards required for new development in the Tallahassee-Leon County 2010 Comprehensive Plan.

Funding

This project should be funded by the City of Tallahassee and Leon County.

Project: Q-9, EVALUATION OF SEPTIC TANK AND SEWER ISSUES

Issues Addressed: Septic tank failures, graywater discharges, extension of sewer services

Lead Agency: NWFWMD

Participants: NWFWMD, HRS, Leon County

Funding: SWIM - \$120,000 (FY 1993-94)
 - \$ 80,000 (FY 1994-95)
 - \$ 30,000 (FY 1995-96)

Implementation: FY 1993-96

Introduction

The objective of this project is to evaluate whether nutrients and bacteria are entering Lake Jackson because of septic tank failure and graywater discharge. Based on water quality sampling in Lake Jackson and some of its tributaries, it is believed that the high density residential developments on the west side of the lake are experiencing septic tank failures due to inadequate septic systems and poorly percolating soils. Residents experiencing failures often reroute some or all discharges from sinks, showers, tubs and washing machines so that their on-site treatment systems treat only the sewage flowing from the house. Graywater, i.e., wastewater from sources other than toilets and kitchen sinks, is often discharged directly onto the ground or into neighborhood ditches, which subsequently flow into the lake. Graywater is often quite high in phosphorous, a nutrient which accelerates eutrophication of the lake by increasing plant and algal growth.

Strategies

This project will quantify the nature and extent of septic tank failures and graywater discharges in those areas of the Lake Jackson watershed served by septic systems and it will identify the potential impacts to the lake resulting from such discharges. Solutions to the problems will be evaluated and strategies to alleviate the problems (including funding) will be developed.

The Tallahassee-Leon County 2010 Comprehensive Plan addresses septic tank problem areas with the following policy:

By 1993, the county will enter into an agreement with Talquin Electric and the City of Tallahassee for the provision of sanitary sewer service for septic tank problem areas in the unincorporated area of the Lake Jackson basin. The City of Tallahassee shall develop a plan for problem areas within the city by 1993.

Scope of Work

The following tasks will be undertaken as part of this project:

- Characterize the quality of non-point runoff entering the west side of Lake Jackson;
- Analyze the topographic, general soil, and septic tank density characteristics of five residential sub-basins on the west side of the lake;
- Conduct a homeowner's survey to estimate the frequency and extent of septic tank failures, the degree to which graywater is discharged directly to swales and stormwater ditches, and the nutrient loading from fertilizer applications;
- Identify septic tank and graywater problem areas and quantify the water quality impacts to Lake Jackson that are attributable to these areas;
- Identify and evaluate all implementable potential solutions, including opportunities and sources for funding; and
- Pursuant to the Tallahassee-Leon County 2010 Comprehensive Plan, evaluate the need for and content of an agreement among Talquin Electric, the City of Tallahassee and Leon County for provision of sewer services to identified septic tank problem areas.

Products

An assessment of nutrient and bacterial inputs to Lake Jackson from unsewered neighborhoods.

A prioritization of problem areas based on soils, topography, and density which will be applicable to other areas of the lake.

A political and financial evaluation of potential solutions.

Funding

This project is being implemented with \$120,000 in SWIM funding for Fiscal Year 1993-94. FY 1994-95 funding of \$80,000 will be requested from the SWIM program for evaluation of potential solutions and some SWIM funding (\$30,000) may be necessary in FY 1995-96 for further work to coordinate or assist in the implementation of solutions. Funding (as in-kind services) will also be sought from the Florida Department of Health and Rehabilitative Services as well as the City of Tallahassee and Leon County.

Project: Q-10, AGRICULTURAL IMPACTS
Issues Addressed: Agricultural runoff
Lead Agency: NFWFMD
Participants: NFWFMD, DEP, Leon County, SCS, County Extension Service
Funding: SWIM - \$20,000
Implementation: FY 1995-96

Introduction

Extensive land holdings in the northern portions of the Lake Jackson watershed are in various types of agricultural use, but have not been examined to determine whether runoff from these areas presents any significant problems to the water quality of the lake. The purpose of this project is to inventory and assess these uses and their possible impact on the water quality of Lake Jackson.

Strategies

The northern portion of the Lake Jackson watershed includes large land areas which are used for agricultural purposes, including silviculture, crop farming and livestock grazing. There are also some smaller agricultural landholdings adjacent to the lake and throughout the watershed. The impacts of these activities, although generally considered to be negligible in comparison to the urban runoff problems, have never been documented. Determination of these impacts is the purpose of this project.

Scope of Work

This project will determine the nature, extent and impact of current agricultural activities on sediment and nutrient loadings to the lake. It will also assess existing regulatory mechanisms for agricultural uses and make recommendations for changes in regulatory and/or management practices if necessary. Proposed tasks include the following:

- Quantify extent of agricultural land uses in the watershed;
- Determine the specific nature of agricultural uses in the watershed;
- Apply standardized loading rates to estimate the possible extent of sediment and nutrient loading to the lake resulting from agricultural land uses;
- Determine whether agricultural best management practices (BMPs) are being implemented;

- Develop and implement new BMPs if necessary; and
- Determine whether landowners are continuing active agricultural use merely to retain an agricultural tax exemption and, if so, determine whether alternatives to this approach are available.

Products

A report which identifies the quantity and types of agricultural activities in the Lake Jackson watershed

Implementation of BMPs.

Possible reduction of nonpoint source pollution loading from agricultural uses.

Funding

SWIM funding in the amount of \$20,000 will be requested to implement this project in FY 1995-96.

Project: Q-11, RECREATIONAL IMPACTS
Issues Addressed: Potential threat to water quality due to recreational activities
Lead Agency: DEP, FGFWFC
Participants: DEP, FGFWFC, NFWFMD, Leon County, Action Team
Funding: Undetermined - possibilities include DEP, FGFWFC, Grants, SWIM
Implementation: FY 1995-96

Introduction

The growth of Leon County and the surrounding area in recent years has led to an increased demand for water-related recreation, a demand which is likely to continue. Lake Jackson is one of the most popular lakes in the area due to its excellent fishing and relatively clean water and hazard-free areas for water skiing and pleasure boating. It is also the largest open water lake which is easily accessible to the Tallahassee urban area. Increasing recreational use has the possibility of adversely affecting water quality of the lake through destruction of aquatic vegetation, petro-chemical pollution (fuel spillage and exhaust), and resuspension of sediments.

Strategies

A literature review related to recreational use and water quality was completed through the SWIM program in 1992. This review indicated that sediment resuspension could be a problem, but that a study specific to Lake Jackson would be necessary to determine the extent of the problem and to develop and defend recommended management strategies. The review also recommended that the DEP enforce regulations concerning slalom courses in Lake Jackson to prevent sediment resuspension from water skiing activities in shallow areas.

A research effort specific to the effects of recreational uses on the water quality of Lake Jackson should be undertaken, with the results being used to develop and implement management strategies to prevent water quality degradation by recreational activities.

Scope of Work

The objective of this project is to provide information to be used in the decision making process concerning regulation of recreational uses.

- Review available literature and data related to recreational uses and water quality in shallow lakes (completed);

- Identify funding sources for necessary research, possibly through the Aquatic Preserve Program or a grant. SWIM funds could be used as possible matching funds for such a study;
- Upon identification of funding, develop a study to determine whether recreational activities are causing unacceptable levels of sediment resuspension in Lake Jackson. The study should compare sediment resuspension levels at various depths and over various types of lake bottom (heavily vegetated, sparsely vegetated, unvegetated, sand, organic). The study should relate pollutant loading from motorized vessels to the total pollutant load entering the lake and to the assimilative capacity of the system to determine whether such loading is unacceptable. Measures to reduce sediment resuspension near high traffic areas should be explored, since sediment resuspension in these areas is most common;
- Utilize Lake Jackson Technical Advisory Committee and Lake Jackson Action Team to review results and develop management strategies based on the research; and
- Implement management strategies.

Products

Recommendation of management strategies (ordinances, enforcement, education programs, etc.) which will prevent or reduce water quality degradation resulting from recreational uses.

Possible recommendation of "no action" if impacts are found to be minimal.

Funding

Funding for this project is undetermined at this time. Various sources should be explored, including the DEP, Florida Game and Fresh Water Fish Commission funds, and state and federal grants. SWIM funds could possibly be used to match funding from another source.

PRESERVATION/RESTORATION PROGRAM

Preservation Initiative

R-1, Long-Term Monitoring of Habitat

Restoration Initiative

R-2, Megginnis Arm Sediment Removal

R-3, Additional Megginnis Arm Restoration

R-3a, Revegetation of Megginnis Arm

R-4, Fords Arm Restoration

R-5, Restoration of Upland and Aquatic Areas

R-6, Timberlane Creek Berm Removal

R-7, Restoration of Yorktown Pond

Project: R-1, LONG-TERM MONITORING OF HABITAT

Issues Addressed: Need for baseline and on-going data to identify preservation needs

Lead Agency: Leon County and City of Tallahassee

Participants: Leon County and City of Tallahassee, NFWMD, DEP, FGFWFC

Funding: City/County - Environmental Planning Section

Implementation: FY 1993-94 --->

Introduction

The protection and preservation of upland habitats throughout the Lake Jackson watershed is essential to protecting the natural resources of the lake basin. The Tallahassee-Leon County 2010 Comprehensive Plan requires the development of conservation and preservation map overlays corresponding to areas that should be afforded a greater degree of concern when considering development requests. The plan also requires the identification of areas of environmental significance and habitats of endangered or threatened species and species of special concern. Clearly, local government recognizes the need to protect ecologically valuable upland areas.

Strategies

The purpose of this project is to develop a comprehensive, coordinated, long-term monitoring program for the conservation and preservation of habitat using remote sensing and field verification. This will be a coordinated effort between the city, county, NFWMD, FGFWFC and DEP. The county has already collected data and produced a set of maps and overlays of environmentally sensitive areas in Leon County (1988). The Tallahassee-Leon County Planning Department Environmental Planning Section will be updating these maps in 1994 on a county-wide basis. In addition, DEP has mapped data from satellite imagery and aerial photography for the Lake Jackson watershed.

This information should be compiled to produce a set of baseline data that can be used to guide management decisions. In addition, a monitoring program should be designed, including appropriate sampling intervals for various activities, that will be used to gauge the success of and improve management practices with respect to critical habitats and environmentally sensitive areas.

Scope of Work

The following activities will be undertaken as part of this project.

- Compile all available information on critical habitats in the watershed, including Leon County sensitive areas maps, DEP maps based on satellite imagery, aerial photography and groundtruthing (date of availability undetermined), maps of historical change in vegetation, and any other maps or data applicable to the project;
- Determine whether additional habitat data is needed and seek to acquire such information.
- Define the parameters and develop an appropriate monitoring strategy. Consider factors such as which monitoring techniques are best for which parameters, how often should parameters be sampled, the cost and staff requirements of various monitoring techniques, on-going programs of other agencies, and how the information will be used in addressing specific management issues;
- Establish criteria for determining habitat significance;
- Develop Natural Features Inventory map series and use the information to guide decision-making processes such as land use planning, environmental permitting, sensitive area protection, and land acquisition; and
- Implement a monitoring program which periodically updates the map series and analyzes habitat changes or losses.

Products

Natural Features Inventory map series which identifies sensitive habitat in the Lake Jackson watershed and county-wide.

Periodic update of the maps to reflect changing conditions.

Management recommendations as appropriate for special attention to specific areas, changes in land use management practices, land acquisition, and other habitat preservation strategies.

Funding

Some work has been performed by DEP's Research Laboratory utilizing DEP funds. Additional costs for establishing baseline data and implementing the program will be provided by the city and county, with possible assistance from existing monitoring programs of the FGFWFC and the DEP. The City of Tallahassee and Leon County will fund this project through the Tallahassee-Leon County Planning Department, Environmental Planning Section.

Project: R-2, MEGGINNIS ARM SEDIMENT REMOVAL
Issues Addressed: Contaminated sediments in Megginnis Arm
Lead Agency: NFWMD
Participants: NFWMD
Funding: DER - \$200,000 (Pollution Recovery Trust Fund)
- \$300,000 (Florida legislative appropriation)
SWIM - \$331,000 (through FY 1989-90)
EPA - \$300,000 (205(j)(5) grant)
Implementation: PROJECT COMPLETED IN FY 1992-93

The restoration of the Megginnis Arm portion of Lake Jackson was undertaken in response to extensive documentation of its degraded condition and need for remedial action. Solids, nutrients and heavy metals from urban runoff had built up within the sediments of the arm and continued to be gradually released into the water column. Greater nutrient resuspension occurred during heavy storms, since these events tended to disturb the sediments. The resuspended contaminants had long been suspected of contributing greatly to poor water quality and associated decreases in recreational, fish and wildlife values within Megginnis Arm and in proximate parts of Lake Jackson proper. In order to restore Megginnis Arm to a more natural state and eliminate a significant source of nutrient pollution, a project involving the removal of accumulated, degraded sediments was undertaken.

This restoration project involved the removal of approximately 112,000 cubic yards of degraded sediments from the deeper portions of Megginnis Arm. A hydraulic dredge was used to remove the accumulated sediment following a thorough analysis which indicated that the resultant spoil was suitable for land application. Permanent placement of the sediment was accomplished on a nearby site with appropriate dewatering facilities, including alum treatment, and berms to prevent the sediment from entering the lake.

This project was implemented and successfully completed with funds from several sources totalling approximately \$1,131,000. The Pollution Recovery Trust Fund, administered by the DEP, provided \$200,000. The 1989 Florida Legislature made a special appropriation of \$300,000, due in large part to lobbying efforts by Leon County on behalf of Lake Jackson. Another \$300,000 was made available from the federal government through an EPA 205(j)(5) grant. The NFWMD expended approximately \$331,000 in SWIM funds to complete the project.

Planning and design for this project was initiated in FY 1989-90 and construction of the disposal area was undertaken in October of 1990. Favorable conditions allowed for the timely completion of the disposal area

and a sheetpile dam to isolate the arm by the end of November 1990. Dredging commenced in December of 1990 and completed by May of 1992. Restoration activities, primarily associated with the consolidation and stabilization of the disposal area, continued into FY 1992-93 and the project was deemed substantially complete prior to the end of December 1992.

Post construction monitoring and evaluation of the success of the sediment removal project is being undertaken as part of the Additional Megginnis Arm Restoration project (R-3). Associated restoration activities currently underway in this area include an EPA-funded project involving revegetation of the littoral zone in Megginnis Arm conducted by District staff in cooperation with the Department of Environmental Protection, Nonpoint Section and Aquatic Plant Section.

Project: R-3, ADDITIONAL MEGGINNIS ARM RESTORATION
Issues Addressed: Restoration of Megginnis Arm
Lead Agency: NFWFMD
Participants: NFWFMD, DNR, FGFWFC, DEP, Leon County
Funding: SWIM - \$25,000 FY 1993-94
 \$25,000 FY 1994-95
 \$27,000 FY 1995-96
Implementation: FY 1993-96

Introduction

Significant alterations to the Megginnis Arm area of Lake Jackson have led to extremely degraded water quality, the destruction of high quality habitat, and invasion by undesirable and exotic vegetation. The completed SWIM project that initiated restoration of Megginnis Arm through removal of contaminated sediments is expected to have substantially improved the water quality in the arm. An intensive monitoring effort will now be implemented to determine the nature and extent of improvements as well as assess the need for further restoration efforts.

The restoration component of this project has been successful in identifying and securing funds for additional restoration in the form of revegetating areas of the arm and educational endeavors related to restoration efforts. The project has also supported numerous administrative and management tasks associated with completion of the sediment removal project. Future restoration coordination activities will be undertaken as part of the Lake Jackson SWIM Planning and Administration project.

Scope of Work

In Fiscal Year 1993-94, the Additional Megginnis Arm Restoration Project is intended to initiate intensive monitoring of water quality and sediments of the arm to assess the success of the sediment removal restoration effort. This will involve water quality monitoring at three or four stations within and proximate to the arm for field parameters as well as nutrient and sediment measurements. This monitoring effort will be performed in coordination with monitoring under project Q-4c, Megginnis Arm Basin Diagnosis. The following is the anticipated scope for the monitoring and analytical aspects of this project through FY 1995-96.

Tasks

1. Development of sampling strategy and QA/QC approvals.
2. Securing of equipment and agreements for laboratory analyses.

3. Initiation of sample collection.
4. Analyses for collected data and correlation with other associated water quality studies to be submitted as periodic reports.
5. Final report and recommendations.

Products

Verification and assessment of the success in restoring Megginnis Arm to a more natural state--improved water and habitat quality. This project is anticipated to continue for three years. Annual reports will be produced, reporting project progress, analyses, correlation with other studies and providing raw data to STORET. In the third year, all data will be analyzed and a final report will be produced summarizing the findings and proffering recommendations. Information gathered during this project will be used in the development of Pollution Load Reduction Goals for Lake Jackson and will also be used to determine additional restoration efforts that may be warranted for Megginnis Arm. The results should also be valuable for projecting effectiveness of similar proposed restoration efforts.

Project Funding:

The following budgets indicate the anticipated SWIM funding required to complete the scope of work according to the tasks above: FY 1993-1994 - \$25,000; FY 1994-95 - \$25,000; FY 1995-96 - \$27,000. Expenditures beyond FY 1993-94 will be re-addressed and possibly reduced depending upon results and recommendations derived from the first year of intensive monitoring and sediment characterization.

Project: R-3a, REVEGETATION OF MEGGINNIS ARM

Issues Addressed: Restoration of Megginnis Arm

Lead Agency: NFWWMD

Participants: NFWWMD, DEP

Funding: U.S. EPA - \$300,000

Implementation: FY 1993-95

Introduction

Historical pollution from stormwater runoff led to degraded water quality, invasion of undesirable and non-native vegetation, and subsequent loss of valuable habitat in Megginnis Arm. While installation of regional stormwater treatment facilities through Project Q-4 and removal of sediments through Project R-2 have improved water quality, revegetation efforts are necessary to restore aquatic habitat within the arm.

Strategies

This project commenced upon completion of the SWIM sediment removal project and entails the design and implementation of native wetland plant restoration. This project includes removal of exotic plant species, planting of native species, and monitoring the success of the restoration effort. Public education will also occur through the involvement of students in the planting and monitoring efforts.

Scope of Work

The objective of this project is the revegetation of the littoral zone in Megginnis Arm to conditions similar to those prior to installation of the pipeline and intensive development of the watershed. A portion of the project is dedicated to public education efforts regarding water quality. The following tasks will be implemented:

- Coordinate with appropriate state agencies regarding appropriate plant species and necessary permits;
- Design planting scheme, including numbers of plants and locations, as well as educational plantings. Issue RFP and award planting contract to subcontractor;
- Develop and prepare planting/monitoring plan for educational efforts and coordinate with appropriate schools. Coordinate with subcontractor for public education plants;

- Coordinate with District Public Information staff to organize video documentation and education videos and events related to the revegetation;
- Plant herbaceous species and trees;
- Monitor vegetation and water quality; and
- Compile and analyze District and Public Education data regarding water quality and planting success. Design and implement additional planting if necessary.

Products

- Megginnis Arm restored to more natural conditions with commensurate improvements in water quality and wildlife habitat.
- Public Education videos documenting project success available to public.
- Data and analysis documenting effects of restoration efforts and applicability to similar projects.

Funding

A \$300,000 grant from EPA funds, administered by the FDEP, was secured to implement this project. SWIM program expenditures for Lake Jackson were used as programmatic match for this grant.

Project: R-4, FORDS ARM RESTORATION
Issues Addressed: Contaminated sediments in Fords Arm
Lead Agency: NFWFMD
Participants: Leon County, Technical Advisory Committee
Funding: SWIM - \$ 50,000 - FY 1993-94
- \$ 25,000 - FY 1994-95
- \$ 25,000 - FY 1995-96

Additional SWIM and local funds will be required for implementation of restoration alternatives.

Implementation: FY 1993-96

Introduction

The construction of Interstate 10 and extensive residential and commercial development in the Fords Arm sub-basin of Lake Jackson has been suspected of causing significant sedimentation of the arm. Unfortunately, the extensive research which has been performed regarding the sediments of Megginis Arm has not been performed for Fords Arm. Preliminary characterization of the sediments beneath the open water of the arm has been conducted as a part of this project. An analysis of historic conditions has also recently been undertaken. These efforts were intended to determine the nature and extent of urban sediments in Fords Arm. Further restoration efforts, following a thorough analysis of these products, will be assessed in FY 1993-94 following discussion and consensual agreement among the Lake Jackson Technical Advisory Committee members. Such efforts may include a more extensive analysis of sediment accumulation and characteristics, in addition to an examination and identification of alternative strategies for restoring the arm.

Strategies

This project will examine Fords Arm to determine whether restoration efforts need to be implemented to prevent recurring water quality problems. The current tasks involve analysis of the previous diagnostic research to determine the nature, extent and seriousness of sediment impacts on the water quality of the arm and to identify restoration efforts which should be undertaken. Upon interagency comment, review, discussion and consideration of alternative solutions, restoration efforts may be implemented to restore the arm. Funding needs and sources for the selected restoration alternatives will be determined upon completion of review for the analytical and diagnostic parts of this project.

This project will be closely coordinated with efforts to establish and improve regional stormwater treatment facilities for the tributaries of Fords Arm (Project Q-4). Sediment removal or treatment will not be undertaken in Fords

Arm until sediment contributions from the tributaries are significantly reduced.

Scope of Work

The objective of this project is to restore Fords Arm of Lake Jackson to a more natural condition. The following tasks will be undertaken:

- Determine the interrelationships between the sediments and water quality problems in Fords Arm;
- If sediments are the primary source of water quality degradation, determine the nature and extent of contaminated sediments in the arm;
- Determine whether removal of the sediments, in-lake "sealing" of the sediments, or another method of restoration is the most appropriate alternative to address any identified problems; and
- Upon determination of appropriate restoration efforts, develop specific tasks to implement the preferred alternative.

Products

Fords Arm restored to a more natural state.

Funding

During FY 1993-94, \$112,000 of SWIM funds is available for implementation of this project (\$50,000 FY 1993-94 allocation and \$62,000 carried over from previous years). The majority of these funds are being held in abeyance pending decisions regarding future restoration activities. Upon resolution of assessments for the completed diagnostic work and determination of the preferred restoration strategy, funding needs will be identified and sources will be explored. In FYs 1994-95 and 1995-96, \$25,000 per year of SWIM funds may be requested to continue restoration assessments and planning work. Other possible sources for restoration activities include: SWIM discretionary funds, federal and state grants, and special legislative appropriations. It is likely that a significant local contribution (probably in the form of matching funds) may be required.

Project: R-5, RESTORATION OF UPLAND AND AQUATIC AREAS
Issues Addressed: Aquatic and upland areas in need of restoration
Lead Agency: Leon County and City of Tallahassee
Participants: Leon County, City of Tallahassee, FGFWFC, NFWFMD, DEP
Funding: City/County - Planning and Growth Management Departments
Implementation: FY 1993-94 --->

Introduction

Significant alteration of upland and aquatic areas in Lake Jackson and its watershed have contributed to the degradation of water quality and natural habitat of the lake and its tributaries. Restoration efforts which may be considered to reverse the downward trends range widely in scope and should each be considered on their own merit, while also being considered in a comprehensive fashion to determine the overall positive impacts which can result from such efforts.

Strategies

This project will identify upland, wetland, and aquatic areas in need of restoration, determine the costs and benefits of restoring the selected sites, prioritize sites for restoration, and implement restoration efforts. The project will be implemented by programs of the City of Tallahassee and Leon County as identified in the Conservation Element of the Tallahassee-Leon County 2010 Comprehensive Plan (Policy 1.4.1 e and Goal 3).

Scope of Work

The objective of this project is to restore upland and wetland areas in the Lake Jackson Watershed to halt and reverse the effects of sediment nutrient, and pollutant loading, and to improve fish and wildlife habitat. Since this program is currently being developed by the city and county, the specific scope of work has not been identified. The following tasks are suggested to fulfill the objective:

- Identify areas in need of restoration--utilize habitat information developed through Project R-1 to identify altered areas;
- Determine costs and benefits of proposed restoration efforts for each identified site;
- Determine whether in-lake restoration efforts should be performed during natural drawdowns--if so include such projects in contingency plan (Project M-12)--participate in the development of the Contingency Plan For Natural Drawdown;

- Prioritize proposed restoration efforts based on costs and benefits; and
- Implement priority restoration efforts in coordination with efforts of other involved agencies.

Products

Restored natural areas.

Improvement in water quality and fish and wildlife habitat.

Funding

This project will be funded by the the City of Tallahassee and Leon County through the Tallahassee-Leon County Planning Department, Environmental Planning Section, and the city and county growth management departments.

Project: R-6, TIMBERLANE CREEK BERM REMOVAL
Issues Addressed: Aquatic and upland areas in need of restoration
Lead Agency: NFWMD
Participants: NFWMD, Leon County
Funding: SWIM
Implementation: PROJECT COMPLETED IN 1992

This project involved an evaluation of the water quality and flooding effects which would be realized through removal of a spoil bank that functions as an earthen berm within a wetland/floodplain area adjacent to Timberlane Creek. The spoil was deposited on the west side of Timberlane Creek during development of a subdivision, and was thought to obstruct the natural flow of water through the wetland and floodplain.

This project was intended to actually remove the berm from the floodplain to increase flows through wetland areas and reduce flooding. However, after further analysis of the floodplain area, it was determined that removal of the berm would not provide measurable water quality benefits and would only provide minimal reduction of flood heights. The detailed analysis can be found in a NFWMD document titled: Timberlane Creek Berm Removal Analysis (Arteaga 1992).

Although the District's analysis indicates that removal of the berm would not improve water quality, it may be desirable to remove the berm to reduce flood heights. The reduction in flood heights would be minimal and would only reduce yard flooding (no structural damage has occurred). Such a project would be the responsibility of the governmental (or private) entity responsible for stormwater system maintenance. The project would not be eligible for SWIM funding since no water quality benefits would be realized.

Project R-7, RESTORATION OF YORKTOWN POND
Issues Addressed: Stormwater runoff from developed areas
Lead Agency: Leon County
Participants: Leon County, NFWMD, Yorktown Residents
Funding: Yorktown Residents..\$104,000
Leon County.....\$156,500 (Stormwater Utility FY 93-94)
SWIM.....\$100,500 (FY 1992-93)
Implementation: FY 1993-94

Introduction

This project involves the restoration of Yorktown Pond by removing accumulated sediments from the pond and redesigning and reconstructing the impoundment and dam to provide stormwater detention and treatment capabilities for this residential impoundment. The dam is over 30 years old and is in need of considerable repair due to its unsafe condition and potential to affect several homes in the event of a catastrophic failure. The impoundment currently provides for substantial sediment removal for runoff from a section of I-10 and a residential area.

The unsafe condition of the dam prompted the District to take enforcement action in 1989 to ensure that the dam would be repaired before a failure occurs. The dam is owned by three property-owners who have indicated that they are unwilling to undertake the needed repairs without outside financial assistance. A consent agreement was reached in July 1990 between the District and the property-owners and provides for the following actions:

- 1) The impoundment will be dewatered by 50 percent after November, 1990;
- 2) The 50 percent water level will be maintained for approximately three years to give the property-owners time to raise funds and prepare plans for repairs; and
- 3) If the repairs are not undertaken within three years, the District will have the opportunity and right to breach the dam and dewater the facility.

Strategies

Since the Yorktown Pond and dam are currently under private ownership, a number of tasks are being undertaken before the restoration is started. The dam and pond are being deeded to Leon County by the various property-owners, and arrangements are being made for temporary and permanent construction and maintenance easements over other lands. The Leon County Public Works Department has coordinated with the adjacent residents and the SWIM program to devise a plan for undertaking the needed repairs. The plan includes repairing the dam for safety purposes as well as redesign and reconstruction of the impoundment to provide wet detention for increased stormwater treatment. Funding has been secured through SWIM, the Leon County Stormwater Utility, and contributions from the residents.

Scope of Work

The following activities will be undertaken to implement this project:

- Leon County will secure public ownership of the dam and pond and other necessary easements;
- Leon County Public Works Department will prepare all necessary designs and permits for the restoration; and
- After permits are secured, Leon County Public Works Department will either contract for the work or undertake the project using county forces.

Products

Yorktown Pond restored to provide enhanced stormwater treatment.

Funding

The District provided \$100,500 through the SWIM program in FY 1992-93 for implementation of this project; Yorktown Pond residents are providing \$104,000; and, utilizing funds from the Stormwater Utility, Leon County will provide the remaining funds necessary for completion of the project, estimated at \$156,500.

WATERSHED MANAGEMENT PROGRAM

Research and Information Initiative

M-1, Ecological Analysis of the Lake Jackson Watershed

Management Initiative

M-2, Land Acquisition

M-3, Park Design Committee

M-4, Aquatic Preserve Management

M-5, Fish and Wildlife Management

M-6, Aquatic Plant Management

Regulatory Initiative

M-7, Regulatory Assessment and Coordination

M-8, Regulation of Recreational Uses

M-9, Ordinary High Water Line

Implementation and Administration Initiative

M-10, Action Team as Oversight/Advocacy Committee

M-11, Coordinate and Update Management Plan

Contingency Plan Initiative

M-12, Contingency Management Plan for Natural Drawdown

Project: M-1, ECOLOGICAL ANALYSIS OF THE LAKE JACKSON WATERSHED
Issues Addressed: Apply existing research and define data gaps; resource management
Lead Agency: Leon County and City of Tallahassee through the Action Team
Participants: Action Team
Funding: Undetermined--Grants
Implementation: FY 1994-95 --->

Introduction

A comprehensive analysis of the interrelationships among the various ecological and natural resource components of the Lake Jackson watershed is necessary to develop a better understanding of the lake and its behavior. For the past two years (FY 1991-93), Leon County has contracted with the FSU Center for Aquatic Research and Management for research regarding the general ecology of Lake Jackson, in addition to several other waterbodies in the county (see Project Q-2). It remains the intent of the county to continue to support research and monitoring of Lake Jackson, although there is no financial commitment beyond FY 1993-94. This research, however, is restricted to the lake itself and an assessment of the ecology of the watershed has not been included within the research design. Leon County has also generated an informal assessment of the historical ecosystems of the Megginnis Arm watershed based on topography and soils.

Strategies

The purpose of this project is to identify and secure one or more sources of funding for a comprehensive ecological analysis of the Lake Jackson watershed. Under Project Q-1, Evaluation and Application of Water Quality Data, the NFWFMD is developing an ecosystem model of the lake to predict the behavior of the lake in response to changes in nutrient loading. The model, however, will be of limited scope because of budgetary constraints and incomplete data about nutrient cycling and community structure.

At a minimum, the project should address local climate; soils; hydrology; vegetation, fish and benthic communities; and human impacts and interactions (including recreation and fish harvest). A project of this magnitude is currently beyond the scope of the NFWFMD, local government and other participating state agencies. However, it may be possible for a research organization or a university to undertake such a study. The Action Team will assume responsibility for identifying possible sources of funding for implementation of this project.

Scope of Work

Specific activities may include the following.

- Identify and investigate possible sources of funding, including Federal 205(j) water quality planning funds, and other grant programs;
- Develop conceptual scope of work for ecosystem analysis; and
- Identify and interview potential researchers.

Products

Recommendations regarding funding for system analysis.

Grant applications for funds.

Plans and procedures for implementing the findings of the analysis.

Funding

Funding for the Action Team is provided by Leon County, which may provide support for the effort to secure funding for this project.

Project: M-2, LAND ACQUISITION
Issues Addressed: Land use management
Lead Agency: Lake Jackson Action Team
Participants: Leon County, City of Tallahassee, NFWMD, DEP, FGFWFC, DCA
Funding: City/County, CARL, Preservation 2000, Florida Communities Trust, Grants
Implementation: FY 1993-94 --->

Introduction

One of the best methods of ensuring that sensitive lands in the Lake Jackson watershed are not developed is to acquire those lands which cannot be adequately protected through regulation. This project was included in the 1990 Lake Jackson Management Plan; however, it was not implemented as designed. A committee to recommend land acquisition for the Lake Jackson watershed was not activated and no acquisition plan for the watershed was prepared.

Despite this lack of formal plans, two major parcels of land were acquired during the 1990 plan cycle. In an effort to protect Lake Jackson and provide additional recreational opportunities to area residents, the District and the City of Tallahassee purchased the 670-acre Elinor Klapp-Phipps Park parcel in the summer of 1992. The adjacent 890-acre Lake Overstreet parcel was secured by the DEP and the City of Tallahassee in late 1993 as an addition to Maclay Gardens State Park. These two large purchases will preserve a continuous swath of land between Lake Jackson to the west and Thomasville Road to the east. The Phipps and Overstreet parcels are exceptional examples of sensitive area protection in the Lake Jackson watershed, and similar additional purchases should be made to preserve other sensitive areas.

Strategies

The purpose of this project is to acquire additional environmentally sensitive lands in the Lake Jackson watershed for preservation, conservation, restoration, passive recreation and perpetual management. The Lake Jackson Action Team will appoint a land acquisition committee to adopt criteria and develop a priority list for purchasing environmentally significant lands that are not adequately protected through the regulatory process. The committee will submit an acquisition plan to the Action Team for submittal to local government and state agencies by 1995.

Scope of Work

Specific tasks include the following:

- Develop roles, responsibilities and procedures for the land acquisition selection committee (Action Team);
- Appoint an ad hoc land acquisition committee; include members with expertise in conservation biology; do not limit membership to Lake Jackson Action Team members--seek volunteers from the general public (Action Team);
- Identify and develop conventional and alternative funding strategies (Committee);
- Coordinate with any established local and state land acquisition committees (Committee and Action Team);
- Establish priorities for purchase of lands in the Lake Jackson watershed (Committee);
- Develop and submit to local government and state agencies a list of parcels in the watershed which should be purchased for preservation purposes (Committee);
- Develop acquisition proposals for appropriate land acquisition programs, provide coordination assistance, and lobby local government, state agencies and others to acquire sensitive lands in the Lake Jackson watershed (Committee and Action Team);
- Ensure that public lands in the watershed are being managed in a manner consistent with the water quality and natural resource protection goals of the Lake Jackson Management Plan and other applicable plans and regulations (Committee); and
- Evaluate the program annually for progress; determine whether to continue or terminate the program at the end of the initial five-year period (Action Team).

Products

Plan for acquisition of environmentally sensitive lands in the Lake Jackson watershed.

Public ownership and management of specific parcels of land.

Funding

Volunteers on the Lake Jackson Action Team Land Acquisition Committee will develop the land acquisition plan and will identify sources of funding for purchase of the lands. Additional funds will be necessary for management of the lands once under public ownership.

Project: M-3, PARK DESIGN COMMITTEE
Issues Addressed: Recreational use of Lake Jackson
Lead Agency: Leon County, City of Tallahassee
Participants: Leon County, City of Tallahassee
Funding: Leon County - Public Works Department
City of Tallahassee - Park and Recreation Department
Implementation: FY 1993-94 --->

Introduction

The design and management of parks and recreational areas is best accomplished through a multidisciplinary approach which includes representatives of nearby neighborhoods, and individuals with expertise in natural resource management, environmental protection, planning, engineering, landscaping/horticulture, architecture, utilities planning/management and archaeology/history. Depending on the nature and location of a specific site, experts in other fields may also be useful. The purpose of this project is to establish a mechanism for an integrated, multidisciplinary approach for design and operation of parks and recreational areas in the Lake Jackson watershed. This approach was recently used in the development of a park design and management plan for the City of Tallahassee/NWFWMD Elinor Klapp-Phipps Park on Meridian Road. Use of a committee with experience in various fields can help to expedite permits, ensure excellent design, develop community support and diffuse community opposition.

Strategies

As new parks are developed or existing parks are modified in the Lake Jackson watershed, the entity responsible for developing and managing the park will establish an ad hoc multidisciplinary group to assist with plans for the design and management of the park. The composition of the group should include the various disciplines mentioned above and should draw from both the public and private sectors.

Scope of Work

As new public park areas are acquired or planned for development, the agency responsible for developing and managing the park will set up an ad hoc committee to assist with the park design and management plan. The committee will work with the agency to ensure that the park design and management plan are consistent with applicable local, state, and federal environmental laws. The committee should also ensure that development of the park will not adversely affect the water quality or natural resources of Lake Jackson. The following tasks should be followed by agencies developing or modifying parks in the Lake Jackson watershed:

- Upon acquisition of a park or determination of a need to modify an existing park, appoint an ad hoc committee with multidisciplinary representation to assist with the process--consult with the Lake Jackson Action Team and other pertinent organizations to find volunteers for the committee;
- Develop schedule for development of the design and management plan;
- Meet with the committee and clearly explain the purposes for which the park was acquired or is being modified--what uses were intended, who will be using the park etc.;
- Work with the committee to develop a design and management plan which is consistent with the purpose of the park acquisition or modification and is mutually consistent with community desires to protect Lake Jackson;
- Upon completion of the design and plan, the committee should assist in presenting the plan to the implementing governing authority for approval and funding; and
- Implement recommendations:

Products

Advisory committees to assist with the design and management of parks and recreational areas in the Lake Jackson watershed.

Park designs which consider and build upon environmental sensitivity of the site and its relationship to Lake Jackson.

Funding

This project will be funded by the Leon County Public Works Department and the City of Tallahassee Parks and Recreation Department.

Project: M-4, AQUATIC PRESERVE MANAGEMENT
Issues Addressed: Management of Lake Jackson as an Aquatic Preserve
Lead Agency: DEP
Participants: DEP, NFWMD, FGFWFC, Leon County, City of Tallahassee
Funding: DEP - Aquatic Preserve Management Program (no dedicated source of funding)
Implementation: 1993-94 --->

Introduction

The Lake Jackson Aquatic Preserve is one of 42 Aquatic Preserves in Florida. It was designated by the Legislature in 1973 for the purpose of "being maintained essentially in its natural or existing condition". In accordance with state law, the Lake Jackson Aquatic Preserve Management Plan was developed and then adopted by the Governor and Cabinet on July 23, 1991. Steps are being taken to incorporate the plan into the Aquatic Preserve Rule, Chapter 18-20, F.A.C.

To date, the Lake Jackson Aquatic Preserve has not received dedicated funding from the Internal Improvement Trust Fund, which is the source for Aquatic Preserve funding throughout the state. The agencies involved with implementation of the Lake Jackson Management Plan should provide ongoing support to the Lake Jackson Aquatic Preserve Program and should seek dedicated funding for this valuable management effort.

Strategies

The Aquatic Preserve Management Plan is one of many steps needed to accomplish long-term resource protection. The plan is intended to serve as a useful guide and reference to the Aquatic Preserve manager and others in helping to maintain the preserve's natural integrity. The current scope of activities under the aquatic preserve management plan includes the following:

- Review and permitting of structures and certain activities on the lake;
- Working with Leon County and other divisions within the DEP to develop new dock criteria;
- Review and comment on aquatic plant removal, control and collection; and
- Distributing general Aquatic Preserve materials and information about Lake Jackson to the public.

Scope of Work

Because there is no dedicated source of funding for managing the Preserve, implementation of the management plan has been limited to the above-mentioned activities. The following tasks will be undertaken to ensure complete implementation:

- Develop supporting policies to be consistent with statutory authority and the overall intent of the Aquatic Preserve Program for helping to ensure that the submerged land resources of the lake remain for future generations to enjoy;
- Coordinate with other resource management agencies to carry out appropriate activities;
- Utilize the plan through "on-site" day-to-day management of the Lake Jackson Aquatic Preserve; and
- Seek a dedicated funding source to provide for continued implementation of the Aquatic Preserve Management Plan. This task should be carried out by all agencies involved with the Lake Jackson Management Plan.

Products

Dedicated funding for the implementation of the Lake Jackson Aquatic Preserve Management Plan.

Improved interagency coordination.

Better management of Lake Jackson.

Funding

This project will be funded through the Aquatic Preserve Management Program. Currently, no funds have been specifically allocated for the Lake Jackson Aquatic Preserve. The Department makes a budget request to fund all of the state's aquatic preserves each year.

Project: M-5, FISH AND WILDLIFE MANAGEMENT AND RESEARCH
Issues Addressed: Application of research to management strategies
Lead Agency: FGFWFC
Participants: FGFWFC
Funding: FGFWFC - \$83,000/year (Wallop-Breaux Federal Aid Project)
Implementation: 1993-96

Introduction

Lake Jackson has historically been known for its high numbers of trophy largemouth bass in the eight to 15 pound size range, with occasional landings of fish exceeding 15 pounds. However, in recent years the high harvest rate of bass in the 2-4.5 pound range caused by increasing recreational fishing pressure has resulted in a reduction of trophy bass landings. Due to this high harvest rate, it is necessary to implement management strategies which will allow more fish to reach trophy size. This project provides for a slot limit wherein bass in the 13-17 inch range must be released. This project is part of the overall fish and wildlife management programs administered by the FGFWFC.

Strategies

The objective of this project is to improve the population structure and angler yields of largemouth bass in Lake Jackson through implementation of a 13-17 inch protective slot limit. In conjunction with the slot limit, a study is being undertaken to evaluate the response of the largemouth bass population to the size restrictive harvest regulation. This study includes electrofishing to determine length-frequency distribution and abundance of bass, and surveys of anglers to evaluate sportfish catch, angling pressure and success in Lake Jackson.

Scope of Work

The following jobs will each be conducted on a yearly basis over the life of the project.

- Electrofishing transects will be sampled at ten predetermined sites to determine changes in the largemouth bass population structure. Samples will be collected each spring and fall. A minimum of 300 largemouth bass will be collected to determine length-frequency distribution and relative abundance. A representative sample will be collected each spring to identify changes in age structure through time;

- A roving creel survey will be conducted on Lake Jackson during the peak fishing season (February-June). Sportfishermen will be interviewed to evaluate catch, angling pressure, and success. These data will be compared to data collected under a previous study (Nordhaus 1989); and
- Assist in collection of data and coordination with other involved agencies in accordance with SWIM. Field data and literature reviews will be combined into monthly, annual, and completion reports.

Products

Study reports including recommendations of strategies for future management of Lake Jackson's largemouth bass fishery.

A more balanced population of largemouth bass in Lake Jackson.

Funding

This project is being funded by a federal grant and implemented by the FGFWFC. It was a three-year project beginning in 1990, but has been continued.

Project: M-6, AQUATIC PLANT MANAGEMENT

Issues Addressed: Exotic aquatic plants

Lead Agency: DEP, Bureau of Aquatic Plant Management, and Leon County

Participants: DEP, FGFWFC, Leon County

Funding: DEP.....\$18,750 (FY 1993-94)
 Leon County..\$56,250 (FY 1993-94)

DEP.....\$18,750 (FY 1994-95)
 Leon County..\$56,250 (FY 1994-95)

DEP.....\$18,750 (FY 1995-96)
 Leon County..\$56,250 (FY 1995-96)

SWIM.....\$10,000 (FY 1994-95) Alternatives Study

Implementation: FY 1993-94 --->

Introduction

Foreign plants, specifically hydrilla, waterhyacinth and alligatorweed, have become established in Lake Jackson. Unless these aquatic plants are controlled periodically, they tend to become very abundant to the detriment of the native plant community, fish and wildlife, and recreational users.

Strategies

The objective of this ongoing project is to selectively reduce exotic plants without significantly damaging the diverse, native plant community. The most difficult task is to keep hydrilla in check without harming other plants. To date, the strategy has been to treat hydrilla annually, if necessary, in the late winter/early spring with fluridone ("SONAR") and to treat only part of the lake at one time. When applied under certain conditions (low water temperature, hydrilla starting to grow), fluridone will target only the hydrilla, and impacts to the native vegetation will be minimal to nonexistent. Fluridone treatments were conducted in 1987, 1988, 1990, 1992 and 1993. Though these treatments have been successful, the DEP will continue to investigate new methods to improve efficacy and/or reduce non-target kill, such as the use of the Hydrellia fly for biological control of hydrilla.

Water hyacinths also tend to proliferate on Lake Jackson, mainly in the southern part of the lake and along Highway 27. The strategy is to maintain very low levels of hyacinths by treating in a detailed manner with 2,4-D every seven weeks during the growing season.

In an effort to control alligatorweed, a highly effective biological control agent, the alligatorweed flea beetle, has been introduced into the United

States. The current management strategy is to ensure that this insect is present in sufficient numbers in the spring to provide acceptable control during the growing season.

In recent years, questions have arisen concerning the ecological effects of the current methods of control and possible alternatives to this method. In response to these questions, SWIM funds will be requested for FY 1994-95 to perform an analysis of available alternatives and to examine the ecological effects and the costs and benefits of the alternatives as they apply to Lake Jackson.

Scope of Work

The following tasks are necessary to implement this project.

- Monitor at least biennially aquatic plant community and direct hyacinth control activities -- after mapping the location of abundant hydrilla in the fall, formulate and execute an effective treatment plan the following spring;
- Secure funding for the aquatic plant management program on an annual basis;
- Monitor the spring population of alligatorweed flea beetles and supplement if necessary;
- Review the history of aquatic plant management efforts for the lake, including a literature review, and identify alternative strategies;
- Examine the costs, benefits, and feasibility of alternative methods of exotic plant controls, such as harvesting and/or use of grass carp; and
- Recommend preferred strategies based on the above studies to guide future aquatic plant management efforts.

Products

The maintenance of a diverse native plant community.

An analysis of the costs and benefits of various aquatic plant management alternatives specific to Lake Jackson.

A summary (for public distribution) of the history of aquatic plant management within Lake Jackson and a summary of the assessment of costs and benefits of management alternatives.

Funding

This program has historically been funded entirely by the DEP (formerly DNR) Bureau of Aquatic Plants, using funds provided by the U.S. Army Corps of Engineers and state match. In a 1993 review of the statewide aquatic plant management program funding situation, the DEP determined that no more state funds may be used for aquatic plant management on Lake Jackson, according to Section 369.22(3), Florida Statutes. This law states that aquatic plant management for intracounty waterbodies (such as Lake Jackson) is the

responsibility of the local government. However, as administrators of the U.S. Army Corps of Engineers (COE) aquatic plant management program, the DEP can provide up to 25% of the funding for aquatic plant management using COE funds.

The DEP subsequently requested that Leon County provide the 75% matching funds necessary for Lake Jackson's aquatic plant management in FY 1993-94. The Leon County Board of County Commissioners (BCC) approved this request (\$56,250) and directed county staff to consider funding for this program in future budget years. The BCC also directed staff to request that the City of Tallahassee provide one-half of the required local match. The City Commission considered this request but did not provide the match because the county revenue source which was providing the funding (General Fund Contingency) includes ad valorem tax revenues generated from within the city limits.

Funding will be required in future years for management of nuisance aquatic plants and should continue to be provided by the DEP and Leon County. Leon County and the DEP will enter into an interagency agreement to ensure that exotic aquatic plants are properly managed on a yearly basis. Since it is likely that funding will be required on a yearly basis, this agreement will provide a formal mechanism for continuing coordination and budgeting. Preliminary estimates indicate that Leon County should budget approximately \$60,000 per year to fund aquatic plant management for Lake Jackson.

The Leon County Board of County Commissioners may also wish to lobby the Legislature to remove the statutory limitations on aquatic plant funding for intracounty waterbodies. This statutory change would make it possible for the DEP to consider funding a larger share of the aquatic plant management program for Lake Jackson.

In FY 1994-95, \$10,000 of SWIM funds will be requested to perform a limited waterbody-specific analysis of the costs and benefits of alternative methods of exotic plant control.

Project: M-7, REGULATORY ASSESSMENT AND COORDINATION

Issues Addressed: Management of Lake Jackson and its watershed, regulation of development and land uses, multiple entities managing the lake and watershed

Lead Agency: NFWFMD

Participants: NFWFMD, Lake Jackson Action Team, Lake Jackson Technical Advisory Committee

Funding: SWIM - \$5,000/year

Implementation: FY 1993-94 --->

Introduction

One of the most effective methods of protecting and restoring Lake Jackson and its watershed is to appropriately regulate land uses and development throughout the watershed. Numerous attempts have been made over the past 20 years to manage and regulate various activities affecting Lake Jackson. Studies have been undertaken and plans, projects, and regulations have been developed--but many were not implemented. The reasons for lack of implementation vary, but most evident has been the lack of funding to carry out identified management strategies and lack of implementation schedules and commitments in the plans which have been prepared for the lake. Implementation of the most recent planning and regulatory activities for Lake Jackson has been more successful than earlier efforts, but these efforts should continue to be evaluated and revised as necessary.

Strategies

This project entails ongoing analysis, coordination and assistance which can be divided into three major strategies: 1) analysis of existing regulations and policies, making recommendations as necessary; 2) assisting with the development of new regulations; and 3) evaluation of past and present management efforts.

An assessment of existing institutional and regulatory programs was performed by the SWIM program in FY 1989-90. As significant changes to local regulatory programs have taken place since the assessment was performed, there is a need to assess new programs as they are implemented. The recommendations regarding implementation and enforcement of state programs also require further work to ensure that Lake Jackson is afforded a high level of protection.

Technical assistance and informed citizen input will be provided to the City of Tallahassee and Leon County in the processes of revising LDRs and implementing and amending the comprehensive plan. The District and the Lake Jackson Action Team will participate in the review and development of regulations and programs which are related to the future management of Lake

Jackson and its watershed. The focus of this effort will be specific to the Lake Jackson watershed, and will thereby provide local government with a better understanding of issues which may not apply to other areas. Where appropriate, specific ordinance language will be recommended and specific program tasks will be suggested.

The project also entails the analysis of past and present management efforts for Lake Jackson and its watershed to identify problems associated with implementation of these efforts. This analysis involves determination of the success or failure of each effort, in whole or in part, and identification of the process which led to success (or failure). At this time, the major management efforts which have been attempted over the past 20 years have been identified and are summarized in the Management Efforts section of the Lake Jackson Management Plan document. The formal analysis of success/failure has yet to be performed, but the current condition of Lake Jackson and its watershed makes it quite evident that many of the historic efforts were unsuccessful. The reasons for these failures seem to be quite varied, but further analysis may identify specific recurring barriers to implementation. This ongoing project will provide those developing new regulations, plans, and programs with insight as to which types of programs are more likely to be successful. As new management strategies are developed, implementation will be monitored and analyzed to determine whether similar problems are being experienced.

Scope of Work

The objective of this project is to ensure that the management of Lake Jackson and its watershed will afford the highest level of protection to the lake, while providing for appropriate levels of responsible land and resource use. The following tasks will be undertaken to implement this objective:

- Utilize processes which have historically been successful to implement current projects, prevent those which were unsuccessful from being used;
- Track current implementation efforts;
- Periodically analyze recent implementation efforts and document processes which produce success/failure;
- Participate in working groups responsible for development of local resource protection and stormwater management ordinances and programs;
- Research model ordinances and programs which could be applied to the management of Lake Jackson and its watershed--recommend model ordinances; and
- Provide written reviews, analysis and recommendations concerning existing and future local and state regulations and programs, including but not limited to:
 - Enforcement of existing regulations pertaining to Aquatic Preserve and OFW status;
 - Enforcement of local land use and environmental regulations;

- Florida Game and Fresh Water Fish Commission officer presence and enforcement;
- Desirability and effectiveness of mitigation activities in the Lake Jackson watershed;
- Adequacy and effectiveness of habitat management, including upland and aquatic environments;
- Variable enforcement effort dependent on need (time of day, year, etc.);
- Penalties in addition to a violation fine based on a determination of the degree of harm or degradation to the environment; and
- Establishment of a special trust fund enhanced by fines and other penalties that is to be used exclusively for restoration activities in the watershed.

Products

Local land development regulations which provide a higher level of protection to Lake Jackson and its watershed.

Implementation of programs identified in the Tallahassee-Leon County 2010 Comprehensive Plan which will help to preserve and restore Lake Jackson.

Identification of successful implementation strategies to be utilized in the future.

Identification of unsuccessful implementation strategies to be avoided.

Analysis of existing regulations and recommendations for changes.

Funding

This project will be funded by SWIM at a level of \$5,000 per year for the next three years. Some local government staff commitment may be required to assist the Lake Jackson Action Team in analyzing programs and in formulating and implementing recommendations.

Project: M-8, REGULATION OF RECREATIONAL USES
Issues Addressed: Multiple governmental entities
Lead Agency: Leon County and City of Tallahassee through the Action Team
Participants: Leon County, City of Tallahassee, NFWMD, DEP
Funding: Leon County
Implementation: FY 1993-94--->

Introduction

Many common recreational activities have the potential to degrade the environmental and aesthetic value of the lake. Local government, through the use of regulations, has the authority to limit or prohibit those activities it deems harmful to the environment. In addition, the DEP and FGFWFC have purview over certain activities. For regulations to be effective, however, they must be applicable to the Lake Jackson watershed and they must be enforced.

Strategies

The purpose of this project is to inventory and evaluate local and state ordinances with respect to their effectiveness and enforcement in regulating lake user activities, and make recommendations for changes in ordinances and/or enforcement policies. At a minimum, regulations for the following activities should be evaluated:

- Noise control (to protect wildlife and aesthetic value);
- Boating/watersport regulations (safety regulations, speeds, motor sizes, skiing);
- Use/activity at public landings (fueling and launching of boats, trampling of vegetation);
- Littering; and
- Mooring of illegal structures (docks, rafts) in open water areas.

Scope of Work

In 1992, NFWMD SWIM staff performed a review of programs which regulate recreational uses. A short report summarizing existing regulations for a number of recreational activities was prepared. The report was reviewed by the Lake Jackson Action Team, and the Action Team felt that enhanced enforcement of existing regulations would be preferable to developing new regulations. Based upon the findings of this review and the Action Team recommendation, this project will focus on encouraging the responsible entities to better enforce existing regulations. For the most part, the project will be implemented by the Action Team with the assistance of the DEP. Specific activities may include the following:

- Identify parties responsible for enforcing particular regulations;
- Define goals with respect to each regulation to be better enforced;
- Contact enforcement entities and request increased enforcement--provide specific examples of violations;
- Utilize information from lake user survey if applicable; and
- Develop recommendations for new or amended enforcement policies if enforcing agencies have difficulties enforcing existing regulations.

Products

Better enforcement of regulations designed to protect water quality, wildlife, natural resources and recreational users of Lake Jackson

Funding

The Action Team is funded by Leon County.

Project: M-9, ORDINARY HIGH WATER LINE (OHWL)
Issues Addressed: Regulatory responsibilities of multiple government entities
Lead Agency: DEP
Participants: DEP, Leon County
Funding: DEP - Bureau of Survey and Mapping
Leon County - Existing Environmental Management Programs
Implementation: FY 1993-94-->

Introduction

The ordinary high water line (OHWL) is the boundary between privately-owned riparian lands and state-owned (sovereignty) lands on navigable nontidal waterbodies. The boundary is typically determined by examining waterbody stage records for an extended period of time (tens of years). Because of the extreme historical fluctuations of Lake Jackson and ambulatory nature of the OHWL, various conclusions have been reached through the years regarding its location. These conclusions have culminated in litigation which remains unresolved at the time of this writing.

In the case of Lake Jackson, determination of an OHWL is especially difficult since recent history (since about 1900) shows that the lake basin periodically drains and floods rather than fluctuating about a more or less static level. The lake has experienced more stable levels since 1970 than during the period 1950-70. Nevertheless, the OHWL is used as a regulatory tool in the Lake Jackson watershed by state, regional and local agencies and it should be clearly delineated for this and other purposes based on the best available data.

The shoreline of Lake Jackson was last mapped in 1979 using aerial photography and topographic mapping. Since that time, there have been several studies to determine the "true" OHWL for Lake Jackson, with considerable difference of opinion between private and public interests resulting in litigation that is still unresolved.

Strategies

Currently, the DEP, Leon County and the City of Tallahassee recognize the 89 or 89.5 foot contour as the OHWL for regulatory and management activities. The purpose of this project is to refine and formally establish an OHWL for administrative purposes. In addition, after the legal issues are resolved, Leon County and the DEP may survey and place markers at the OHWL in strategic locations.

Scope of Work

A specific scope of work for the mapping will be developed by the DEP, including a schedule and date of completion. Upon refinement of the OHWL elevation for administrative purposes, existing photography and mapping may be used to approximate its location. Surveys may be required of an applicant to determine extent and/or to assure that certain activities in specific locations do not encroach. Leon County will develop a scope of work for surveying and marking the OHWL. The DEP and Leon County will coordinate with each other in both the mapping and marking efforts.

Product

Maps delineating the OHWL at the determined contour.

Markers at strategic locations that indicate the OHWL.

Funding

Funding for the establishment of the OHWL will be through the DEP Bureau of Survey and Mapping. Leon County should provide funding for the survey and markers through existing programs.

Project: M-10, ACTION TEAM AS OVERSIGHT/ADVOCACY COMMITTEE
Issues Addressed: Multiple government entities
Lead Agency: Leon County through the Action Team
Participants: Leon County, Action Team
Funding: Leon County - staff commitment
Implementation: FY 1993-94 --->

Introduction

There is a continuing need for a citizen-based committee to monitor and report on implementation of the Lake Jackson Management Plan, to implement certain projects in the plan, and to review and make recommendations on other activities in the watershed. The Lake Jackson Action Team, made up of members appointed by the Leon County Board of County Commissioners, is the citizen-based, oversight/advocacy committee for the Lake Jackson Management Plan. The City of Tallahassee is represented on the Action Team, however, this group has no formal responsibility to the City Commission.

Strategies

The purpose of this project is to staff and fund the Action Team as a citizen-based committee to carry out the following activities with respect to the Lake Jackson Management Plan.

- 1) Monitor implementation of the plan, report periodically to the city and county commissions, and make suggestions and recommendations as necessary on those projects being implemented by the city and county.
- 2) Implement certain projects in the plan, especially the Public Education and Awareness projects.
- 3) Other activities related to management of the watershed, including commenting on amendments proposed for the comprehensive plan and land development regulations; serving as advocates for the lake, sponsorship of land acquisition through grant programs such as SOR, P2000 and CARL; and identification of other funding sources and strategies.

Scope of Work

The following activities should be accomplished to implement this project.

- Designate staff and budget;
- Establish staff responsibilities;
- Plan Action Team meeting and reporting schedule;
- Make assignments and set deadlines;
- Determine level of involvement in management activities such as land use decisions; and
- Coordinate with NFWMD and other agencies in updating the plan.

Products

An active committee to monitor and assist with implementation of the Lake Jackson Management Plan.

Funding

The Action Team is staffed and funded by the Leon County Growth and Environmental Management Department.

Project: M-11, COORDINATE AND UPDATE MANAGEMENT PLAN

Issues Addressed: Multiple governmental entities, application of research (new and existing)

Lead Agency: NFWMD

Participants: NFWMD, Technical Advisory Committee, Leon County, City of Tallahassee

Funding: SWIM - \$30,000 FY 1993-94
 - \$30,000 FY 1994-95
 - \$30,000 FY 1995-96

Implementation: FY 1993-94 --->

Introduction

The implementation of a comprehensive program for the management of Lake Jackson and its watershed requires ongoing coordination by the SWIM program with the numerous programs and projects of other entities involved with the lake. There are also ongoing tasks such as monitoring of plan implementation, research coordination, pursuit of funds, technical advisory committee coordination, program oversight, and plan updates; all of which require significant staff commitments by the District.

Strategies

This project will continue to provide administrative support to ensure implementation of the Lake Jackson Management Plan. This support includes: development of responsibilities and accountability for implementation of SWIM funded projects, determination of alternative funding mechanisms and securing of funds; coordinating all research funded by SWIM; coordinating the Lake Jackson Technical Advisory Committee; coordination with the Lake Jackson Action Team; and coordination with the programs and projects of other federal, state, and local agencies.

Scope of Work

The objectives of this project include the following.

- Implement and update as necessary a coordinated, comprehensive plan for the Lake Jackson Watershed;
- Provide for the research necessary to guide the management programs; and
- Ensure that adequate management strategies are in place and are being implemented.

Specific tasks which will be undertaken are listed below.

- Monitoring the implementation and evaluating the effectiveness of the Lake Jackson Management Plan--making recommendations or changes when appropriate.
- Providing technical assistance to the Lake Jackson Action Team as needed.
- Coordinating implementation of the SWIM program through Technical Advisory Committee meetings and internal project coordination efforts.
- Seeking and securing mechanisms to implement projects which are experiencing funding shortfalls.
- Coordinating all research funded under the SWIM program and determining methods to apply the research to management efforts.

Products

Lake Jackson Management Plan document with strategies, project schedules, and funding.

Implementation and coordination efforts will be detailed in quarterly and annual reports.

Funding

This project will be funded annually by SWIM.

Project: M-12, CONTINGENCY MANAGEMENT PLAN FOR NATURAL DRAWDOWN

Issues Addressed: Multiple governmental entities, land use management, recreational use, restoration of native habitat

Lead Agency: NFWFMD

Participants: NFWFMD, DEP, FGFWFC, Leon County, Action Team

Funding: SWIM - \$25,000 (plan development, FY 1994-95)
\$20,000 (interagency coordination FY 1995-96)

Implementation: FY 1994-96

Introduction

Lake Jackson is known for its tendency to periodically "go dry" by draining into active sinkholes in the lake bottom. These events have occurred every 20 to 25 years, but could occur during any prolonged dry period that results in a reduction of ground water levels. A study performed by the FGFWFC (Dobbins et al. 1988) indicated that natural drawdowns in Lake Jackson are beneficial to the fisheries as well as the entire lake ecosystem. The possibility of another natural drawdown occurring raises questions concerned with how the lake should be managed while it is empty and what restoration and preservation efforts could be implemented during such an event. This project is intended to develop a comprehensive management and restoration plan that will be implemented in the event of another natural drawdown.

Strategies

The time required to obtain permits, secure approval and funding for research, and develop management strategies can be lengthy, even after such needs have been identified. Upon the occurrence of a natural drawdown of Lake Jackson, restoration efforts could not be implemented without permits. Considering the time necessary to prepare local, state and federal environmental permits and gain approval, it is possible that the lake could refill before the permits could be issued. This is also true for the approval and funding of research projects and the implementation of lake management strategies and ordinances. The objective of this project is to ensure that all the necessary preliminary steps have been taken so that appropriate management strategies can be implemented immediately after a drawdown of the lake occurs.

The development of a contingency plan will require identification of the lake management issues to be addressed, a short-term data gathering effort, determination of need for additional information or research (if necessary) and acquisition of permits (if needed). The plan development process will require coordination with all agencies responsible for management of the lake and will therefore be coordinated through the Lake Jackson Technical Advisory Committee. If necessary, a smaller working group may be developed to concentrate on this effort.

Scope of Work

The following tasks will be undertaken as part of the Contingency Management Plan for Natural Drawdown:

- Identify components of the plan;
 - Review existing lake management literature and data which will be used in the development of the plan; determine needs for additional management research (if any);
 - Determine what types of research may need to be performed during drawdown: design studies, develop and obtain approval for Quality Assurance/Quality Control plans;
 - Examine restoration possibilities, including litter and trash removal, removal or burning of sediments, restoration of boat landing areas and dredging of channels, habitat restoration and species plantings and removals, etc.;
 - Develop specific engineering plans and drawings as needed; and
 - Develop recreational management strategy, addressing issues surrounding use of the lake during drawdown (e.g., should vehicles be allowed to drive on lake bottom; if not, how to prevent such activities).
- Implementation Mechanisms
- Select lead agency to implement and coordinate the contingency plan;
 - Determine funding needs for identified projects and secure commitments for funding in the event of a natural drawdown;
 - Determine needs for specific contingency regulation (legislation, ordinances, etc.) and develop as necessary;
 - Determine which mechanism will trigger implementation of the contingency plan, e.g., lake level or visible draining. Consider the applicability of phased activities (specific actions which take place when the water level drops to established levels); and
 - Acquire necessary permits.

Products

Comprehensive lake management plan to be implemented upon natural drawdown of Lake Jackson.

Funding

\$45,000 in SWIM funds is proposed over a two-year period for development of the contingency plan. Additional SWIM funding may be requested if the

preliminary work reveals a need for more extensive analysis and site specific information.

PUBLIC EDUCATION AND AWARENESS PROGRAM

Coordination Initiative

E-1, Planning and Administration

Public Awareness Initiative

E-2, Printed Materials

E-2a, Lake Jackson Educational Publication

E-3, Media Relations

E-4, Corporate/Private Sponsorship

E-5, Miscellaneous Awareness Activities

Education Initiative

E-6, School Programs

E-7, Educational Materials

E-8, Outdoor Educational Displays

E-8a, Educational Displays at Public Areas

E-8b, Educational Exhibit at Megginis Arm Facility

Community Involvement Initiative

E-9, Community Activities

E-10, Citizen Water Quality Monitoring

Research Initiative

E-11, Public Awareness Survey

E-12, Lake User Survey

Project: E-1, PLANNING AND ADMINISTRATION

Issues Addressed: A coordinated, cooperative approach to educating the general public and creating public awareness

Lead Agency: NFWFMD (coordination)

Participants: NFWFMD, Leon County, City of Tallahassee, Action Team, businesses and others as needed

Funding: SWIM - \$3,000 (FY 1993-94)
 - \$5,000 (FY 1994-95)
 - \$5,000 (FY 1995-96)

City/County - In-Kind

Implementation: FY 1993-94 --->

Introduction

Prior to the establishment of the Lake Jackson Public Education Working Group, educational opportunities and public awareness efforts concerning Lake Jackson were provided by various state and local organizations without coordinated goals, objectives or an organized plan. A coordinated effort allows a more efficient use of available staff and resources and increase general awareness of objectives. The objective of the coordination initiative is to provide a cooperative, integrated approach for implementation of the Lake Jackson Public Education and Awareness Program.

Strategies

Continue the Public Education Working Group consisting of one citizen member of the Lake Jackson Action Team and a representative from each public information department of the NFWFMD, Leon County, and the City of Tallahassee. A representative of the Leon County School Board will also be included. This group shall not be limited to the members listed herein and shall include the cooperation of other interested agencies as needed. Responsibilities will be shared more or less equally among the public information staff members of the three agencies.

Scope of Work

The goal of this project is to provide educational opportunities and public awareness efforts concerning Lake Jackson through a coordinated, cooperative approach using integrated public awareness and educational tools from the agencies and persons serving on the Public Education Working Group. Efforts will include organizing events for "Lake Jackson Action Day" on an annual or semi-annual basis.

Outlined below are the primary tasks to be accomplished under this program.

- Contact appropriate persons to serve as members on the group;
- Organize and hold, as necessary, group meetings to carry out projects of the Lake Jackson Management Plan's Public Education and Awareness Program;
- Delegate responsibilities to group members for each project to be undertaken by the joint group;
- Integrate public awareness and educational materials as applicable; and
- Seek corporate/private sponsorship for education and awareness projects.

Products

A committee which coordinates public education and awareness activities.

Funding

This project will require staff commitments from the District, the City of Tallahassee and Leon County. The SWIM program has allocated \$3,000 for District staff support during FY 1993-94 and \$5,000 per year will be requested from SWIM for FY 1994-95 and FY 1995-96.

Project: E-2, PRINTED MATERIALS

Issues Addressed: Watershed management, stormwater runoff, on-site stormwater treatment, regulatory and management programs affecting the lake, responsible recreational behavior, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, other agencies, organizations and businesses as needed

Funding: Funding needs and sources will vary depending on recommended activities--SWIM will fund printing of some materials

Implementation: FY 1993-94 --->

Introduction

Because the general public may have limited awareness of the issues outlined above, this project will endeavor to foster awareness of the lake, issues surrounding the lake, and activities and occurrences which influence the lake's water quality. An inexpensive method available to assist in the public awareness initiative is the use of the printed materials. Thus, a large number of printed pieces may be produced and distributed. These materials will improve public awareness and educate the public about the lake and its watershed, including basin habitats and natural resources, stormwater treatment, watershed management, and responsible recreational behavior.

Strategies

The Public Education Working Group will work together to develop written materials which address the issues listed. Responsibilities, such as topic research and writing, will be assigned to committee members for each task listed. Distribution of products plays a key role in the success of this project and may be undertaken by the working group.

Scope of Work

Using publications and direct mail, this project will develop and distribute information to area residents and visitors about the value of the lake, watershed management, treatment of stormwater runoff, preservation and restoration activities, responsible recreational behaviors, the various regulatory and management programs affecting the lake, and the simple behavioral and activity changes which can be made to help improve the lake's water quality.

Products

The products of this project will vary depending on the specific activities recommended.

Funding

This project will require commitment of staff time from the NFWMD, the city and county, depending on which activities are pursued. As materials are developed, SWIM funds may be used for printing.

Project: E-2a LAKE JACKSON EDUCATIONAL PUBLICATION

Issues Addressed: Educating the public about the lake, watershed management, stormwater runoff, stormwater treatment, responsible recreational behavior, ecosystems, and management roles and responsibilities

Lead Agency: Leon County and City of Tallahassee through the Action Team

Participants: Public Education Working Group

Funding: City/County
SWIM

Implementation: FY 1993-94

Introduction

The Lake Jackson Technical Advisory Working Group and the Lake Jackson Action Team have determined a need to develop an educational publication that specifically addresses the Lake Jackson Basin. Residents within the basin, properly informed and reasonably engaged in a cooperative effort to manage the basin, are an essential aspect of a comprehensive lake management plan. While publications can be found that address lake management in a general sense, or that address Lake Jackson briefly, nothing was available that had a focus on the basin. A broad-based publication on the SWIM Program, entitled "A Guide to Protecting Our Surface Waters" was printed and distributed in 1990. A poster/brochure, called "Lake Jackson: The Big Picture" was printed and distributed in 1993.

It is assumed that a majority of residents within the basin have a limited knowledge of the lake's history, condition, recreational uses, and plant and wildlife communities. Little is commonly known about which agencies are responsible for what aspect of the lake's management, or of lifestyle changes that can have a positive impact on the lake. It is also assumed that many residents would welcome and benefit from this type of information.

Strategies

Though publications have been developed, others are needed to cover different topics and reach varying target audiences. The initial step is to develop a multi-agency publication committee with the charge of completing all tasks associated with researching, writing, editing, printing, distributing and funding a Lake Jackson Handbook for basin residents. It is recommended that this committee be composed of a subgroup of Technical Advisory Committee and Lake Jackson Action Team members.

Encouraging personal responsibility for restoring and protecting the lake through Best Management Practices and for developing a clear understanding of

local government and state agency roles and responsibilities will be the central theme of the publication. Motivational elements of the publication should include an historical perspective, a lay description of the biological function of a drainage basin, and an assessment of how individuals benefit from the resource, as well as general information about the fishing and recreational use of the lake.

Scope of Work

The goal of this project is to develop and distribute a handbook publication specifically about Lake Jackson and its watershed that is inviting and enjoyable to read, that is easily understood by a broad range of people, that provides a concise but comprehensive scope of information, and that encourages residents to become active participants in lake and watershed management.

Outlined below is a list of the primary tasks necessary to accomplish the goal of the project:

- Establish (sub)committee and formalize charge;
- Develop outline of publication;
- Develop budget;
- Develop strategy to fund project through private and corporate contributions;
- Divide and assign tasks and timeline;
- Execute tasks within timeline; and
- Develop distribution strategy and implement.

Products

A Lake Jackson handbook for distribution to residents and businesses in the watershed.

Funding

This project will require staff commitment from the NFWMD, the city, the county and other participating agencies. SWIM funds may be requested for publication and distribution of the handbook.

Project: E-3, MEDIA RELATIONS

Issues Addressed: Watershed management, stormwater runoff, on-site stormwater treatment, regulatory and management programs affecting the lake, responsible recreational behavior, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, other agencies, organizations and businesses as needed

Funding: Funding needs and sources will vary depending on recommended activities

SWIM - \$6,000 (FY 1993-94)

Implementation: FY 1993-94 --->

Introduction

Because the general public may have limited awareness of the issues outlined above, this project will use media relations to foster awareness of the lake, issues surrounding the lake, and activities and occurrences which influence the lake's water quality. An inexpensive method available to assist in the public awareness initiative is the use of media opportunities and assistance. Through the media, large audiences may be reached quickly. This is especially important when a timely message must be delivered to the public. These efforts may increase public awareness and educate the public about the lake and its watershed, including basin habitats and natural resources, stormwater treatment, watershed management, and responsible recreational behavior.

Strategies

The Public Education Working Group has worked together to foster relationships with the media and solicit media assistance as needed to address the issues listed and will continue to do so. Responsibilities, such as topic research and writing, will be assigned to group members for each task listed as is deemed appropriate and necessary. Successful coordination of media reports is fundamental to this project and will be undertaken by the joint committee.

Scope of Work

Using contacts with the media, this project will develop articles for publication in newspapers and magazines, news and feature stories for broadcast on radio and television, and public service announcements for all media. The goal of this project is to inform area residents about the value of the lake, watershed management, stormwater runoff, treatment of stormwater

preservation and restoration activities, responsible recreational behaviors, the various regulatory and management programs affecting the lake, and the simple behavioral and activity changes which can be made to help improve the lake's water quality.

Products

The products of this project will vary depending on the specific activities recommended.

Funding

This project will require a staff commitment from the District, city and county, depending on which activities are pursued. In addition, SWIM has allocated \$6,000 for Fiscal Year 1993-94.

Project: E-4, CORPORATE/PRIVATE SPONSORSHIP

Issues Addressed: Watershed management, stormwater runoff, on-site stormwater treatment, regulatory and management programs affecting the lake, responsible recreational behavior, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, other agencies, organizations and businesses as needed

Funding: Funding needs and sources will vary depending on recommended activities

Implementation: FY 1993-94 --->

Introduction

Because the general public may have limited awareness of the issues outlined above, this project will endeavor to foster awareness of the lake, issues surrounding the lake, and activities and occurrences which influence the lake's water quality by seeking corporate or private sponsorship of activities. Because resources available to implement the Public Education and Awareness Program are finite, the assistance of corporations and private organizations is essential in the program's overall success.

Strategies

The Public Education Working Group will work together to foster relationships with local corporations and private organizations to solicit assistance as needed to address the issues listed. Responsibilities, such as initial contact with an organization, will be assigned to group members for each task listed as is deemed appropriate and necessary. Successful coordination of corporate and private contacts and participation is fundamental to this project and will be undertaken by the working group.

Scope of Work

Relationships with local corporations and private organizations will be developed and cultivated by individual members of the joint committee. With the benevolent assistance of various corporations and private organizations, area residents may be better informed about the value of the lake, watershed management, treatment of stormwater runoff, preservation and restoration activities, responsible recreational behaviors, the various regulatory and management programs affecting the lake, and the simple behavioral and activity changes which can be made to help improve the lake's water quality.

Products

The products of this project will vary depending upon the recommended activities.

Funding

This project will require commitment of staff time from the NWFWD, the city and county, and depending on which activities are pursued, additional funds may be necessary.

Project: E-5, MISCELLANEOUS AWARENESS ACTIVITIES

Issues Addressed: Watershed management, stormwater runoff, on-site stormwater treatment, regulatory and management programs affecting the lake, responsible recreational behavior, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, other agencies, organizations and businesses as needed

Funding: SWIM - \$ 6,000 (FY 1993-94)
 - \$10,000 (FY 1994-95)
 - \$10,000 (FY 1995-96)

Additional funding and in kind services may be necessary depending on particular activities.

Implementation: FY 1993-94 --->

Introduction

Because the general public may have limited awareness of the issues outlined above, this project will endeavor to foster awareness of the lake, issues surrounding the lake, and activities and occurrences which influence the lake's water quality. Certain activities have proven to be effective in creating general awareness of the issues and in fostering educational opportunities. These activities will continue to provide increased awareness and educational opportunities.

Strategies

The Public Education Working Group will work together to continue ongoing activities which address the issues listed. Responsibilities, such as providing display materials for exhibits or demonstrating about stormwater runoff with the tabletop EnviroScape model, will be assigned to group members for each task listed as is deemed appropriate and necessary. Successful coordination of ongoing activities and group participation is fundamental to this project and will be undertaken by the working group.

Scope of Work

Through cooperative efforts, area residents and visitors may be better informed about the value of the lake, watershed management, treatment of stormwater runoff, preservation and restoration activities, responsible recreational behaviors, the various regulatory and management programs affecting the lake, and the simple behavioral and activity changes which can be made to help improve the lake's water quality.

Products

The products of this project will vary depending on the recommended activities.

Funding

This project will require a staff commitment from the District, the city and county, and depending on which activities are pursued, additional funding may be required. The SWIM program has allocated \$6,000 for this project for FY 1993-94 and SWIM funds of \$10,000 per year will be requested for FY 1994-95 and FY 1995-96.

Project: E-6, SCHOOL PROGRAMS

Issues Addressed: Watershed management, stormwater runoff, on-site stormwater treatment, regulatory and management programs affecting the lake, responsible recreational behavior, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, other agencies, organizations and businesses as needed

Funding: Funding needs and sources will vary depending upon recommended activities
SWIM \$10,000 (FY 1993-94)

Implementation: FY 1993-94 --->

Introduction

Because the general public and school children may have limited awareness of the issues outlined above, this project will endeavor to foster awareness of the issues and provide educational opportunities in the classroom and in the field for students and the general public to learn more about the lake. The objective of the education initiative is to educate the general public about the lake, its ecology and its watershed through the use of publications, audiovisuals, outdoor displays, field trips, experiments, tours, demonstrations, and other educational activities.

Strategies

Coordinate with schools and community organizations in the watershed to develop or obtain programs and educational materials about Lake Jackson, watershed management, and the issues listed above.

Scope of Work

In order to address the issues listed and fulfill the objective of this project, materials must be purchased or researched, written, approved by the school system, produced, and distributed to appropriate grade levels in the schools. Also, educational activities must be organized and implemented.

Products

The products of this project will vary depending upon the recommended activities.

In FY 1993-94, the primary focus of this project will be to provide funding for school field trips to the District's Lake Jackson stormwater treatment facility.

Funding

This project will require a staff commitment from the District, the city and county, and depending on which activities are pursued, additional funding may be required. The SWIM Program has allocated \$10,000 for FY 1993-94 to fund field trips to the District's Lake Jackson stormwater treatment facility. Most of these funds will be used to reimburse the School District for substitute teachers and school bus transportation to the facility. SWIM funds may be requested in future years to implement this project.

Project: E-7, EDUCATIONAL MATERIALS

Issues Addressed: Coordination of educational programs, watershed management, stormwater runoff, on-site stormwater treatment, regulatory and management programs affecting the lake, responsible recreational behavior, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, other agencies, organizations and businesses as needed

Funding: Funding needs and sources will vary depending on materials developed

Implementation: FY 1993-94 --->

Introduction

Because the general public and school children may have limited awareness of the issues outlined above, this project will endeavor to foster awareness of the issues and provide educational opportunities to learn more about the lake. The objective of the education initiative is to educate the general public about the lake, its ecology, and its watershed through the use of publications, audiovisuals, outdoor displays, field trips, experiments, tours, demonstrations, and other educational activities.

Strategies

Develop educational materials and programs for use in classrooms, field trips, tours, demonstrations, workshops, seminars, and public speaking activities. Emphasize the issues associated with Lake Jackson, the various programs and government agencies that are addressing these issues, and the concepts of watershed management and individual responsibility.

Scope of Work

In order to address the issues listed and fulfill the objective of this project, materials must be obtained or researched, written, produced, and distributed to appropriate audiences.

Products

The products of this project will vary depending on the recommended activities.

Funding

This project will require a staff commitment from the District, the city and county, and depending on which activities are pursued, additional funding may be required. SWIM funds may be requested to implement this project.

Project: E-8, OUTDOOR EDUCATIONAL DISPLAYS

Issues Addressed: Coordination of educational programs, watershed management, stormwater runoff, on-site stormwater treatment, regulatory and management programs affecting the lake, responsible recreational behavior, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, DEP, other agencies, organizations and businesses as needed

Funding: Funding needs and sources will vary depending on recommended activities
SWIM - \$7,000 (FY 1993-94--Project E-8a)
- \$5,000 (FY 1994-95--Project E-8a)
- \$5,000 (FY 1995-96--Project E-8a)

Implementation: FY 1993-94 --->

Introduction

Because the general public may have limited awareness of the issues outlined above, this project will endeavor to foster awareness of the issues and provide educational opportunities to learn more about the lake. The objective of the education initiative is to educate the general public about the lake, its ecology, and its watershed through the use of publications, audiovisuals, outdoor displays, field trips, experiments, tours, demonstrations, and other educational activities.

Strategies

Design and construct outdoor displays that illustrate the principles of watershed management, preservation and restoration, stormwater runoff, effective stormwater treatment, and other issues related to Lake Jackson. Emphasize the issues associated with Lake Jackson, the various programs and government agencies that are addressing these issues, and the concepts of watershed management and individual responsibilities.

Scope of Work

In order to address the issues listed and fulfill the objective of this project, information must be researched and written, displays must be constructed, and appropriate sites must be selected for installation. In addition, informational pieces may need to be produced to enhance the effectiveness of the displays.

Products

Displays and exhibits.

Printed companion pieces for the displays.

Funding

This project will require a staff commitment from the District, the city and county, and depending on which activities are pursued, additional funding may be required. The SWIM Program has allocated \$7,000 for FY 1993-94 and SWIM funds of \$5,000 per year for FY 1994-95 and FY 1995-96 will be requested.

Project: E-8a, EDUCATIONAL DISPLAYS AT PUBLIC AREAS

Issues Addressed: Lake resources, watershed management, stormwater runoff, responsible recreational behavior, regulatory and management programs affecting the lake, ecosystems

Lead Agency: Public Education Working Group

Participants: Working Group, DEP, NFWMD, FGFWFC, Leon County, City of Tallahassee

Funding: SWIM - \$7,000 (FY 1993-94)
- \$5,000 (FY 1994-95)
- \$5,000 (FY 1995-96)

Implementation: FY 1993-96

Introduction

Lake Jackson has long been recognized as a popular recreational resource for sport fishing, water skiing, pleasure boating and other activities. Unfortunately, there are currently limited public education materials available at public sites around the lake such as boat landings and public parks. Several signs were developed and installed in 1992 (through an EPA grant) at Millers Landing, Rhoden Cove Landing, Megginis Arm Canoe Landing, Highway 27 Landing and Sunset Landing. The construction of outdoor informational displays at these sites is a simple, relatively inexpensive yet high-profile method of educating the most frequent users about the natural resources of the lake and the potential threats to these resources.

Strategies

The purpose of this project is to educate the users of the lake by constructing permanent outdoor displays at public sites around the lake. Sites for consideration include Old Bainbridge Park, a planned new park near the existing Highway 27 Landing, Elinor Klapp-Phipps Park, stormwater treatment facilities, and other identified locations. Placing the displays at these sites around the lake will ensure high visibility to user groups such as fishermen and pleasure boaters, as well as to participants in classroom and field activities and programs.

The displays will be designed to illustrate, with pictures and text, the recreational, aesthetic and biological values of the lake, current threats to the resources including urban growth and stormwater runoff, stormwater treatment, and how citizens can help in protecting and preserving Lake Jackson. The displays will be sturdily designed to complement the lake environment and blend into the park settings.

Scope of Work

The following tasks are integral to implementation of this project.

- Complete preliminary design;
- Investigate and secure source of funding to complete project;
- Seek approval from county to construct displays at the identified sites;
- Develop the specifications and initiate the bidding process for design and construction of the displays giving consideration to the existing preliminary plans;
- Finalize text, photographs, diagrams and other exhibit materials for the displays; and
- Supervise production of exhibits and construction of displays.

Products

Outdoor educational displays at selected sites around Lake Jackson.

Funding

The SWIM Program has allocated \$7,000 for FY 1993-94 to install displays at Old Bainbridge Park. SWIM funds of \$5,000 per year for FY 1994-95 and FY 1995-96 will be requested for the development and installation of educational displays at additional sites.

Project: E-8b, EDUCATIONAL EXHIBIT AT MEGGINNIS ARM FACILITY
Issues Addressed: Educating the public about watershed management and
stormwater treatment
Lead Agency: NFWMD
Participants: NFWMD, Technical Advisory Committee
Funding: SWIM - \$5,000
Implementation: FY 1995-96

Introduction

The Lake Jackson Megginnis Arm Stormwater Treatment Facility was completed by the NFWMD in 1984 with funds and assistance provided by the U.S. Environmental Protection Agency and the Florida Department of Environmental Regulation. It consists of a 20-acre wet detention pond, a 4.5-acre intermittent sand and fabric filter inside the pond, and a 5.8-acre artificial marsh. Sedimentation and filtration take place in the wet detention pond and nutrient uptake occurs in the marsh. This facility provides an excellent opportunity for educating citizens, students and policy-makers about the principles and practice of watershed management, conventional and innovative methods of stormwater treatment, and the various plant and wildlife resources of Lake Jackson. The purpose of this project is to design and construct educational displays at the Megginnis Arm facility and provide access/tours for schools in the watershed and eventual access to the general public.

Strategies

Educational displays will be designed and constructed for the various components of the facility in phases.

Phase 1 Design a display that provides a complete and unrestricted view of, but not necessarily access to, the detention pond and filter. Include self-explanatory text and illustrations that describe the reasons for watershed management and the principles and practice of stormwater treatment.

Phase 2 Design interpretive displays for the marsh with self-explanatory text and diagrams on the purpose and functioning of the marsh, vegetation in the marsh, and the wildlife that can be found in the marsh and lake environments.

Phase 3 Expand the exhibits at the detention pond and provide for passive recreational activities such as walking and jogging.

Initially, access to the facility will be limited pending thorough review of the issues associated with public access. Hopefully, the District, the city

and county can eventually enter into an agreement for shared responsibilities associated with the operation and maintenance of the facility as a public educational/recreational area.

Scope of Work

Implementation of this project involves the following tasks.

- Determine the level of activity desired or expected once the educational displays are complete. Consider whether groups and/or individuals will view the displays without guidance, or if the District (or other agency) will provide staff for guided tours. This will guide subsequent decisions regarding the type and location of displays, degree of detail in the text and the need for accessory structures such as benches, covered pavilions and water fountains;
- Determine specific information to be included in the displays, giving priority consideration to how the facility functions, various methods of stormwater treatment and what causes the need for such facilities (the concept of watershed management). Write text and design diagrams and illustrations;
- Design display structures and select locations. Consider plaques, observation booths, kiosks, walkways, signs and any other means of displaying the information to suit the overall project. The degree of public access will determine in part the nature and location of the structures;
- Determine if any of the tasks require contracting for professional services. If so initiate and follow through with the bidding process;
- Construct and install the displays;
- Determine if any improvements/alterations are required in the area surrounding the facility, such as relocating the fence, grading walkways, or constructing bridges and/or walkways;
- Negotiate with the city and county for shared responsibilities for operation and maintenance of the facility as a recreational area; and
- Develop and implement a program for guided tours of the facility for schools in the watershed.

Products

Educational displays at both the filter area and the marsh.

Program for guided tours.

Funding

SWIM funding of \$5,000 will be requested in FY 1995-96 for the first phase of this project.

Project: E-9, COMMUNITY ACTIVITIES
Issues Addressed: Responsible use of the lake and its resources
Lead Agency: Public Education Working Group
Participants: Working Group, Action Team, other agencies, businesses and organizations as needed
Funding: SWIM - \$2,000 (FY 1993-94)
- \$2,000 (FY 1994-95)
- \$2,000 (FY 1995-96)
Additional funding needs and sources will vary depending upon recommended activities

Implementation: FY 1993-94 --->

Introduction

Direct participation is a valuable tool for educating residents and lake users about management of the Lake Jackson watershed and will promote a high level of commitment to protecting and preserving the lake and its natural resources.

Strategies

The purpose of this project is to organize activities for community involvement that are both fun and educational.

Scope of Work

The scope of work will vary depending on the recommended activities.

Products

Increased awareness and commitment on the part of the public to preserving and protecting Lake Jackson.

Funding

This project will require a staff commitment from the District, the city and county, and depending on which activities are pursued, additional funding may be required. The SWIM Program has allocated \$2,000 for FY 1993-94 and SWIM funds of \$2,000 per year will requested for FY 1994-95 and FY 1995-96.

Project: E-10, CITIZEN WATER QUALITY MONITORING

Issues Addressed: Lake resources, community involvement

Lead Agency: Leon County, Lake Jackson Action Team

Participants: Leon County, City of Tallahassee, Action Team, NFWMD, DEP

Funding: - Undetermined

Implementation: FY 1995-96 --->

Introduction

The Florida LAKEWATCH Program was initiated in the mid-1980s by the Institute of Food and Agricultural Sciences (IFAS) and is currently implemented by the Department of Fisheries and Aquaculture at the University of Florida. The program trains citizen volunteers to collect data to monitor the water quality of area lakes. The volunteers typically collect water samples for nitrogen, phosphorous and plant biomass. In addition, volunteers use a Secchi Disk to determine the clarity of the lake water.

A citizen-based water quality monitoring program such as LAKEWATCH can provide regularly scheduled long-term data collection on lakes that, due to funding restrictions, might not be continuously monitored by any agency. In addition, the program provides an educational experience for the citizen volunteers. Implementation of a citizen-based monitoring program for Lake Jackson could provide an inexpensive, effective means of collecting regular, long-term water quality data for basic parameters such as nitrogen and phosphorous. The information collected by the citizen volunteers could then be used along with other data to establish water quality trends and guide management decisions.

Strategies

The objective of this project is to provide an inexpensive, effective means of collecting data on basic water quality parameters. The collection effort should be long-term (unending) using standard sampling intervals and techniques. The intent is to establish a monitoring program using citizen volunteers to collect samples for water quality analysis.

Scope of Work

This project involves establishing a citizen-based monitoring program for Lake Jackson.

- Contact Florida LAKEWATCH for advice in establishing the program;
- Review Comprehensive Plan requirements and current and planned water quality monitoring programs of the city and county to determine the proper role and responsibilities of the volunteer program;
- Acquire necessary equipment; make arrangements for analysis, possibly with city laboratory;
- Solicit and train volunteers; implement sampling efforts; and
- Periodically review success of the program; publish results.

Products

An ongoing water quality monitoring program that provides reliable data on a regular basis

Funding

This project is designed to be a comprehensive, long-term, lakewide water quality monitoring program. There should be minimal costs associated with the project once it is established. Initiation of the project (purchase of equipment, training of volunteers, etc.), should be funded by local government, local corporate/private sponsors or civic organizations.

Project: E-11, PUBLIC AWARENESS SURVEY
Issues Addressed: Level of knowledge and awareness
Lead Agency: NFWFMD
Participants: NFWFMD
Funding: SWIM - \$12,500
Implementation: FY 1994-95

Introduction

The Lake Jackson Management Plan calls for a number of education and awareness activities in the watershed over the next three years which will require a significant expenditure of public funds. During the past years of implementation of the Lake Jackson Management Plan, District staff have experimented with a variety of approaches, some of which have been productive, others which have not. Because of the varying success of these past efforts, there is an apparent need to quantify the public's knowledge about Lake Jackson in order to design and implement education and awareness programs that are both effective in accomplishing the plan's objectives and efficient in spending limited public monies.

Strategies

The purpose of this project is to conduct a survey to determine the degree of public awareness about Lake Jackson's natural resources, management of the watershed, preservation and restoration activities, and individual responsibility for the lake environment. The program will include follow-up surveys to determine the success of the public education and awareness activities.

Scope of Work

The design and implementation of the survey program will be contracted to a professional survey research organization.

Implementation of this project will include the following activities.

- Develop a schedule for the bidding process and determine who will receive a request for a proposal;
- Prepare requests for proposals;
- Review proposals and award contract;
- Coordinate with survey research firm in development and implementation of survey(s);

- Prepare report based on results and analysis of survey(s) with recommendations for educational/awareness needs and strategies;
- Revise public education and awareness projects and emphasis as necessary based upon the results of the survey; and
- Periodically resurvey the user population to determine effectiveness of educational/awareness programs.

Products

Survey results and recommendations regarding future public education activities in the Lake Jackson watershed.

Funding

SWIM funds of \$12,500 will be requested for implementation of this project in FY 1994-95.

Project: E-12, LAKE USER SURVEY
Issues Addressed: Current level of public's knowledge and awareness, effectiveness of awareness/education programs
Lead Agency: Kennesaw State College
Participants: FSU Department of Economics (Dr. Frederick Bell)
Funding: EPA Clean Lakes Program Grant
Implementation: FY 1993-94

Introduction

Lake Jackson is used for a variety of recreational activities, including boating, fishing, skiing, canoeing, swimming, bird and animal watching, and relaxation. It is important that all recreational users be aware of and employ responsible recreational behavior in order to preserve and protect the natural resources associated with the lake. The purpose of this project is to determine the economic impact and recreational value of Lake Jackson. The survey results may be helpful in measuring the success of various education and awareness programs.

Strategies

A survey of lake users will be performed to determine the economic value of Lake Jackson. An U.S. Environmental Protection Agency Clean Lakes Program grant has been awarded to Kennesaw State College to administer a number of surveys for lakes in the south, and Dr. Frederick Bell of Florida State University will be administering the Lake Jackson component of the grant. The survey results will provide the following information:

- 1) Characterization of who uses Lake Jackson, including standard demographic information such as age, county/state of residence, income, and level of formal education.
- 2) Determination of user patterns, including what activities, when, how long and how often.
- 3) Determination of level of user knowledge about the lake and its resources, the value of clean water, and overall economic value of the lake.

Scope of Work

The following tasks have been or will be undertaken by Kennesaw State College to implement this project.

- Prepare and administer survey instrument; and
- Prepare report based on results and analysis of survey(s).

The following tasks will be performed by NFWFMD staff.

- After reviewing the final report, determine whether the survey data could be used to provide additional information to help focus public education efforts;
- Obtain raw data and perform additional analysis, if necessary;
- Prepare report based on additional analysis with recommendations for education/awareness programs, and other projects, if applicable; and
- Revise public education and awareness projects and emphasis as necessary based upon the results of the survey.

Products

Estimate of the economic value of Lake Jackson, as well as the potential economic impacts of water quality changes in the lake.

Lake user survey specific to Lake Jackson.

Results and analysis of survey(s).

Report with recommendations and strategies for education/awareness programs.

Funding

The U.S. EPA has awarded a grant to Kennesaw State College for this survey. Any District work on this project will be funded through Project M-11.

LAKE JACKSON MANAGEMENT PLAN

APPENDIX 2

General Description of the Lake Jackson Watershed

Developed by
Northwest Florida Water Management District
pursuant to
Surface Water Improvement and Management (SWIM) Program
in cooperation with
Florida Department of Environmental Protection

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GENERAL DESCRIPTION OF THE LAKE JACKSON WATERSHED

Physical Setting

Lake Jackson is located approximately seven miles north of the City of Tallahassee (Leon County, Florida) in a physiographic region called the Tallahassee Hills. The Tallahassee Hills cover a 40 km wide strip of uplands located in Gadsden, Jefferson, Leon, Liberty and Madison counties that extend from the Withlacoochee River on the east westward to the Apalachicola River. The lake lies within the Ochlockonee River basin. It has a drainage area of 43.2 square miles and a surface area of 4,000 acres (excluding Carr Lake and Mallard Pond; see Figure 1). The lake is long and irregular in width, ranging from one-half to two miles, and has two extensions in the southern part of the lake, Megginnis and Fords arms. Lake level varies from 76 to 96 feet NGVD, with an average depth of 12 feet in the northern half and 8 feet in the southern half. The surrounding hills are at elevations of 220 to 230 feet (Bishop 1973).

Lake Jackson is a closed basin; it has no water loss through surface water runoff. However, the lake receives inflow from three main tributaries, Megginnis and Fords creeks, draining the southern portion of the basin, and Ox Bottom Creek, which drains the northeastern portion. There are few well-defined drainageways on the northern and western sides of the basin; however the lake receives overland runoff from all adjacent areas (Wagner 1984).

Surface Geology and Soils

The surface geology in the eastern portion of the uplands is dominated by the yellowish-red, clay-sands of the Miccosukee Formation, while the Hawthorn Formation, a phosphatic deposit, generally dominates the geology westward from the Ochlockonee River. However, thick deposits of clastics overlie the main geological formations in many areas, and where these deposits occur there are often many lakes, ranging in size from large shallow lakes to relatively deep sinkhole lakes. Lake Jackson is typical of lakes in this area, being a shallow lake with locally deep sinkholes (Canfield 1981).

Bathymetry and Lake Origin

Bathymetry

Lake Jackson is a relatively flat-bottomed basin marked locally by small steep-sided depressions (see Figure 2). The two major depressions in the lake bottom are Lime Sink and Porter Hole Sink, with bottom elevations of 57 feet NGVD and 61 feet NGVD, respectively. The depressions lie approximately on a northwest-southeast trending line and are separated by an elevated area stretching perpendicularly across from Brill Point (Wagner 1984).

The bathymetry of Megginnis Arm is characterized by a relatively deep trough in the southern reach which narrows and slopes gently northward towards two shallow sills. One sill is the result of a past effort to hydrologically

isolate the arm from the rest of the basin, and the other resulted from installation of an underground gas pipeline across the arm near where it joins the main basin. In contrast to Megginnis Arm, Fords Arm is quite shallow in the inner reaches and deepens very gradually towards the open lake (Harriss and Turner 1974).

Five major areas of the lake become separated by bottom ridges when water levels recede. In the northern portion, the U.S. 27-Lime Sink area is isolated from the Miller's Landing area by the North Saddle. In the southern portion, the Porter Hole depression area becomes isolated from the Church Cove area. Although not completely isolated from the Porter Hole depression, the Megginnis and Fords arms' areas form another distinct lake bottom area. It appears that the area of Megginnis and Fords arms is drained by a series of channels to the Porter Hole depression (Wagner 1984).

Lake Origin

There are two theories for the origin of large lake basins in Florida. Sellards (1910) suggested that large closed basins like Lake Jackson formed as a result of sinkhole dismemberment of former stream valleys. The initial removal of earth materials was by surface streams, but subsequent basin enlargement was by solution of the underlying limestone and washing of the overlying clastics through the resulting sinkhole into the subterranean drainage system. White (1958) proposed that the large lake basins were formed by solution of the upper surface of the more soluble portions of limestones overlain by insoluble clastics. This type of solution would occur when the potentiometric surface was higher than the area occupied by the lakes, favoring horizontal movement of water through the insoluble clastics. White considered that sinkhole activity was the end, or the destructive, phase of a lake basin cycle rather than the creative process as proposed by Sellards (Harriss and Turner 1974).

Wagner (1984) proposed the following scenario for the origin of Lake Jackson. Lake Jackson was probably once part of a tributary stream to the Ochlockonee River. During the Pleistocene, surface tributaries removed the Hawthorn Formation within this area (Stringfield 1966) and dissected deeply into the formation allowing streamflow to be captured by subsurface drainage. With much of the original thickness of the Hawthorn Formation removed, water moved downward into the carbonate sequences. Dissolution of the limestone along vertical openings provided the initial development stages of solution channels and sinkholes. Large areas overlying the solution channels eventually collapsed as the roof above the solution channel weakened, and the sinkholes, which had formed along the course of the solution channels, coalesced. The result was the formation of a large solution basin that no longer connects with the Ochlockonee River. A ridge separates the river from this solution basin; no surface outlet remains and drainage is locally funneled to the lake. Erosional deposition and fill from the collapsed overlying sediments have formed a relatively low permeability unit in most of the basin, which has reduced the quantity of water lost to subsurface drainage.

Covered Karst Topography

The Porter Hole and Lime Sink depression areas are remnant features of the karstic processes that formed Lake Jackson. Vertical preferential flow tends to be concentrated within these depression areas where the percentage of leakage from the lake to the ground water is probably greater at all times than in other areas. This is because the confining unit beneath the depressions is assumed to be disturbed and it therefore allows more water to move vertically than is the case in most of the remainder of the lake bottom where the underlying confining unit is probably intact. Further, the permeable material underlying the depression areas is assumed to be more susceptible to piping processes than areas where the low permeability clays are undisturbed (Wagner 1984).

The formation of a sink similar to Porter Hole and Lime Sink is a function not only of the underlying material but also the pressure of water in the lake. As lake elevations rise, greater hydraulic head develops and greater pressures are exerted on the lake bottom. Vertical passageways caused by piping can begin to develop and penetrate into the more permeable fill material underlying the depression areas. This creates deeper vertical conduits that eventually penetrate the residual fill material and intersect the underlying carbonate aquifer, creating a sinkhole. Therefore, when the hydraulic head of the lake exceeds a certain value over a period of time, sinkholes may begin to form (Wagner 1984).

The vertical conduits can also be plugged or partially filled by sediments washing into the sinkhole after each rainfall event. The collapsed material, along with clays and silts transported by the channels leading into the sinkhole, will eventually wash into and become lodged within the conduit opening. With subsequent rains, more material will be transported into the conduit and an even more effective plug will develop. When plugging decreases the sink's acceptance rate or inflow exceeds the acceptance rate, water will begin to accumulate in the lake basin (Wagner 1984).

Hydrogeology of the Lake Jackson Area

There are three major hydrogeologic units in the Lake Jackson basin: 1) the Surficial Aquifer; 2) the Intermediate System, which includes a confining unit and an aquifer contained within the unit; and 3) the Floridan Aquifer System, which is the primary source of water for the area.

Surficial Aquifer

The Surficial Aquifer is not present within the main body of the lake basin, but is found in the higher topographic areas surrounding the lake. It is composed predominantly of sands and clayey sands, and averages 20 feet in thickness. The Surficial Aquifer is recharged in the vicinity of the lake, and rainwater that infiltrates the soil migrates vertically downward to the water-table. Movement within the aquifer is primarily lateral. The water-table generally represents a subdued replica of the surface topography, and water within the aquifer moves from higher to lower topographic elevations. In the immediate vicinity of Lake Jackson the water moves to the lowest depression (the lake) where it is discharged as seepage.

Because the potentiometric surface of the underlying Intermediate System is lower than that of the Surficial Aquifer, water from the Surficial Aquifer has the potential to leak downward through the confining unit material. The amount of leakage is dependent on the permeability of the clay beds separating the two aquifers and the head differences of the two potentiometric surfaces. In the Lake Jackson area, the head difference can be as great as 90 feet (Wagner 1984).

Intermediate System

The Intermediate System is present in the area surrounding Lake Jackson and may have a thickness as great as 130 feet; within the main body of the lake the thickness has been reduced to 70 feet or less. The system is composed primarily of low permeability clays, interrupted near the base by the Intermediate Aquifer, a thin sequence of low permeability carbonates. The basal clay beds that occur beneath the Intermediate Aquifer range between 10-20 feet in thickness and separate the Intermediate Aquifer from the underlying Floridan Aquifer System.

Movement within the Intermediate Aquifer is mainly lateral from areas of high to low potentials. On the western side of the Lake Jackson drainage basin, movement within the aquifer is toward streams which dissect the aquifer with the primary discharge area being the Ochlockonee River. In the eastern half of the drainage basin, movement within the aquifer is less defined, but the general gradient is southerly.

The potential exists for water to leak through the clay beds separating the Intermediate Aquifer from the Floridan Aquifer, depending on the permeability of the confining unit and the head differences. Where the confining unit is breached by solution features, the amount of leakage will be substantially greater than in undisturbed areas. The head difference between the two aquifers for this area is about 40-50 feet (Wagner 1984).

Floridan Aquifer System

The Floridan Aquifer is composed primarily of limestone with a productive thickness of about 500 feet. The aquifer can be divided into two dominant permeability zones. Approximately the top 100 feet of the aquifer, referred to as Zone A, is a fine grained carbonate characterized by moderate permeability. The upper 30-50 feet of Zone A contains unsaturated carbonates in some areas in the vicinity of the lake. The carbonates underlying Zone A are referred to as Zone B and have an extremely high permeability. Zone B is the primary portion of the Floridan Aquifer tapped locally by municipal and other high-yielding wells.

Regional movement within the Floridan Aquifer is southeasterly toward Wakulla County; the main discharge areas are Wakulla Springs, Spring Creek and offshore of Wakulla County in the Gulf of Mexico (Wagner 1984).

Lake Level Fluctuations and Surface Hydrology

Over the last century the level of Lake Jackson has varied as much as 20 feet. The history of fluctuations and the hydrological factors affecting the level of the lake are described below.

Lake Level Fluctuations

The level of Lake Jackson has fluctuated over the years, at times being dry or partially dry, which occurs at elevations below 78 feet NGVD. The extremes for the period of record (1950-93) show a maximum elevation at 96.16 feet NGVD, which occurred June 18, 1966, and a minimum elevation at 75.68 feet NGVD, which occurred January 4, 1957 (Wagner 1984). The lake experienced a drawdown most recently in October-November 1982.

Official records of lake elevations prior to 1950 do not exist, however, there are observations by local residents of the lake being dry or large portions of the lake bottom being exposed. Sellards (1914) reported that the lake bottom was dry or nearly dry during 1907. In May 1907, an opening occurred in Lime Sink, located off the southern shore in the northern portion of Lake Jackson, draining water from the lake and leaving the sink and a portion of the lake bottom dry. A second sink opened in June 1907 in the Porter Hole area about one mile southeast of Lime Sink. Other pre-record years in which the lake was reported to be dry or partially dry are 1909, 1932, 1935 and 1936 (Hughes 1967; Wagner 1984). Including 1982, the lake has been dry six times this century.

The average lake elevation over the period of record is 85.54 feet NGVD while the average since 1970, a period without wide fluctuations, has been 84.37 feet NGVD. Based on the distribution of recorded elevations, a minimum elevation of 78.1 feet and a maximum elevation of 93.8 feet may be expected once every 25 years.

Hydrology

Lake level fluctuations depend on the hydrology of the system, i.e., the inflow and outflow of water. Inflow is by rainfall, surface water runoff and groundwater discharge from the water-table to the lake basin. Outflow occurs by evaporation from the lake surface, loss of water through sinkholes, leakage through the bottom of the lake, and transpiration of water by vegetation (Wagner 1984).

Rainfall

Long-term rainfall data are not available for the immediate Lake Jackson basin; however, based on data from nearby rainfall stations, Wagner (1984) estimated average rainfall for the Lake Jackson watershed to be approximately 58 inches per year, or about 19,200 acre-feet. Rainfall within the Lake Jackson watershed accounts for the greatest changes in lake levels. Predictably, above normal rainfall causes the lake to rise, and below normal rainfall allows the level of the lake to gradually decrease (Wagner 1984).

Surface Water Runoff

Discharge measurements have been taken on Megginnis, Fords and Ox Bottom creeks since the mid-1970s. Wagner (1984) indicated that runoff may be 60-70 percent of the rainfall event although Bartel, Macmillan and Ard (1992) report that average runoff, at over 10,100 acre-feet per year, is about 53 percent of rainfall.

Surficial Aquifer Discharge

No data are available to quantify the contribution of inflow by discharge from the Surficial Aquifer. Base flow in the creeks appears to be low, and frequently no flow conditions exist. Wagner (1984) assumed the greatest amount of flow occurs during prolonged wet periods and decreases during dry periods, and that discharge from the Surficial Aquifer provides a relatively insignificant contribution to the total volume of water in the lake.

Evapotranspiration

The amount of water lost from the lake through the effects of lake surface evaporation, and to a lesser extent by transpiration, contributes to the outflow from the basin. No direct measurements of evaporation and transpiration are available for Lake Jackson; however, Wagner and Musgrove (1983) reported that evapotranspiration was a major cause of lake level decline for nearby Lake Iamonia, which is similar in origin and physical setting to Lake Jackson. Because Lake Jackson has less emergent and floating vegetation, this process may not have the same degree of impact; however, it does contribute to water loss during dry periods (Wagner 1984). Bartel, Macmillan and Ard (1992) report average evapotranspiration, based on pan coefficients, to be about 17,000 acre-feet per year.

Leakage to Groundwater System

This category of outflow includes loss through solution features and through general bottom infiltration. Lake Jackson contains at least two major sinks that have been active since 1950. Lime Sink tends to drain the northern portion of the lake, and Porter Hole Sink drains the southern portion. Porter Hole Sink appears to be capable of accepting at least 3,000 gallons per minute (6.1 cfs) at a lake elevation of 78 feet NGVD. In a study of a similar sink in northern Leon County (Iamonia Sink), Wagner and Musgrove (1983) reported a discharge rate of greater than 6,000 gallons per minute (12.3 cfs) at maximum lake elevation. Wagner (1984) concluded, based on similar characteristics of the solution features, that the sinks in Lake Jackson may have the ability to accept comparable volumes of water. Bartel, Macmillan and Ard (1992) report average total leakage, based on the continuity equation, to be about 11,800 acre-feet per year (or 7,320 gpm). This rate, encompassing the activity of two sinkholes and the lake bottom, is consistent with Wagner's estimates. Thus, it is possible that losses from the lake through solution features could account for as much as 32 inches in lake level differences per year.

Estimates of water loss due to leakage through the lake bottom sediments where the confining unit is relatively undisturbed by solution features are based on approximations of the permeability of the clays

separating the lake bottom from the aquifer. Wagner (1984) estimates that a loss of less than three inches per year can be accounted for through bottom infiltration.

In summary, Lake Jackson's fluctuations appear to be directly related to rainfall patterns and sinkhole activity (Hughes 1967; Wagner 1984; Bartel et al. 1992). Furthermore, Wagner (1984) proposed that given a prolonged drought period occurring when the elevation of Lake Jackson is 82.0 feet NGVD or less the predominant hydrologic factor will be leakage to the groundwater system and a natural drawdown is likely to occur.

Sediments

General Description

There are three generic types or assemblages of sediment recognized in Lake Jackson (Schamel 1974):

- (1) underlying geologic formation - the basement supporting the lake basin;
- (2) "natural" sediment - sediment deposited by natural processes unmodified by urbanization; and
- (3) "urban" sediment - sediment derived from rapid erosion of land cleared for construction and deposited in the lake by processes or at rates that differ appreciably from natural processes or rates.

Underlying Geological Formation

The underlying geologic formation is uniform across the lake basin, and consists of a compact, texturally homogenous, unsorted sandy clay or clayey sand. It is considered to be the upper portion of the Hawthorn Formation (Middle Miocene) (Schamel 1974).

Natural Sediment

The natural sediment of Lake Jackson is generally less than 4.5 feet thick, although there are greater thicknesses northwest of Rhoden Cove Landing, in the southwestern corner of the lake near U.S. 27 and at Miller's Landing. Thickness appears to be most closely related to bathymetry, particularly the slope of the basin.

The natural sediment in Lake Jackson has two diverse components: 1) well sorted, fine quartz sand, which is relatively featureless, and 2) muck (sapropel) and peat, which is decayed or partially decayed vegetative matter. In a typical section, the bottom layer of sediment is sand and is relatively free of organic matter but may contain clay or silt. The fraction of organic matter increases uniformly toward the top of the section, and peat or muck, with minor amounts of sand or organic rich sand, covers almost the entire lake bottom.

The natural sediment in the deepest portion of Megginnis Arm differs from the typical section described above. It is at least 3 feet thick and exhibits fine (1-2 mm) rhythmic laminations that may relate to individual storm events. The clay pinches out in the shallower fringes of southern

Megginnis Arm. In eastern Fords Arm, the muck and peat at the top of the natural sediment contains minor amounts of clay and silt thought to have been derived from construction sites in the Fords Arm watershed. The fraction of clay/silt in the muck and the thickness of the layer, which nowhere exceeds 0.6 feet, decrease sharply to the west (Schamel 1974).

Schamel (1974) postulated a model for natural sedimentation processes in Lake Jackson. The natural sediment is derived in situ from within the lake basin by 1) biogenic production of muck and peat, and 2) winnowing of silt and clay from the underlying geologic formation by wave action to produce a fine, well sorted sand. The muck is generated predominantly in the deeper or lower energy portions of the lake and the sand is generated within a broad high-energy zone close to the shoreline or in shallows, which sweep back and forth across the lake basin with the rise and fall of lake level. The winnowed fines are possibly removed from the lake basin through sinks.

Urban Sediment

Prior to the dredging of Megginnis Arm (concluded in May 1992), sediment that was unequivocally urban in character had been restricted to the southern half of Megginnis Arm, extending northward as far as the bathymetric ridge separating Megginnis Arm from the main lake basin, and the central area of Fords Arm. Dredging removed approximately 112,000 cubic yards of urban sediment from Megginnis Arm (NFWFMD 1992). No dredging is currently planned for Fords Arm.

Urban sediments have two basic components: 1) sandy material ranging from fine to extremely coarse, and 2) clay material virtually devoid of organic matter. The sandy material is composed of interbedded fine-to-coarse sand and pebbly sand, and includes mud clasts, ironstone pebbles and grains, sandstone clasts, charcoal and leaf fragments, and rare asphalt-coated sand grains. Building materials, blocks of masonry and macadam, a metal shopping basket and armored mud balls embedded in the dredged sand attested to the urban provenance and the rapidity of transport of the delta sediments. Urban clay material is virtually devoid of organic matter and is less compact and less organic than the underlying natural clay.

The dominant sedimentation process in southern Megginnis Arm in both pre-urban and urban times has been deposition of material derived from erosion in the watershed. Urbanization and highway construction have dramatically changed sedimentation rates and the character of the sediment, but not the basic process responsible for the sediment.

Based on the dredged volume, urban sediments were estimated to be accreting in Megginnis Arm at an average rate of 4,000 - 4,570 cubic yards per year since the early 1970s. This volume was attributed largely to the construction of the Tallahassee and Sugar Creek malls. The absence of newer projects of that scale plus the operational status of the Megginnis Creek and I-10 Stormwater Treatment facilities suggest that current rates of accretion are a fraction of this historical rate. The District has proposed additional SWIM funding to evaluate the effectiveness of dredging and related restoration activities.

In terms of contamination within urban sediments, Landing (1989) determined that the sediments of Megginnis Arm contained concentrations of total petroleum hydrocarbons (TPH) ranging from 20-250 ppm while those in the central lake were about 10 ppm. Landing (1992) also determined that TPH concentrations in Fords Arm were below detection limits. Fords Arm, however, was enriched in organic carbon relative to Megginnis Arm and this was attributed to stormwater nutrient loading.

Heavy Metals

Iron and manganese are the most abundant heavy metals in Lake Jackson and the highest concentrations are found in the natural sediments in Megginnis and Fords arms. In general, the concentration of heavy metals decreases with depth and higher concentrations of heavy metals are found along the normal flow path for water through the arms, suggesting that heavy metals have been deposited or removed from the water column during flow through these areas. Outside the flow path, concentrations of heavy metals are considerably lower (Wanielista et al. 1984). LaRock and Landing (1991) suggested that suspended particles (clays and organics) have scavenged dissolved metals during settling and deposition. Landing (1992) attributed the enriched levels of copper, zinc, and lead in Fords Arm to this process.

Nutrients

As with heavy metals, concentrations of phosphorus in the sediments indicate that deposition and accumulation is related to the normal flow of stormwater through the arms, decreasing toward the mouths of the arms and with areas outside of this flow path exhibiting significantly lower concentrations. Sediment concentrations of nitrogen, however, do not follow the same trend as phosphorus, which in Fords Arm exhibited a pattern of phosphate scavenging via iron redox cycling and ferric hydroxide precipitation. While nitrogen accumulation occurs near the center of Megginnis Arm, and is probably the result of continual growth and deposition of plant material not directly related to stormwater inputs (Wanielista et al. 1984), nitrogen concentrations are higher at the edges of Fords Arm (LaRock and Landing 1991).

Biology

There are several detailed studies documenting the biology of Lake Jackson, including those done by the Florida Game and Fresh Water Fish Commission (FGFWFC) in the late 1970s and early 1980s (Smith 1974; Babcock 1975, 1976; Dobbins and Rousseau 1982). The Florida DNR documented the vertebrate wildlife resources of the watershed in its Aquatic Preserve Management Plan (1991). Livingston (1993) provides the most recent assessment of in-lake fauna. The lack of more recent published biological data is unfortunate given that the periodic fluctuations in lake level can dramatically alter the lake's flora and fauna, completely eliminating some species and greatly enhancing others. For example, the 1957 natural drawdown is presumed responsible for the abundance of trophy-sized largemouth bass, but apparently also caused the elimination of chain pickerel and threadfin shad

(French and Olsen 1976). Except where noted, the biological information provided here does not reflect the effects of the 1982 natural drawdown and subsequent refilling; however, as such information becomes available it will be incorporated into the plan.

Aquatic Fauna

Fisheries

Table 1 gives the scientific and common names of 19 species of fish recovered from Lake Jackson during a study conducted in the spring and fall from 1974-75 through 1981-82 (Dobbins and Rousseau 1982). Two species reported by Smith (1974), Ictalurus natalis (yellow bullhead) and Centrarchus macropterus (flier), were not collected in this study. On the other hand, two species not reported by Smith, but collected by Dobbins and Rousseau, were Dorosoma petenense (threadfin shad) and Fundulus seminolis (seminole killifish). Since this study, Chain Pickerel (Esox niger) has been collected and Yellow Bullhead has returned to the lake.

TABLE 1. Scientific and common names of fishes collected from Lake Jackson 1974-82 (Dobbins and Rousseau 1982)

Common Name	Scientific Name	Family
Bowfin	<u>Amia calva</u>	Amidae
Golden shiner	<u>Notemigonus crysoleucas</u>	Cyprinida
Coastal shiner	<u>Notropis petersoni</u>	
Taillight shiner	<u>Notropis maculatus</u>	
Lake chubsucker	<u>Erimyzon sucetta</u>	Catostomidae
Brown bullhead	<u>Ictalurus nebulosus</u>	Ictaluridae
Tadpole madtom	<u>Noturus gyrinus</u>	
Golden topminnow	<u>Fundulus crysotus</u>	Cyprinodontidae
Seminole killifish	<u>Fundulus seminolis</u>	
Mosquitofish	<u>Gambusia affinis</u>	Poeciliidae
Brook silverside	<u>Labidesthes sicculus</u>	Atherinidae
Bluespotted sunfish	<u>Enneacanthus gloriosus</u>	Centrarchidae
Bluegill	<u>Lepomis macrochirus</u>	
Warmouth	<u>Lepomis gulosus</u>	
Redear sunfish	<u>Lepomis microlophus</u>	
Largemouth bass	<u>Micropterus salmoides</u>	
Black crappie	<u>Pomoxis nigromaculatus</u>	
Swamp darter	<u>Etheostoma fusiforme</u>	Percidae
Threadfin shad	<u>Dorosoma petenense</u>	Clupeidae

Lake Jackson has a fairly low total standing crop when compared to other Florida lakes, but one in which sportfish comprise an unusually high portion. The three major sportfish species in Lake Jackson are largemouth bass (Micropterus salmoides), bluegill (Lepomis macrochirus) and redear sunfish (Lepomis microlophus). These three species comprise approximately 75% of the average total weight of fish samples collected throughout the study period (Dobbins and Rousseau 1982).

Largemouth bass are abundant and account for approximately 30% of the average total standing crop. Although Lake Jackson is known primarily as a trophy lake for largemouth bass, the vast majority of individuals are associated with the smaller size classes. Harvestable largemouth bass less than or equal to 15 inches in total length account for an average of approximately 87% by number of all harvestable bass. Based on otolith studies, the largemouth bass of Lake Jackson appear to be a slow growing population.

Bluegill sunfish comprise an average of approximately 33% of the total of all fish. Redear sunfish are the least abundant of the major sportfish species, comprising an average of approximately 11.5% of the total standing crop. Other sportfish species include black crappie (Pomoxis nigromaculatus) and warmouth (Lepomis gulosus), however both are present in only small numbers (Dobbins and Rousseau 1982).

Threadfin shad had been reported as being abundant in Lake Jackson prior to the natural drawdown of 1957, but were not found after the lake refilled. Consequently, in the spring of 1979, a total of 3,650 adult threadfin shad were stocked in the lake in an attempt to expand the forage base of the fishery. It appeared this venture was successful until the fall of 1981 when no threadfin shad were recovered. The species' demise was apparently due to a combination of severe cold weather and lowered water levels, which reduces the lake's capacity to ameliorate rapid temperature changes (Dobbins and Rousseau 1982). The species was restocked intermittently through 1984. Following lowered lake levels through 1993, restocking of another 3,000 to 4,000 adults is planned for 1994 (Dobbins, personal communication). Another species, chain pickerel (Esox niger), reappeared in 1991. Chain pickerel may have arrived from elsewhere in the watershed via Lake Carr or Fords Arm. The population, which prefers more highly vegetated waterbodies, had a strong year-class in 1993 and is expanding.

In the fall of 1981, 104 Seminole killifish (Fundulus seminolis), a species never before reported in Lake Jackson, were recovered. Current assessments of the status of the Seminole killifish are not available, however, if still present, the potential exists for this species to be an important addition to the forage base of the lake (Dobbins and Rousseau 1982).

Aquatic Invertebrates

Table 2 lists the invertebrates that were collected from Lake Jackson by Dobbins and Rousseau (1982) from 1974 to 1977. The most abundant group of macroinvertebrates belong to the family Tendipedidae (midges). Midges are an important food group, forming a large part of the diet of many freshwater fishes (Usinger 1971). Smith (1974) reported a dramatic increase in the abundance of tendipeds following a 4 feet increase in water levels, but

Dobbins and Rousseau (1982) found that a 1.7 feet rise had no significant effect on tendiped abundance.

The principal amphipod in Lake Jackson is Hyalella azteca. Described by Pennak (1953) as clean water organisms, the scarcity of amphipods in Megginnis Arm can be attributed to degraded conditions there. Increases in amphipods were noted from 1976 to 1977 and are thought to be related to rising water levels (Dobbins and Rousseau 1982).

In contrast to amphipods, phantom midges (Chaoborus sp.) of the family Culicidae are found in greatest numbers in upper Megginnis Arm, but are absent or present in low numbers in the lake proper. Holcomb (1976) found the abundance of the culicid Chaoborus to be positively correlated with lake degradation, therefore the abundance of Chaoborus in the arm is another indicator of degraded conditions (Dobbins and Rousseau 1982).

TABLE 2. Aquatic macroinvertebrate groups collected from Lake Jackson from 1974-77 (Dobbins and Rousseau 1982)

Common Name	Phylum
Flatworms	Platyhelminthes
Roundworms	Nematoda
Aquatic worms	Annelida
Leeches	
Scuds	Arthropoda
Shrimp	
Seed Shrimp	
Mayflies	
Dragonflies	
Damselflies	
Caddis flies	
Water beetles	
Leaf beetles	
Flies	
Phantom midges	
Midges	
Biting midges	
Snails	Mollusca
Bivalves, clams	

Oligochaetes (aquatic worms) are found throughout Lake Jackson although highest numbers are usually found in Megginnis Arm. Hirudinea (leeches), although typically found in low numbers over most of the lake, are usually absent in upper Megginnis Arm. Pennak (1953) indicated that leeches

are rarely found on mud and clay bottoms, which would explain their absence. Other aquatic macroinvertebrates found less frequently are turbellarians (flatworms), nematodes (roundworms), decapods (freshwater shrimp), odonates (dragon flies and damselflies), hemipterans (true bugs), coleopterans (beetles) and ostracods (seed shrimp) (Dobbins and Rousseau 1982).

As noted at the beginning of this section, the macroinvertebrate samples described above are from a study conducted from 1974 to 1977. Dobbins and Rousseau reported in 1982 that, since the termination of invertebrate sampling in the spring of 1977, water levels in Lake Jackson declined to a point not reached since the 1957 natural drawdown. During the 1982 dewatering, large expanses of lake bottom were exposed, including all macroinvertebrate stations in Megginnis and Fords arms. They predicted that upon reflooding patterns of macroinvertebrate occurrence would be markedly altered in terms of population diversity and numbers due to vegetation changes, sediment consolidation, and compaction and solidification of formerly unconsolidated organic ooze. Dense stands of terrestrial vegetation and re-establishment of aquatic vegetation in areas where it had long been absent were also expected to increase diversity and abundance of macroinvertebrates, which would in turn increase the quality and standing crop of the Lake Jackson sport fishery. Such dramatic results have been observed and documented by artificial drawdowns instigated on other Florida lakes (e.g., Wegener and Williams 1974), however there is no significant documentation of the effects produced by a natural dewatering and reflooding. A comprehensive biological assessment would be appropriate to document the effects the 1982 natural drawdown and refilling on the biology of Lake Jackson.

Livingston (1993) characterized the macroinvertebrate community in Lake Jackson in 1988 and correlated the diversity with dissolved oxygen at the lake's bottom. A comparison with the previous inventories of the lake was not made, however. Thirty-six different species were identified, dominated by Chironomids (bloodworms) and Nematodes (roundworms). Open lake samples exhibited higher diversity and numbers. Chironomids, indicative of reducing environments, were predominant in and adjacent to the arms.

Flora

The flora of Lake Jackson include submerged and emergent wetland species. The lake's fringe features both woody transitional and water-tolerant upland species.

Aquatic Flora

A total of 73 vascular plant species were collected from Lake Jackson from 1974 to 1979 (see Table 3). There is limited information regarding the non-vascular and planktonic species of the lake. The three most common submerged species were Bacopa caroliniana, Eleocharis baldwinni and Sagittaria subulata var subulata, a dwarf sagittaria. Bacopa is generally considered a submergent plant but can exist as an emergent in moist soils immediately above the waterline. It appears to be sensitive to lake level changes and is most abundant at the water's edge. Eleocharis baldwinni likewise thrives as an emergent in moist soils at the water's edge and appears, in general, to be capable of tolerating drier soils than Bacopa. Sagittaria subulata var

subulata does not commonly occur in moist soils above the waterline (Dobbins and Rousseau 1982).

An important emergent species, Panicum hemitomon, establishes above the lake edge, yet also survives when submerged. It is very responsive to dewatering and reflooding, and appears to be stimulated by spring burning and by mowing in late summer. Dense beds of emergent Panicum provide excellent cover for fish and are productive feeding grounds (Dobbins and Rousseau 1982).

Nelumbo lutea (American lotus) is a floating-leaf plant occurring as marginal throughout large portions of Lake Jackson. Nelumbo is seasonal in its growth and coverage. Floating leaves first appear during the spring and continue to grow throughout the summer, with maximum coverage reached by early fall. At this time Nelumbo begins to die back with stems and leaves subjected to heavy predation by insects, primarily pyralid lepidopterans (bonnet worms). By midwinter the dieback is completed, with little evidence remaining of the plant's previous presence. Nelumbo appears to be sensitive to fluctuations in water level, changing in abundance when the water rises or falls (Smith 1974; Dobbins and Rousseau 1982). In Lake Jackson, Nelumbo was found to be sensitive to herbicides, as its coverage was substantially reduced in the southern end in 1975 and 1976 when hydrilla (Hydrilla verticillata Royal) was treated with chemicals (Dobbins and Rousseau 1982).

TABLE 3. Vascular Plants from Lake Jackson transects, 1974-79 (Dobbins and Rousseau 1982)

Common Name	Scientific Name
Gerardia	<u>Agalinis fasciculata</u>
Ragweed	<u>Ambrosia</u> sp.
Broom straw	<u>Andropogon</u> sp.
Aster	<u>Aster dumosus</u>
Carpet grass	<u>Axonopus</u> sp.
Groundsel-tree	<u>Baccharis glomeruliflora</u>
Water hyssop	<u>Bacopa caroliniana</u>
Beggar ticks	<u>Biden mitis</u>
Fanwort	<u>Cabomba caroliniana</u>
	<u>Centella repanda</u>
Buttonbush	<u>Cephalanthus occidentalis</u>
Coontail	<u>Ceratophyllum demersum</u>
Nutsedge	<u>Cyperus</u> sp.
Queen Anne's Lace, Wild carrot	<u>Daucus carota</u>
	<u>Dichondra carolinensis</u>
Crab grass	<u>Digitaria sanguinalis</u>
	<u>Dioda</u> sp.
Brazilian elodea	<u>Egeria densa</u>
Water hycyanth	<u>Eichhornia crassipes</u>
Spikerush	<u>Eleocharis baldwini</u>
	<u>Erigeron canadensis</u>
Pipewort	<u>Eriocaulon</u> sp.
	<u>Eryngium baldwini</u>

CONTINUED

TABLE 3. Continued

Common Name	Scientific Name
Dog-fennel	<u>Eupatorium capillifolium</u>
	<u>Fimbristylis</u> sp.
Umbrella grass	<u>Fuirena squarrosa</u>
	<u>Galactia</u> sp.
Cudweed, Rabbit tobacco, Everlasting	<u>Gnaphalium obtusifolium</u>
Cudweed	<u>Gnaphalium purpureum</u>
Creeping cucumber	<u>Melothria</u> sp.
	<u>Hibiscus</u> sp.
	<u>Hydrilla verticillata</u>
Marsh pennywort	<u>Hydrocotyle umbellata</u>
St. John's-wort	<u>Hypericum mutilum</u>
Rush	<u>Juncus biflorus</u>
Rush	<u>Juncus dichotomus</u>
Rush	<u>Juncus effusus</u>
Cut grass	<u>Leersia hexandra</u>
Japanese clover	<u>Lespedeza striata</u>
Frog's-bit	<u>Limnobium</u> sp.
Loosestrife	<u>Ludwigia arcuata</u>
Loosestrife	<u>Ludwigia leptocarpa</u>
Wax myrtle	<u>Myrica cerifera</u>
Watermilfoil	<u>Myriophyllum pinnatum</u>
	<u>Najas ancistrocarpa</u>
Bush-pondweed, Water nymph	<u>Najas guadalupensis</u>
American lotus, yellow nelumbo, Pond nuts	<u>Nelumbo lutea</u>
	<u>Nitella</u> sp.
	<u>Nuphar advena</u>
Spatter-dock, Cow-lily, Yellow pond-lily	<u>Nymphaea odorata</u>
Fragrant water lily	<u>Nymphoides aquatica</u>
Floating heart, Banana lily	<u>Oldenlandia</u> sp.
	<u>Oxalis stricta</u>
Wood sorrel	<u>Panicum hemitomon</u>
Maidencane	<u>Panicum repanda</u>
Torpedo grass	<u>Paspalum notatum</u>
Bahia grass	<u>Polygonum hirsutum</u>
Smartweed	<u>Pontederia cordata</u>
Pickerelweed	<u>Rhexia cubensis</u>
	<u>Rhynchospora perplexa</u>
Beak rush	<u>Rhus copallina</u>
Dwarf or winged sumac	<u>Rubus canadensis</u>
Blackberry	<u>Sagittaria subulata</u>
	<u>Sagittaria latifolia</u>
Arrowhead	<u>Salix nigra</u>
Black willow	<u>Solidago altissima</u>
Goldenrod	<u>Stellaria</u> sp.
Chickweed	<u>Spiranthes vernalis</u>
Spring ladies tresses	<u>Utricularia biflora</u>
Bladderwort	<u>Vigna luteola</u>

CONTINUED

TABLE 3. Continued

Common Name	Scientific Name
Grape	<u>Vitis</u> sp.
Yellow-eyed grass	<u>Wahlenbergia</u> sp. <u>Xyris</u> sp.

Hydrilla, an exotic plant which has become a serious problem in bodies of water throughout the state, became established in Lake Jackson during the early 1970s. It has since been found throughout the lake, but in response to nutrient enrichment, virtually exploded in the summer of 1986, threatening recreational use in the entire southern half. In the spring of 1987, the Florida Department of Natural Resources (FDNR) first treated the hydrilla with with \$100,000 worth of SONAR, a herbicide. The lake has since been treated in 1988, 1990, 1992 and 1993. As of October 1993, hydrilla occupies roughly one-third of the lake's area.

Dendrology

Trees comprise a major part of the vegetation surrounding Lake Jackson. The dominant pine species is loblolly pine; the major hardwood species include live oak, water oak, laurel oak and sweetgum. Sweetgum trees, which are not particularly sensitive to water level changes, are abundant in lowlands subject to flooding as well as drier uplands (Neuman 1985).

Oak trees, generally associated with xeric communities, are abundant along the lake shoreline in well-drained soils. The major oak species are live oak, laurel oak and water oak. Live oak and laurel oak are "weakly tolerant" to water inundation, meaning they are capable of living from seedling through maturity in soils that are temporarily inundated for durations of 1-4 weeks. Water oak is considered "tolerant" to water inundation, i.e., capable of withstanding flooding for most of one growing season during which new root development can be expected. Oak trees are not generally considered a pioneer species since they do not readily invade disturbed areas as quickly as other species (Neuman 1985).

Loblolly pine (old field pine) has the ability to rapidly invade abandoned sites. It is considered moderately tolerant to inundation and is capable of living from seedling to maturity in soils inundated about 50% of the time (Neuman 1985).

Vegetative Succession and Lake Level Fluctuations

Dobbins and Rousseau (1982) documented a general trend in vegetative succession when declining lake levels exposed significant amounts of organic sediments in Lake Jackson. As water levels subsided to less than one foot in depth over organic muck bottom, large assemblages of Bacopa caroliniana, Sagittaria subulata var subulata, and Eleocharis baldwinni began to appear. Germination of these plants increased as water levels continued to drop, and

by the time sediments became exposed dense stands of these species were present. As the extent of dewatering and consolidation increased, these plants were replaced by emergent and terrestrial species. Dwarf sagittaria could not tolerate complete dewatering and was the first to disappear. Bacopa survived and flourished as an emergent as long as soil moisture remained sufficiently high. Eleocharis tolerated dewatering best and survived longest on exposed sediments before being eliminated.

As submergent species disappeared from exposed sediments, marginal and emergent plants began to dominate. Pontederia cordata (pickerelweed) and Cyperus sp. (sedges) were among the first to appear, followed shortly by Juncus sp. (rushes), Fuirena squarrosa (umbrella grass), Polygonon hirsutum (smartweed) and others. Terrestrials such as Eupatorium capillofolium (dog fennel), Andropogon sp. (broom straw), Paspalum notatum (bahia grass), Digitaria sanguinalis (crabgrass) and Dichondra carolinensis eventually became established in these areas.

Gilbert (1985) documented the vegetative succession of Lake Jackson in 1984 after lake levels had risen subsequent to the 1982 dewatering. In the lower palustrine zone (aquatic), Nelumbo lutea (lotus) and Eleocharis sp. (hairgrass) were the dominant species. In the upper palustrine zone (wetland-transitional), Gilbert found primarily Sacciolepis striata and Bidens mitis (beggar tick). The transitional mesic zone contained Liquidambar styraciflua (sweetgum), Myrica cerifera (wax myrtle) and Sambucus canadensis (elderberry). Quercus spp. (oak) was the dominant species in the upland zone.

Vertebrate Wildlife

The wildlife of the Lake Jackson watershed are diverse and include several endangered or threatened species and species of special concern. The following summary of vertebrate species in the Lake Jackson watershed is taken from the DNR Aquatic Preserve Management Plan (FDNR 1991).

Mammals

The mammalian fauna of the Lake Jackson watershed are summarized in Table 4 below.

TABLE 4. Mammalian fauna of the Lake Jackson watershed

Common Name	Scientific Name
Virginia Opossum	<u>Didelphis virginiana</u>
Least Shrew	<u>Cryptotis parva</u>
Shorttail Shrew	<u>Blarina brevicauda</u>
Eastern Mole	<u>Scalopus aquaticus</u>
Raccoon	<u>Procyon lotor</u>
Long-tailed Weasel	<u>Mustela frenata</u>
River Otter	<u>Lutra canadensis</u>
Spotted Skunk	<u>Spilogale putorius</u>
Striped Skunk	<u>Mephitis mephitis</u>

CONTINUED

TABLE 4. Continued

Common Name	Scientific Name
Red Fox	<u>Vulpes vulpes</u>
Gray Fox	<u>Urocyon cinereoargenteus</u>
Bobcat	<u>Felis rufus</u>
Eastern Gray Squirrel	<u>Sciurus carolinensis</u>
Eastern Fox Squirrel	<u>Sciurus niger</u>
Southern Flying Squirrel	<u>Glaucomys volans</u>
Round-tailed muskrat	<u>Neofiber alleni</u>
Eastern Cottontail	<u>Sylvilagus floridanus</u>
Marsh Rabbit	<u>Sylvilagus palustris</u>
Coyote	<u>Canis latrans</u>
Whitetail Deer	<u>Odocoileus virginianus</u>
Nine-banded Armadillo	<u>Dasyurus novemcinctus</u>

Birds

More than 150 species of upland birds, wading birds, waterfowl and shore birds have either breeding, summer, or winter ranges that overlap the Lake Jackson watershed. A standard field guide (e.g., Peterson 1980) provides detailed information on particular species.

Several species of ducks use Lake Jackson as a wintering area. The FGFWFC, in its 1984-1988 Midwinter Waterfowl Inventory, noted that ring-necked ducks (Aythya collaris) are the most prevalent users and that they move locally on a daily basis between Lake Jackson and the surrounding wetlands. Other ducks that use the lake during the winter include the following: Aythya affinis (lesser scaup), Anas americana (American wigeon), Bucephala albeola (buffleheads), Oxyura jamaicensis (ruddy ducks) and Fulica americana (American coots) (Eggeman, FGFWFC, Personal Communication 1988).

A wading bird rookery is located approximately 1.5 miles from Lake Jackson. Nesting wood storks (Mycteria americana) were first documented there in 1984 (Florida Natural Areas Inventory); however, wood storks may have nested in this area as early as 1976 (Rodgers, FGFWFC, Personal Communication 1988). Little blue herons (Egretta caerulea) have been active in the rookery since 1976, but it is not known whether they have recently nested at the site (Runde, FGFWFC, Personal Communication 1988). Cattle egrets (Bubulcus ibis) also nest in the rookery. All of these species forage on Lake Jackson. There is another large wading bird colony on an island between Carr Lake and Mallard Pond in the northern part of the watershed (Young et al., FGFWFC 1987). Other small wading bird and/or shorebird colonies may occur within the lake basin. During periods of low water level, the lake bottom has been used by shorebirds for nesting (Jackson, Florida Natural Areas Inventory, Personal Communication 1988).

Amphibians

Amphibians found in or around north Florida lake environments are listed in Table 5.

TABLE 5. Amphibians found in or around North Florida lake environments.

Common Name	Scientific Name
Greater Siren	<u>Siren lacertina</u>
Eastern Lesser Siren	<u>Siren intermedia</u>
Two Toed Amphiuma	<u>Amphiuma means</u>
Green Frog	<u>Rana clamitans</u>
Pig Frog	<u>Rana grylio</u>
Bullfrog	<u>Rana catesbeiana</u>
Southern Leopard Frog	<u>Rana utricularia</u>

In addition to the above amphibians, the following species of amphibians probably occupy, either permanently or seasonally, damp microhabitats adjacent to Lake Jackson.

TABLE 6. Amphibians that probably occupy (permanently or seasonally) damp microhabitats adjacent to Lake Jackson.

Common Name	Scientific Name
Mole Salamander species	<u>Ambystoma</u> spp.
Tree Frog species	<u>Hyla</u> spp.
Red and Mud Salamanders	<u>Pseudotriton</u> spp.
Brook Salamander species	<u>Eurycea</u> spp.
Little Grass Frog	<u>Limnaoedus ocularis</u>
Eastern Narrowmouthed Toad	<u>Gastrophryne carolinensis</u>
True Toad species	<u>Bufo</u> spp.

Reptiles

Populations of aquatic and semi-aquatic reptiles probably inhabit areas of wetlands or open water habitat within the Lake Jackson watershed. These are summarized in Table 7 below.

TABLE 7. Aquatic and semi-aquatic reptiles that probably inhabit the Lake Jackson watershed

Common Name	Scientific Name
American Alligator	<u>Alligator mississippiensis</u>
Stinkpot	<u>Sternotherus odoratus</u>
Eastern Mud Turtle	<u>Kinosternon subrubrum</u>
Florida Cooter	<u>Pseudemys floridana</u>
Yellow-Bellied Slider	<u>Trachemys scripta</u>
Eastern Chicken Turtle	<u>Deirochelys reticularia</u>
Florida Softshell	<u>Trionyx ferox</u>
Alligator Snapping Turtle*	<u>Macrolemys temmincki</u>
Snapping Turtle	<u>Chelydra serpentina</u>
Water Snake species**	<u>Nerodia spp.</u>
Black Swamp Snake	<u>Seminatrix pygaea</u>
Mud Snake	<u>Farancia abacura</u>
Ribbon Snake	<u>Thamnophis sauritus</u>

* Documented in nearby Lake Iamonia (Florida Natural Areas Inventory), and may possibly occur in Lake Jackson.

** Three Nerodia species probably occur within Lake Jackson watershed.

Species and Habitats of Special Significance

Certain species of wildlife in the Lake Jackson watershed have been designated as endangered (E), threatened (T) or a species of special concern (SSC) by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act or the FGFWFC regulations. Other species are "under review for federal listing (UR2), but substantial evidence of biological vulnerability and/or threat is lacking." Endangered species are biologically vulnerable species of limited numbers which are currently in danger of extinction due to existing environmental stresses to the species itself, and/or dangers to their remaining significant habitat(s). Threatened species, although not as critically stressed as endangered species, are also jeopardized. Species of special concern have generally experienced either a long-term or occasional catastrophic population reduction or habitat loss, and may therefore be particularly vulnerable to one or more types of environmental stress.

TABLE 8. Endangered species, threatened species, and species of special concern in the Lake Jackson watershed.

E=endangered, T=threatened, SSC=species of special concern, USFWS=U.S. Fish and Wildlife Service, FGFWFC=Florida Game and Fresh Water Fish Commission, UR2=under review for federal listing.

Species	Designation	
	FGFWFC	USFWS
Round-tailed Muskrat* (<u>Neofiber alleni</u>)	UR2	
Wood Stork (<u>Mycteria americana</u>)	E	E
Little Blue Heron (<u>Egretta caerulea</u>)	SSC	
Snowy Egret (<u>Egretta thula</u>)	SSC	
Bald Eagle (<u>Haliaeetus leucocephalus</u>)	T	E
Osprey (<u>Pandion haliaetus</u>)	SSC	
Least Tern (<u>Sterna antillarum</u>)	T	
American Alligator (<u>Alligator mississippiensis</u>)	SSC	T(S/A)**
Alligator Snapping Turtle*** (<u>Macroclemys temmincki</u>)	SSC	UR2

* Documented in nearby Carr Lake (Florida Natural Areas Inventory), and may occur in Lake Jackson.

** Threatened due to similarity of appearance.

*** Documented in nearby Lake Iamonia (Florida Natural Areas Inventory), and may possibly occur in Lake Jackson.

It should be noted that significant habitats such as the wood stork rookery previously discussed require substantial protection. Even minor disturbances to such areas may have considerable adverse impacts on species populations.

Water Quality

The water quality of Lake Jackson was studied extensively in the late 1970s, and documented in several FGFWFC reports (Smith 1974; Harriss and Turner 1974; Dobbins and Rousseau 1982). More recent studies include those by LaRock (1988), Livingston (1988), LaRock (1990), LaRock and Landing (1991), Livingston (1993), and generally indicate a worsening of overall water quality since the studies of the seventies. As additional data becomes available, they will be incorporated into the management plan. The following discussion of the water quality of Lake Jackson is based on the above studies.

Temperature and Dissolved Oxygen

The thermal regime of a lake is related to its trophic state. Because higher water temperatures tend to stimulate aquatic plant growth, other factors such as nutrient supply being equal, this water quality parameter is of critical importance. The distribution of temperature with depth in a lake, by virtue of controlling density, also influences the circulation of lake water and the exchange of dissolved substances, such as nutrients between bottom waters and surface waters. In spite of the shallowness of Lake Jackson, and therefore the ease of wind mixing, considerable temperature differences between surface and bottom waters occur even in winter when more temperate lakes would be nearly homogenous with respect to temperature (Harriss and Turner 1974).

The thermal regime of a lake, in part, determines the amount of dissolved oxygen in the lake. Temperature affects the level of saturation and cooler waters are capable of containing more oxygen. Further, thermoclines inhibit the transfer of oxygen between lake layers. Where bottom waters contain more decomposing organic matter, low dissolved oxygen conditions are likely to exist, especially if the water column is thermally stratified. In the center of Lake Jackson the amount of dissolved oxygen varies only slightly with changes in season and depth, partly because of mixing from wind. Notable exceptions occur in spring and early summer when oxygen sags are present and correspond with thermal stratification (Harriss and Turner 1974).

The seasonal fluctuation in dissolved oxygen in Megginnis Arm frequently creates oxygen sags in near-bottom waters, especially during thermal stratification which occurs throughout the warmer weather. This stratification, however, is not very stable. One critical factor bearing on the temperature-dissolved oxygen cycle in Megginnis Arm appears to be stormwater runoff following heavy rainfall. The frequency of low dissolved oxygen level in the bottom waters of Megginnis Arm is considerably greater than in the lake proper, clear evidence that the biota in the arm are at times stressed with respect to oxygen (Harriss and Turner 1974).

Livingston (1993) measured dissolved oxygen at both the surface and the bottom of the lake. [Other recent research included surface measurements only or diurnals for one location and one date.] Oxygen sags, periods of prolonged concentrations below 4.0 ppm, occurred throughout much of the lake's shallow areas during the warmer months (May through September) of 1992. Currently, Fords Arm exhibits the lowest average oxygen levels in the lake (less than 6.0 mg/l), while Megginnis Arm and adjacent waters average between 6.0 and 8.0 mg/l. The remainder of the lake exhibits near-saturation levels of dissolved oxygen.

pH

pH is an index of hydrogen ion activity in water and originates in natural waters largely from the carbonic system. It is important in aquatic ecosystems because it exerts major influence on the chemical form, and thus the mobility of many elements. For instance, the bio-availability of many nutrients and toxic substances, particularly metals, varies markedly with pH. In addition, aquatic organisms can exert considerable control on pH, especially in poorly buffered systems, through photosynthesis and respiration by removal and addition of carbon dioxide from solution.

Harriss and Turner (1974) reported the average pH of surface water from Lake Jackson proper and Fords Arm ranged from 5.7 to 9.1; however, in Megginnis Arm the range was from 6.5 to 10.2. Dobbins and Rousseau (1982) reported similar pH values, and noted that the highest values generally occurred in upper Megginnis Arm and were associated with algal blooms.

Alkalinity

Alkalinity is an index of the capacity of a natural waterbody to neutralize hydrogen ions, and thus expresses the pH buffering capacity of the water. Alkalinity is attributable to the presence of carbonates, bicarbonates, hydroxides and, to a lesser extent, borates, silicates, phosphates and organic substances. Consequently, alkalinity tends to be correlated with conductivity (see below).

Harriss and Turner (1974) found the average total alkalinity of surface water from Fords Arm to be higher than that from the main body of Lake Jackson. For Megginnis Arm the values were much higher. Megginnis Arm also exhibited a marked increasing trend in total alkalinity; Fords Arm exhibited a lesser but definitely increasing trend. The origin of higher and increasing alkalinity in Megginnis and Fords arms is unknown but may be silicates from land runoff. Whatever the origin, the higher alkalinities in Megginnis Arm clearly account for the apparent better pH buffering in this sector of the lake (Harriss and Turner 1974).

Alkalinity may also be correlated with increasing organic matter. Carbon dioxide from increased respiration and oxidation of detritus contributes to the formation of additional carbonates in the water column. As macrophyte and phytoplankton populations continue to rise in the lake, alkalinity may be expected to increase.

Alkalinity concentrations increased uniformly in late 1983 - early 1984 throughout the lake. These concentrations have remained high, and currently alkalinity levels throughout the lake are roughly 50 percent greater than they were a decade ago.

Specific Conductance

Specific conductance (or conductivity) is a measure of the ability of water to conduct an electrical current, and thus depends upon the presence and quantity of ionic forms of the elements in solution. In general, the average conductivity in Fords Arm is higher than water from the main body of the lake, and that in Megginnis Arm is yet higher (Harriss and Turner 1974). In

addition to this pattern, conductivity has exhibited an increasing trend in Megginnis Arm, and a similar but lesser trend in Fords Arm. It appears that the increased land runoff from the urban watershed is solely responsible for the increasing conductivity in Megginnis and Fords arms (Harriss and Turner 1974). LaRock (1990) correlated the increase in conductivity within Megginnis Arm between 1971 and 1985 with the change in impervious surface within the arm's drainage area. This effect, however, appears to be local in character: the outer reaches of the arm as well as the main body of the lake have not shown a similar response. Harriss and Turner (1974) noted that conductivity in the open lake is essentially constant.

Turbidity and Suspended Solids

The turbidity of water is a measure of the extent to which the intensity of transmitted light is reduced by suspended solids contained in the water. In other words, turbidity is a measure of how clear or cloudy the water is, and is a function of how many microscopic particles are suspended in the water column. Turbidity had been one of the most obvious of the water quality problems facing Lake Jackson, and both Harriss and Turner (1974) and Dobbins and Rousseau (1982) reported that turbidity measurements taken in Megginnis and Fords arms are greater and more variable than in other parts of the lake.

Lakewide elevated levels of turbidity were observed after the construction of I-10 and following the refilling of the lake in 1983. Construction site erosion was the cause in the first instance while resuspension of dried and disturbed sediments was the primary cause in the second case. Additional spikes in turbidity levels in the southern part of the lake are attributed to the construction of the Megginnis Arm stormwater treatment facility in 1983-84 and the dredging of the arm in 1989. Turbidity and suspended solids have not been a significant problem since that time, and except for Megginnis Arm, turbidity has remained at near background levels. Elevated levels in the arm may be indicative of resuspension of sediments during periods of high flow.

True Color

Water color may be of natural mineral or plant origin, caused by metallic substances such as iron and manganese compounds, or the result of humus substances, peat, tannis, algae, weeds and protozoa. The average true color from Megginnis and Fords arms is somewhat higher than that of the open lake. Higher true color appears to correspond with "wet" periods when there was higher land runoff into the lake and with major algal blooms (Harriss and Turner 1974).

Secchi Depth

Secchi depth is the water depth at which a 21 cm diameter white disc can no longer be seen by a surface observer. It is used to determine the lower limit of the photic zone. Because both turbidity (suspended matter) and true color influence water transparency, the Secchi depth is a measure of the combined effect of these water quality parameters. Secchi depths in Lake Jackson generally indicate that most of the water column is well lighted, with

the exception of inner Megginnis Arm, and is thus capable of supporting plant growth (Harriss and Turner 1974).

Total Residue

Total residue (total suspended solids) is the amount of material present in a container following evaporation of a water sample at a given temperature. High values for this parameter are considered indicative of poorer water quality. Trends of total residue measurements for Lake Jackson are similar to those of turbidity and Secchi disc depth in that higher values of total residue are consistently found in samples taken from Megginnis and Fords arms, with lower values being recorded for locations in the lake proper (Dobbins and Rousseau 1982).

Chloride and Sulfate

Chloride and sulfate are among the major anions usually found in natural waters. Chloride is a "conservative" element in that it is highly soluble and does not participate significantly in biochemical or adsorption reactions. Sulfate is also conservative, but less so than chloride because of its role in the biological sulfur cycle.

The limited data on these elements in water from Lake Jackson suggests that both are low in concentration with very little spatial or temporal variation. In Megginnis Arm, however, sulfate concentrations do appear to be somewhat higher (Harriss and Turner 1974; Dobbins and Rousseau 1982).

Landing and Guentzel (LaRock and Landing 1991) determined that chloride concentrations in the lake are particularly sensitive to lake level (volume). Rapid increases in volume due to rainfall are accompanied by decreases in concentration; however, because stormwater contributes to the total load the total mass of chloride in the lake increases with volume. The dominant source of chloride is believed to be oceanic aerosols.

Concentrations of sulfate, unlike chloride, decrease during the growing season as a result of reduction in the sediments and plant uptake. Elevated levels of sulfate, in both bulk deposition and stormwater, are related to acid deposition.

Silicon

Dissolved silicon in lake water and stormwater is derived primarily from the weathering of silicate minerals in soils where it is typically the second most abundant element. In Lake Jackson, dissolved silicon concentrations vary widely, but are consistently higher in the southern arms than in the main lake. High dissolved silicon levels in the arms correlate with turbidity, and therefore with runoff into the lake. High dissolved silicon in Lake Jackson bottom waters is sometimes associated with low dissolved oxygen, suggesting recycling of silicon from decaying organic matter or bottom sediment (Harriss and Turner 1974). As indicated above, the increase in silicon is correlated with the lake's increase in alkalinity and buffering.

Nitrogen

Nitrogen exists in several states in aquatic systems. Ammonia, nitrite, and nitrate represent successively oxidized inorganic forms of the element. Organic nitrogen, i.e., that which has been assimilated into plant and animal tissue and detritus, comprises the largest share by weight of total nitrogen in the lake.

Nitrate is the end product of the aerobic stabilization of organic nitrogen and normally reaches highest concentrations in the final stages of biologic oxidation. Nitrite, on the other hand, is generally formed in natural waters by the action of bacteria upon ammonia and organic nitrogen. Since this form of inorganic nitrogen is readily oxidized to nitrate it seldom occurs in significant concentrations in surface waters (Harriss and Turner 1974). Its presence then, even in small quantities, is often used to indicate degraded water quality. Concentrations of nitrite are typically below detection limits in Lake Jackson, except in Megginnis Arm, where its concentration is typically one order of magnitude below that of nitrate.

Natural surface waters are typically low in nitrate because it is readily converted to organic nitrogen in plant cells by photosynthesis. Nitrate concentrations in Lake Jackson waters vary widely, more so in time than space. Seasonally, nitrate concentrations are highest in winter and early spring lakewide because of reduced rates of organic assimilation (Harriss and Turner 1974; Dobbins and Rousseau 1982). The highest concentrations, however, are associated with increased rainfall and so elevated concentrations of nitrate may be the result of increased runoff.

Ammonia in natural waters generally results from the microbial decomposition of nitrogenous organic matter. As the reduced form of inorganic nitrogen in water, it typically reaches highest concentrations in anoxic waters and in waters containing abundant decomposing organic matter. It appears that ammonia mirrors nitrate in terms of its seasonal peaks (ammonia can also be taken up by plants). Pulsing of dissolved oxygen, i.e., high levels during daytime productivity during the growing season, contribute to depletion of ammonia in bottom waters. Spikes in ammonia concentration have been correlated with periods of increased rainfall (Harriss and Turner 1974) and may be assumed to be linked with surface runoff from vegetated areas as well as from areas served by septic tanks.

Historically, nitrate and total nitrogen concentrations have fluctuated, with concentrations of both parameters in the open lake at times greater than in the arms. Since 1990, however, nitrate concentrations have been increasing in the lake's less developed areas and are now greater in the lake's main body than in the arms. Conversely, total nitrogen levels are now higher in the arms than in the lake. The marsh at the Megginnis Arm stormwater treatment facility may be assumed to be a factor in the reduction in nitrate concentrations in this area of the lake while elevated quantities of phytoplankton and macrophytes may be responsible for the higher total nitrogen levels in the arms.

Phosphorous

Phosphorus is an essential plant nutrient which often occurs in natural waters in growth-limiting proportions to other nutrients. Phosphorous is found in two forms in the lake: dissolved and particulate. Orthophosphate is a dissolved form of phosphorus and it is one of the end products of the decomposition of organic matter, although it may also be derived from the leaching of primary or secondary phosphatic minerals in soils and sediments. The onset of eutrophic conditions, e.g., nuisance algal blooms, has been related to critical concentrations of soluble phosphorus (Harriss and Turner 1974). Experiments by LaRock and Landing (1991) suggest that Lake Jackson is phosphorous limited.

Orthophosphate concentrations in Lake Jackson exhibit considerable spatial and temporal variation, with highest concentrations occurring in Megginnis Arm. Both Megginnis and Fords arms exhibit marked horizontal concentration gradients, with the highest concentrations in the inner portions. Average and maximum concentrations generally increase southward in the lake and in near-bottom areas of deeper waters. Peaks in orthophosphate concentrations in the southern arms correspond with turbidity peaks and stormwater runoff events (Harriss and Turner 1974).

Concentrations of orthophosphate in Megginnis Arm are frequently above accepted critical levels, and therefore capable of causing nuisance algal blooms. In contrast, concentrations in the northern open lake, even the maximum concentrations observed, are 3-4 times lower than in Megginnis Arm. Following excessive storm runoff, concentrations in Fords Arm are sometimes in the lower range of critical levels. Apparently, orthophosphate concentrations in Lake Jackson are naturally limiting to algal growth, and excessive land runoff in Megginnis Arm, and perhaps in Fords Arm, and is supplying sufficient quantities of phosphorus to cause nuisance algal growths in these areas (Harriss and Turner 1974).

Total phosphorous levels in the lake are moderate, generally below 0.1 mg/l, although concentrations in Fords Arm remain about double this level. It may be concluded that the Megginnis Arm stormwater treatment facility is successfully capturing phosphorous while Fords arm, which has no such facility, has become the main conduit for phosphorous into the lake. The retention pond may be removing significant fractions of particulate phosphorous, which represented the largest share of phosphorous entering the lake.

Phytoplankton Productivity

Phytoplankton productivity (measured in terms of ug/l of chlorophyll *a*) is a measure of the active growth rate of planktonic algae. This growth rate is dependent on many factors, the most important of which are light, availability of nutrients, population size, growth stage and water temperature. High growth rates in lakes are typically associated with eutrophic conditions and low growth rates with oligotrophic conditions.

Phytoplankton productivities in Lake Jackson are seasonal, with the highest open lake values occurring in spring and summer. Based on average and maximum chlorophyll concentrations observed in Lake Jackson, it appears that

Fords Arm and adjacent waters have the greatest phytoplankton productivity. This productivity may be correlated with total phosphorous loading from the arm. While the southern lake and both arms exhibit characteristics indicative of cultural eutrophication (Harriss and Turner 1974), the levels observed are not considered excessive or hypereutrophic.

Chlorophyll concentrations have increased throughout the main body of lake over the past 20 years, with peak productivity occurring in the arms and adjacent waters during the mid-1980s. Current data indicate productivity in the southern part of the lake to be roughly twice that of the lake's main body and about four times the level of a decade ago.

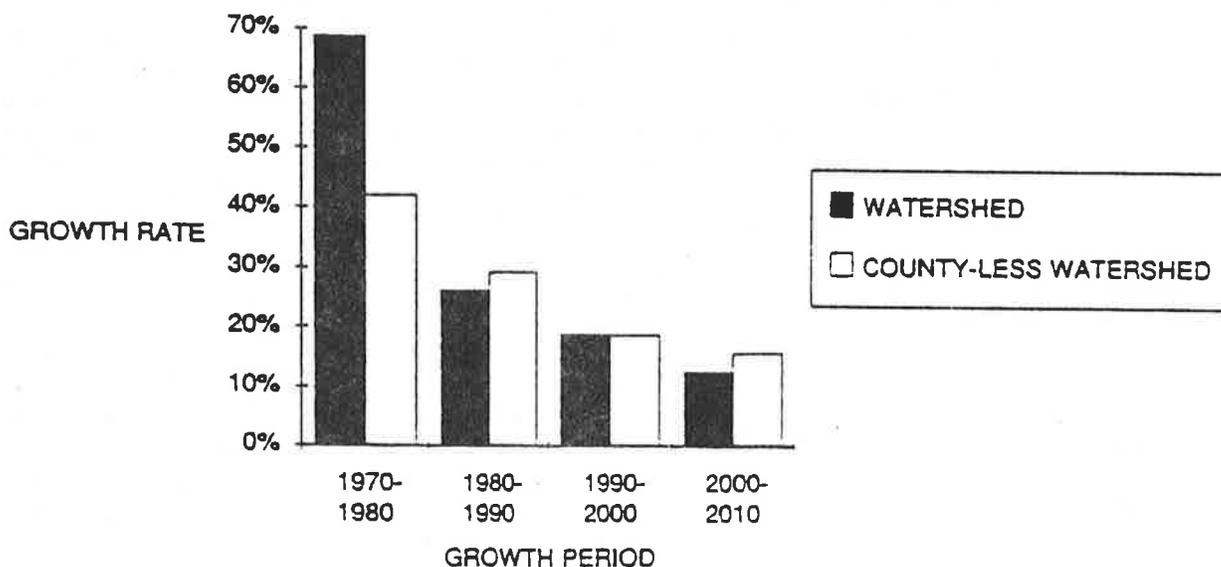
Socio-demographics

The Tallahassee region has been evolving from a rural to an urban area for the last 150 years. Since 1930 there has been a rapid increase in the population of Leon County and Tallahassee, particularly since World War II. From 1950 to 1990 the population of Tallahassee grew from 27,237 to 124,773; in 1992 the population of Leon County was estimated to be 202,570 (BEBR 1993). Population projections for Leon County are 227,100 in the year 2000, and 261,600 in the year 2010. This represents a 37 percent increase in population in the next 20 years. The growth in the city's population is reflected by the expansion of the incorporated area of Tallahassee. In 1952 the incorporated area was 5.80 square miles, and by 1971 it had expanded to 26.14 square miles. By 1994, with the annexation of the Lake Overstreet parcel, the incorporated area of Tallahassee will be more than 65 square miles.

The City of Tallahassee represents an important share of the Lake Jackson watershed. Including the "Greenbelt" acquisitions and annexations (i.e., Maclay Gardens, and the Phipps and Lake Overstreet properties), the city comprises nearly 26 percent of the land in the watershed. Conversely, more than 12 percent of the city lies in the watershed. The city contributes a disproportionate share of stormwater to the lake because of the intensity of development within the Megginis Arm and Fords Arm sub-basins.

The rate of population growth within the Lake Jackson watershed has historically exceeded the growth rate of those portions of Leon County which are not within the watershed. This trend is expected to decline to a point where the growth of the watershed closely resembles the projected growth of the remainder of the county in future years. As Table 9 below illustrates, between 1970 and 1980, the growth rate for the Lake Jackson watershed was approximately 69 percent compared to the remainder of the county which experienced a growth rate of 42 percent. The predicted growth rate for the watershed between 1980 and 1990 is 26 percent compared to 29 percent for the county and for the period of 1990 to 2000 the watershed and the county are both predicted to experience a 19 percent increase (Tallahassee-Leon County Planning Department 1988). The extreme growth of the watershed between 1970 and 1980 can be attributed to the construction of Interstate 10, which provided easy access to the area, and the development of major commercial areas in the southern portion of the watershed. These construction activities and subsequent population increases are the cause of most of the problems which Lake Jackson is currently experiencing.

TABLE 9. Population analysis - Lake Jackson watershed versus Leon County



Land Use in the Lake Jackson Basin

Historically, land use in the Lake Jackson watershed has been forestry and agriculture, dating back to the Apalachee Indians who cultivated the land for corn and other crops. Paisley (1981) reports that when Leon County was first settled by white men in the early 19th century Lake Jackson bordered some of the best farmland in the area. The Lake Jackson watershed remained in an essentially undeveloped state until the mid-twentieth century when residential and eventually urban development began to encroach as Tallahassee experienced accelerated growth.

There are currently three primary categories of land use in the Lake Jackson basin: urban, suburban and forestry/agriculture. In general, the urban and suburban areas are in the southern part of the basin and drain into the lake through Megginnis Creek on the south and Fords Creek on the east. Interstate 10 transverses the subbasins of these two tributaries and, until the construction of the I-10 stormwater treatment facility in 1992, contributed a substantial amount of untreated stormwater runoff to the lake system. The Megginnis Creek sub-basin is highly urbanized (over 80%), consisting of residential areas, apartment complexes, office parks, commercial areas (including three large shopping malls), and two schools. The Fords Creek sub-basin is primarily suburban, but is undergoing rapid development. This area is still serviced in part by septic tanks. Most of the northern portion of the Lake Jackson basin is forestry/agriculture and is part of a large private estate with limited public access. The forested portion (mixed pine-hardwoods) is located primarily along Ox Bottom Creek, while the farmland is on the higher areas towards the periphery of the basin (Turner et al. 1977).

The west side of Megginnis Arm contains a number of unique natural features which need to be considered when land use decisions are being made. Many of these features fall within the Okeeheepkee sub-basin of the Lake

Jackson watershed and have been the subject of an indepth environmental analysis by the Leon County Department of Public Works. The analysis identified sensitive features such as severe grades (slopes exceeding 20%), pristine creek and ravine systems, and at least five springs. Also identified were soils with severe erosion potential, existing erosion and sedimentation problems and a number of drainage system problems. The study stated that runoff from construction was often highly turbid, in one case resulting in a fish kill in a manmade lake, and in another resulting in turbidity levels significantly higher than those standards established by the Florida Department of Environmental Protection (FDEP) (Leon County Department of Public Works 1986).

The Okecheepkee sub-basin and the area immediately to the north of it (east of U.S. 27), is served almost entirely by septic systems. The concentration of septic tanks in this area exceeds 200 per square mile and has been designated as a "septic tank problem area" in the Tallahassee/Leon County 2010 Comprehensive Plan. Despite this designation, most of the area is not included in the future service area of the Master Sewer Plan (Tallahassee-Leon County Local Planning Agency 1990).

Present land use patterns are expected to continue, especially residential development in the southern, eastern and western parts of the basin. A special "Lake Protection" land use category which restricts new residential development to one unit per two acres or one unit per one acre clustered in portions of the Lake Jackson watershed has been included in the local comprehensive plan. This should change the nature of future residential development in the watershed, but is not expected to decrease the demand for residential property in this area, nor is it likely to improve the characteristics of runoff.

It is evident that the existing stormwater systems within the Lake Jackson basin are not providing an adequate level of treatment and that with the predicted increases in population and alteration of natural systems within the watershed these systems will become even more overloaded. Consequently, it is imperative that local government, through the comprehensive planning land development regulations and related programs, provide for environmental safeguards and adequate treatment of stormwater runoff from new development as well as providing for retrofit of the existing stormwater systems.

LAKE JACKSON WATERSHED

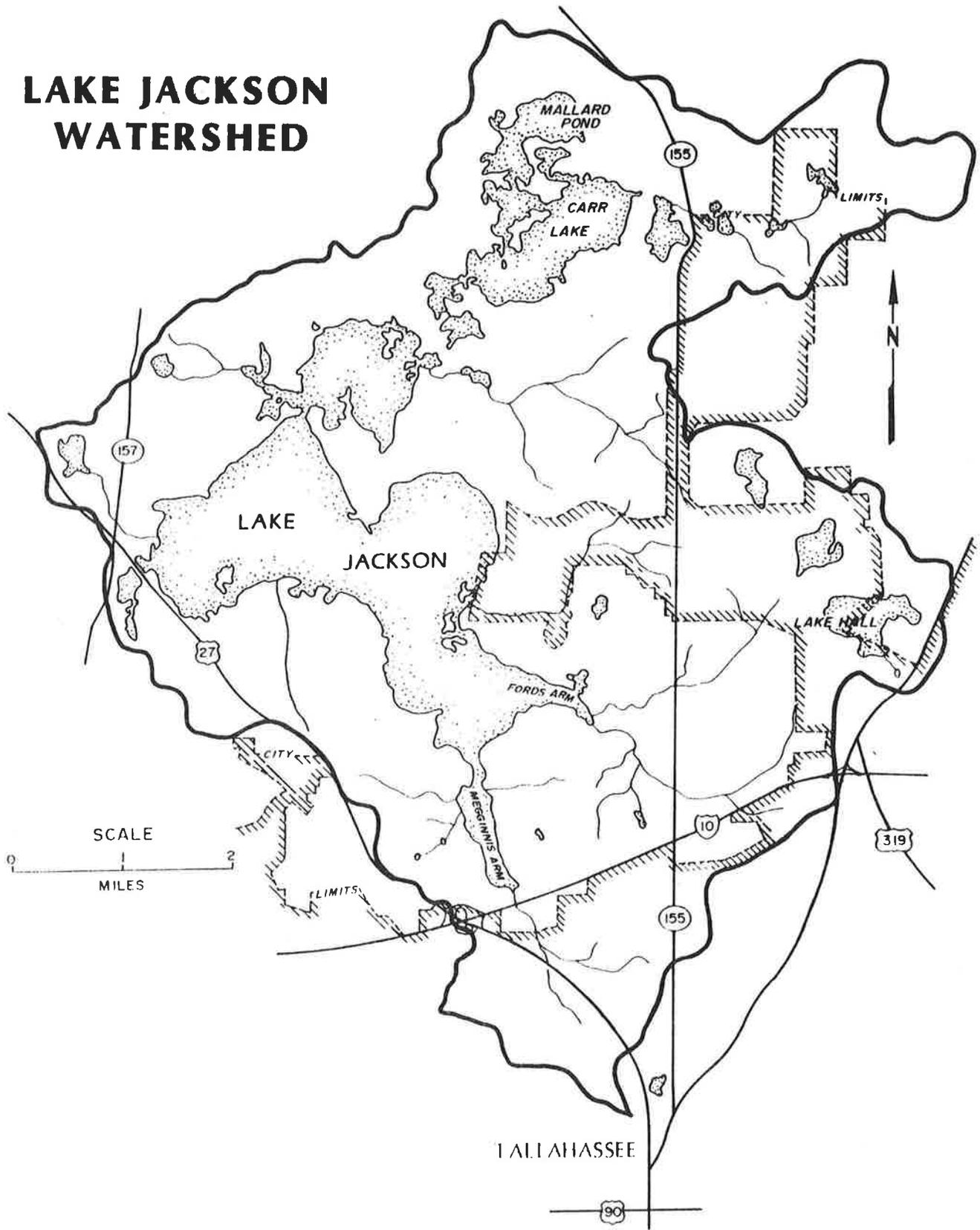
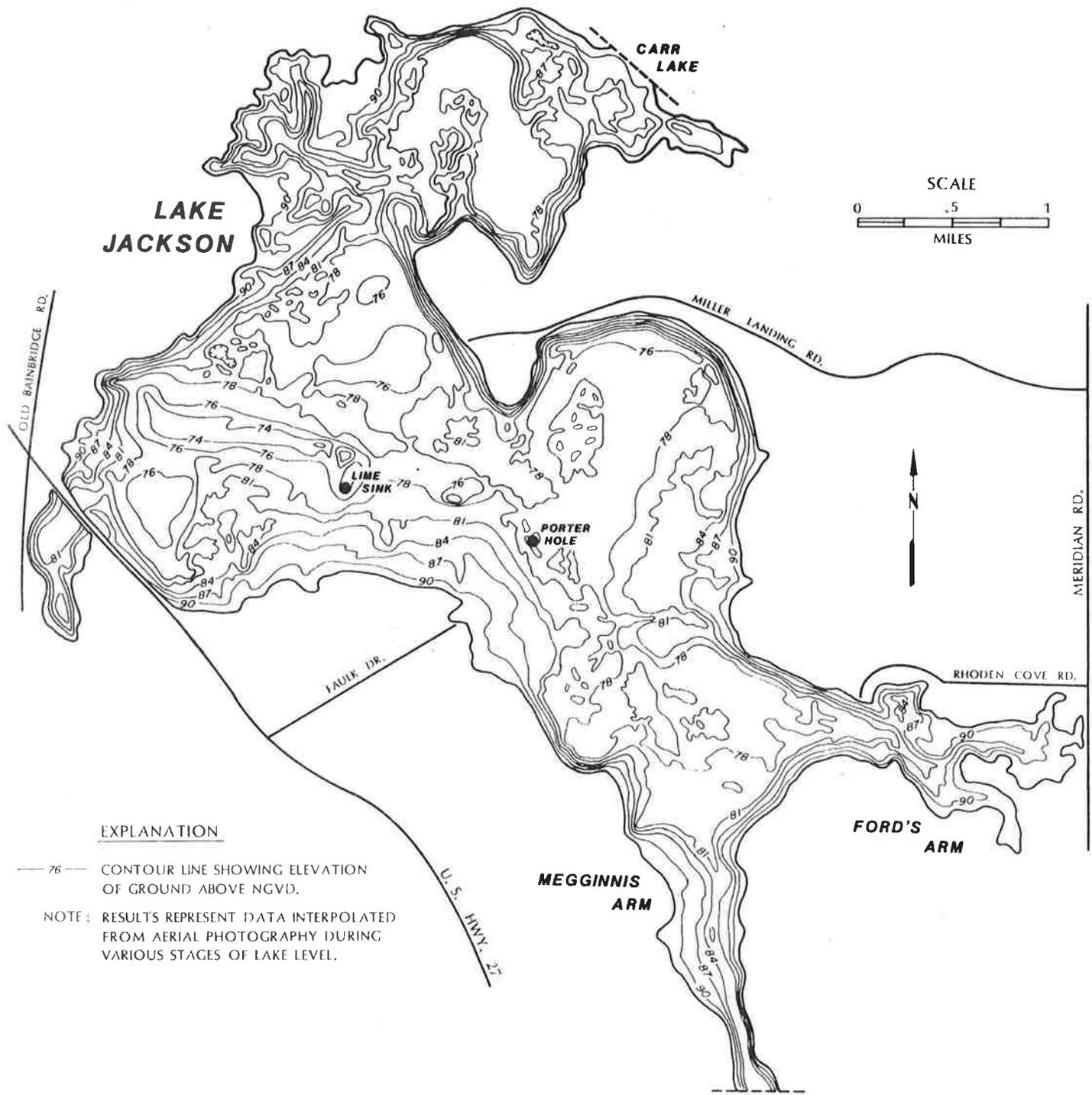


FIGURE 1. MAP OF THE LAKE JACKSON WATERSHED.



EXPLANATION

— 76 — CONTOUR LINE SHOWING ELEVATION OF GROUND ABOVE NGVD.

NOTE: RESULTS REPRESENT DATA INTERPOLATED FROM AERIAL PHOTOGRAPHY DURING VARIOUS STAGES OF LAKE LEVEL.

FIGURE 2. LAKE JACKSON BOTTOM CONFIGURATION. (SOURCE: WAGNER, 1984)

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LAKE JACKSON MANAGEMENT PLAN

APPENDIX 3

Institutional and Regulatory Assessment

SUMMARY

Developed by
Northwest Florida Water Management District
pursuant to
Surface Water Improvement and Management (SWIM) Program
in cooperation with
Apalachee Regional Planning Council
and
Florida Department of Environmental Protection

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INSTITUTIONAL AND REGULATORY ASSESSMENT
OF THE
NORTHWEST FLORIDA WATER MANAGEMENT DISTRICT
SUMMARY

Introduction

There are a multitude of regulations and programs that affect the management of surface waters throughout the Northwest Florida Water Management District. In order to develop and effectively implement Surface Water Improvement and Management (SWIM) plans for priority water bodies, it is important to understand the various programs and the roles of the public entities that implement them. Therefore, the District has conducted an institutional and regulatory assessment of all government agencies responsible for surface water management in northwest Florida. This appendix presents a summary of the full report, which is available upon request from the District.

The Institutional and Regulatory Assessment included the following tasks.

- Identify the primary agencies and groups including the federal, state, regional and local governments that are essential to the successful implementation of the SWIM program.
- Determine the extent to which plans, ordinances and policies of the governmental jurisdictions within the District are consistent with the efforts to restore and/or protect surface waters.
- Contact the primary agencies and governments and evaluate their ability to participate in the SWIM process.
- Define the roles and responsibilities of primary agencies and governments.
- Establish a mechanism (or identify an existing mechanism) to coordinate the activities of the primary agencies and governments which can impact the SWIM process.
- Develop recommendations for additional policies, regulations or legal authorities that would facilitate implementation of the SWIM Plans.
- Concurrent with primary agency and government actions, review and assess the responsibilities and possible roles of all other resource-oriented agencies, groups or affected parties which are within the SWIM basins.

The assessment included investigations in three major areas: 1) federal, regional and state programs and regulations; 2) local regulations; and 3) the effectiveness of these efforts in regard to the successful protection and management of surface waters. District staff performed the assessment of federal, regional and state regulations and gauged their effectiveness through the use of an interagency opinion survey. The results of the assessment were compared with the interagency survey results to determine whether individuals involved in implementation of regulatory programs felt these programs were adequate and effective. The West Florida and Apalachee Regional Planning Councils (RPCs) performed the local assessment under contract with the District in order to determine whether ordinances are currently in place or under development in areas directly affecting the five priority SWIM waterbodies within the District. The assessments are discussed in more detail below.

Federal, Regional and State Assessment

The assessment of federal, state, and regional regulations and management programs was performed by District staff. Agencies with jurisdiction over surface waters were identified and requests for information concerning their authorities and programs were sent out in March, 1989. The major agencies involved in surface water regulation, such as the Florida Department of Natural Resources (DNR), Florida Department of Environmental Regulation (DER), and U.S. Environmental Protection Agency (EPA) received multiple requests since several programs within the agencies perform specific, individualized tasks associated with the protection of surface waters. A few of the agencies required follow-up requests for information due to insufficient preliminary responses, while others required follow-up requests due to additional programs identified in their initial responses.

Upon receipt of responses from the state and federal agencies, the authorities and the specific programs were summarized under the appropriate agency (Appendix I in the report). Due to the large number of state and federal programs which indirectly affect surface waters, the summary was targeted toward those programs which are more directly related to the management of surface waters. The information contained in the appendix was analyzed and compared with the results of the interagency opinion survey to determine which agencies and programs are consistent with the successful implementation of the SWIM program and its primary goal of protecting and preserving surface waterbodies.

Local Assessment

The District contracted with the West Florida Regional Planning Council and the Apalachee Regional Planning Council to perform assessments of the local institutional and regulatory structures for management of surface waters throughout the district. It was determined that the RPCs were familiar with local ordinances and officials and would be able to perform a more thorough local assessment. The final product from the RPCs is in the form of reports for each local government which include: descriptions of ordinances reviewed; an assessment of the adequacy and effectiveness of local government ordinances; recommendations for improvement; a summary and update of local

government comprehensive planning activities; references to model ordinances which might be recommended for protection of surface waters; and suggestions for implementation of the recommendations (Appendix II in the report). The RPCs also provided the District with copies of all ordinances reviewed as well as all model ordinances referenced or recommended. These contracts were completed and submitted to the District in December, 1989. The local assessment will be used to identify issues of concern which need to be addressed to ensure successful implementation of existing and future SWIM plans.

Interagency Survey

The purpose of the SWIM Regulatory and Institutional Interagency Survey was to help identify and coordinate the efforts of those agencies and governments which are integral to successful implementation of the SWIM program in northwest Florida. The interagency survey was essentially an opinion survey which focused upon the implementation and coordination of federal, state and regional programs. The survey examines:

- 1) The adequacy of existing environmental regulations to protect the SWIM priority water bodies.
- 2) Specific problems with program implementation, enforcement of the regulations and permit conditions and the adequacy of existing environmental monitoring programs.
- 3) Coordination between agencies responsible for environmental regulation and other involved agencies.
- 4) Suggestions for improved coordination or implementation.
- 5) Effectiveness of the agencies' activities and programs in water resource protection and management.

As part of the implementation process for the SWIM Plans, the District established Technical Advisory Committees (TACs) made up of staff members from key federal, state, regional and local agencies. The role of the TACs is to assist the District in development and identification of pertinent technical data and assessment of historical and future impacts on each of the priority water bodies. The opinion surveys were sent to all federal, state and regional members of SWIM TACs and other agency personnel involved in implementation of environmentally oriented programs which impact SWIM basins. The agencies surveyed included:

Federal:

Environmental Protection Agency
Army Corps of Engineers
Fish and Wildlife Service
National Marine Fisheries Service

State:

Department of Environmental Regulation
Department of Natural Resources
Department of Community Affairs
Department of Agriculture and Consumer Services
Florida Game and Fresh Water Fish Commission

Regional:

Apalachee Regional Planning Council
West Florida Regional Planning Council
Northwest Florida Water Management District

In May 1989, the District began developing the survey. A first draft was completed in mid-July and was administered within the District. Based upon responses and suggestions from the in-house survey, a revised survey was developed (Appendix III of the report). Approximately seventy surveys were mailed in August 1989, to staff members of the various agencies.

The rate of response was lower than anticipated. The survey was re-administered to TAC members for each of the SWIM priority water bodies. The survey was also administered within the District and results of the in-house survey were incorporated into the final report. Upon receipt of the surveys, a cursory statistical analysis was performed and a list of recommended actions was prepared for the final report.

Analysis of Major Programs

In order to assess the effectiveness of the various federal, state, regional and local programs which affect surface waters, the programs were grouped into the following six categories: 1) Land Use, 2) Wetlands, 3) Point Source, 4) Nonpoint Source, 5) Enforcement, and 6) Special Designations.

The most significant programs within these categories were identified and analyzed to determine whether their effectiveness within the framework of the SWIM program. The analysis takes into account the original intent of the programs as well as issues and problems related to implementation. Recommendations as to how federal, regional, state and local programs can interact with the SWIM program are also included as a guide for implementation of SWIM plans.

Since each SWIM waterbody is unique and the problems affecting them may be addressed through a broad spectrum of programs, many of the programs which are best implemented on a waterbody-specific basis are not targeted in this analysis. For example, a plan for a rural watershed with agriculture and silviculture runoff problems would target different regulatory program or best management practices (BMP) than would a plan for a watershed affected by urban runoff. During development update and implementation of the individual SWIM plans, these programs will be considered as they apply to the specific waterbodies.

A copy of the complete Institutional and Regulatory Assessment is available from the Northwest Florida Water Management District, Route 1, Box 3100, Havana, Florida 32333, 904/539-5999.

LAKE JACKSON MANAGEMENT PLAN

APPENDIX 4

Evaluation of Management Efforts

Developed by
Northwest Florida Water Management District
pursuant to
Surface Water Improvement and Management (SWIM) Program
in cooperation with
Florida Department of Environmental Protection

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LAKE JACKSON MANAGEMENT EFFORTS

Chronological Highlights

- 1972 through 1974 - Construction of Interstate 10 across 2.1 km of Megginnis and Fords Arms Watersheds. The construction caused severe sedimentation in both Megginnis and Fords Arms and clouded the water of large portions of the lake on more than one occasion.
- 1973 - Adoption of Leon County Erosion/Sediment Control Act.
- 1973 - Leon County Water Quality Management Plan.
- 1973 through 1974 - Florida Department of Transportation installs silt barriers across Megginnis and Fords Arms to prevent sediments from the construction of I-10 from entering the main body of the lake.
- 1974 - Schamel sediment report documents Megginnis Arm water quality problems resulting from urban sediments.
- 1974 - Designated as an Aquatic Preserve by the Florida Legislature.
- 1975 - Department of Administration Lake Jackson Report published.
- 1976 - DER proposes Chapter 17-23, F.A.C., The Lake Jackson Drainage Basin (Leon County) Water Quality Control Rule--Rule was never adopted due to court challenge.
- 1979 - As a result of being an Aquatic Preserve, Lake Jackson was automatically granted Outstanding Florida Water (OFW) status upon adoption of the OFW rule on March 1, 1979. EPA Clean Lakes grant obtained for stormwater treatment.
- 1983 - Northwest Florida Water Management District's Lake Jackson/Megginnis Arm Stormwater Treatment Facility goes on line.
- 1984 - Wanielista sediment report
- 1988 - Lake Jackson Conservation Plan completed by Leon County Department of Public Works, Environmental Management Division.
- 1988 - Designated as third highest priority surface waterbody in the Northwest District for receipt of Surface Water Improvement and Management (SWIM) program funding.
- 1988 - (December 21) Initial SWIM Plan approved by DER for the Lake Jackson watershed, implementation of five projects directed toward restoration and preservation begins.

- 1989 - City of Tallahassee constructs regional stormwater detention facility on Boone Boulevard in the southern portion of the watershed.
- 1989 - Environmental Management Acts adopted by Leon County and the City of Tallahassee which include special provisions for the Lake Jackson watershed.
- 1989 - The Tallahassee-Leon County 2010 Comprehensive Plan is adopted. The plan contains a "Lake Protection" land use category for the Lake Jackson watershed, which represents the first formal land use designation adopted for waterbody protection in Leon County.
- 1990 - NFWFMD Megginnis Arm Stormwater Treatment Facility expanded utilizing funds from SWIM and EPA.
- 1990 - City of Tallahassee constructs regional stormwater treatment facility on John Knox Road near the Tallahassee Mall.
- 1989 - Leon County Board of County Commissioners appoints the Lake Jackson Action Team, a committee made up of citizens and agency representatives, to oversee development of an action plan and to coordinate implementation of the plan.
- 1990 - The Lake Jackson Management Plan, a comprehensive watershed management plan which includes SWIM projects as well as projects of other agencies, is adopted.
- 1990 - The \$1.3 million Megginnis Arm Restoration (sediment removal) project starts.
- 1991 - As part of an expansion project, stormwater treatment facilities are installed for the entire Tallahassee Mall site (approx. 100 acres).
- 1991 - Sand filter and irrigation system on the District's Megginnis Arm stormwater treatment facility are upgraded. Approximately 9,000 cubic yards of accumulated material was also removed from the heavy sediment basin of the facility.
- 1992 - A \$300,000 U.S. EPA Grant is secured by the NFWFMD to revegetate Megginnis Arm.
- 1992 - Leon County, the Florida Department of Transportation, and the NFWFMD SWIM program work together to construct the I-10 Megginnis Arm Creek regional stormwater treatment facility.
- 1992 - The Lake Jackson Regional Stormwater Retrofit Plan is completed by the NFWFMD.

- 1992 - The City of Tallahassee and the NFWMD purchase the 670-acre Elinor Klapp-Phipps park property on the east shore of Lake Jackson for water quality and habitat protection.
- 1992 - Lake Jackson Action Team holds "Lake Jackson Action Day" in October to involve the public in lake protection and management.
- 1993 - A purchase agreement is negotiated for the 890-acre Lake Overstreet parcel. This parcel, in combination with Maclay Gardens State Park and the Elinor Klapp-Phipps Park, provides for the preservation of a wide "greenway" between Thomasville Road and Lake Jackson.

A more detailed summary of activities which occurred between 1990 and 1994 can be found in Appendix 6.

State Agency and Local Government Efforts

Florida Department of Environmental Protection

The Florida Department of Environmental Protection (DEP) [formerly the Departments of Environmental Regulation (DER) and Natural Resources (DNR)] has been involved in the management and restoration of Lake Jackson since the early 1970s, with several of its programs being coordinated to address the problems which have been experienced. The DEP manages the U.S. Environmental Protection Agency (EPA) Clean Lakes and Nonpoint Source Programs throughout the state, administers the SWIM program, controls exotic aquatic vegetation, prepares and implements Aquatic Preserve plans, regulates wetland resource alterations, sovereign state lands, and stormwater management, and administers the Pollution Recovery Trust Fund.

Responding to the overall degradation of Lake Jackson, the Florida Department of Administration, Division of State Planning (now the Department of Community Affairs) performed a study of the management of the lake watershed in 1975. This study resulted in a report (Florida Department of Administration 1975) which recommended actions by the various state and local agencies responsible for the management of the watershed. One of the recommendations was for the Environmental Regulation Commission (DEPs governing body) to "adopt a rule designed to limit surface runoff from future as well as existing development and structures in the basin." In 1976, such a rule (Chapter 17-23, F.A.C., The Lake Jackson Drainage Basin (Leon County) Water Quality Control Rule) was considered for adoption, but was successfully challenged and subsequently abandoned by the DEP.

Clean Lakes funds were used in 1974 to analyze the sediments of Megginnis Arm, in 1977 to conduct a diagnostic study of Megginnis Arm, in 1981 to fund the construction of the Megginnis Arm Regional Stormwater Facility, and in 1978-87 for lakewide water quality monitoring. The SWIM expansion of the Megginnis Arm Facility in 1990 was partially funded by Clean Lakes and the program is currently funding a diagnostic/feasibility study which will document sediment

and water quality throughout the entire lake. The results of this Clean Lakes study will be quite valuable to the SWIM efforts to restore and preserve Lake Jackson.

The DEP Stormwater Management Section prepared a statewide nonpoint source (NPS) assessment and management plan which was approved by the EPA in 1989. This assessment and plan made the state eligible to receive federal NPS grant funds pursuant to Section 319 of the Federal Clean Water Act. Lake Jackson was designated as a NPS priority watershed and \$300,000 was requested from EPA to augment funding for the SWIM Megginnis Arm Sediment Removal Project. The DEP Stormwater Management section has also provided technical assistance to Leon County and the City of Tallahassee in the development of environmental ordinances.

The DEP is the primary agency in charge of controlling the spread of hydrilla, an exotic aquatic plant which thrives in the nutrient-laden waters of the southern portion of the lake. Hydrilla is controlled on Lake Jackson by using fluridone, a herbicide which selectively targets the hydrilla plant without significantly harming native plant species. Total eradication of the plant is virtually impossible and the alternative of not treating it would cause the lake to become choked with extremely dense mats of hydrilla.

The DEP has prepared an Aquatic Preserve Management Plan for Lake Jackson which establishes management areas within the preserve. The areas are determined by identifying relatively homogenous areas of natural resources in the preserve and adjacent upland uses. Each area has specific design criteria for any new structures and for structures being modified. These criteria are intended to allow a riparian owner to have reasonable ingress and egress while minimizing impacts to the preserve. The plan also includes a "Management Action Plan" chapter which addresses long-term management of the preserve. For this plan to be implemented, it will be necessary for the Legislature to provide funding to the Aquatic Preserve Program for staffing and research, monitoring, and enforcement.

In a coordinative effort with SWIM, DEP has also provided services for mapping of the Lake Jackson watershed through the use of satellite imagery, aerial photographs, existing maps, and ground truthing. These maps identify vegetation (submerged, emerged, wetland, upland etc.), agriculture, silviculture, and development (residential, commercial, and industrial).

DEP regulatory activities which relate most directly to the management of Lake Jackson are the Wetland Resource and Stormwater Management permitting programs. The DEP receives and processes Wetland Resource Regulation applications according to Chapters 17-4 and 17-312, F.A.C. Stormwater Management permits are processed according to Chapter 17-25, F.A.C., the Stormwater Rule.

The Pollution Recovery Trust Fund administered by the DEP purchased 4,000 cypress and 2,000 water tupelo trees which were planted around Lake Jackson during a public education/awareness project in May 1989. These trees can

provide water quality benefits and habitat diversity to the lake. Pollution Recovery Trust funds in the amount of \$200,000 were also dedicated to the restoration of Megginnis Arm by Governor Martinez in the summer of 1989, and were used by the SWIM Sediment Removal project to dredge the arm.

Florida Game and Fresh Water Fish Commission

The Florida Game and Fresh Water Fish Commission (FGFWFC) has monitored the fisheries of Lake Jackson since as early as 1954, and currently has a study underway on Lake Jackson concerning the effects of a protective slot limit harvest regulation for largemouth bass. The FGFWFC installed fish attractors on the lake in the early 1970s and is the primary agency for enforcing fishing, hunting and boating regulations on freshwater lakes.

Florida Department of Transportation

In 1973, the Florida Department of Transportation (FDOT) installed silt barriers across Megginnis and Fords Arms to prevent erosion pollution generated by the construction of I-10 from entering the main portion of the lake. The barriers were removed upon completion of the highway construction. The DOT recently participated in implementation of the Lake Jackson Management Plan by acquiring, at a cost of approximately \$288,000, four parcels of land needed for the I-10 Megginnis Creek regional stormwater treatment facility. The DOT donated the land to Leon County, and the facility was constructed in 1992 using funds from SWIM and Leon County.

Northwest Florida Water Management District

The District designed and constructed a stormwater treatment facility on Megginnis Arm, completing construction in 1983. Construction of the experimental facility was jointly sponsored by the U.S. Environmental Protection Agency (EPA) and the Florida Department of Environmental Regulation (DER) with EPA providing 60 percent of the funding and DER 40 percent. The District provided engineering services, including a feasibility study and preparation of construction plans. The District also acquired the necessary land and provided construction, operation and maintenance services.

The facility consists of a 20-acre detention pond which includes a heavy sediment basin, a 4.2-acre, four-quadrant sand filter system designed primarily to filter sediment from stormwater before it leaves the detention pond; and a 9-acre, three-cell artificial marsh, the main purpose of which is to remove nutrients, primarily nitrogen and phosphorous.

The District is currently responsible for operation and maintenance of the facility. Leon County, through a cooperative agreement, assists in maintaining the facility by providing manpower and equipment when necessary and by periodically mowing grassy portions of the property. In late 1989, the

City of Tallahassee made a similar commitment to provide maintenance services. County personnel have also removed trash from the banks of the detention pond and, on one occasion, removed several thousand cubic yards of accumulated sediment from the pond. The Florida Department of Corrections periodically provides manpower to remove clay from the sand filter.

Probably the most significant problem associated with the Megginnis Arm facility is rapid and intense development within the drainage basin of the facility. The clearing of land and substantial increases in impervious surface area have caused significant sedimentation and pollution problems for the facility and Lake Jackson.

The SWIM program, with funding assistance from the EPA Clean Lakes program, expanded the facility by approximately 20% in early 1990. SWIM funds were also used to improve the filter system in 1991. The expansion provides additional storage and treatment capacity, thereby reducing the frequency of events which overwhelm the facility. Upstream stormwater retrofits have also helped to substantially reduce peak flows and sedimentation to this system.

The District is also the lead agency for implementation of the SWIM program in northwest Florida. The intent and scope of this program are outlined elsewhere in this document.

Leon County

Leon County is the primary agency with control over local land use decisions and the drainage system in the unincorporated area of the county. The county also regulates development and implements the Environmental Management Act for the entire county, including the incorporated portions.

Leon County has a long history of attempts to manage Lake Jackson in various ways. In the 1950s, when the lake was dry, the county tried to plug the sinkholes with construction debris and junked automobiles. During the 1970s, numerous plans and studies documented the problems which the lake was experiencing and made recommendations concerning restoration of the degraded portions of the lake and prevention of future degradation. Prior to the late 1980s, very few of the recommended actions to improve water quality were undertaken by the county. The county has constructed a number of boat landings and parks around the lake, which provide good public access and are well maintained, and the county also assists in the maintenance of the District's Megginnis Arm stormwater treatment facility.

In late 1987 and early 1988, at the request of the County Commission, the Department of Public Works, Environmental Management Division, prepared the Lake Jackson Conservation Plan. This plan is based on the recommendations of a technical advisory committee made up of professionals from a variety of state, local and regional agencies.

One result of the Lake Jackson Conservation Plan was the development of the Lake Jackson Special Development Zone in the Leon County Environmental Management Act which became effective January 15, 1990 (Ordinance number 89-44, Codified as Chapter 7, Code of Laws of Leon County, Florida). The ordinance includes the following specific requirements for developments within the Lake Jackson watershed:

- Stormwater management facilities must provide treatment greater than that required by Chapter 17-25, F.A.C. for Outstanding Florida Waters and may require more stringent standards if discharges fail to meet state water quality standards.
- The area between 89 and 100 feet NGVD (referred to as "Zone A") has severe development restrictions including a requirement that clearing and soil disturbance shall not exceed the greater of five percent or a maximum of 4,000 square feet of a development site, whichever is greater. Septic systems in this zone are also severely restricted.
- In the area between 100 and 110 feet NGVD ("Zone B"), a minimum of fifty percent of a site must remain natural.
- Most non-residential land uses are prohibited in Zones A and B.

Other key features of the ordinance include: requirements for stormwater retrofit for areas not in compliance with state and federal water quality discharge requirements; operating permits for stormwater facilities; and a more stringent county environmental enforcement program. This ordinance is a much-needed step toward addressing many of the problems which have affected Lake Jackson in the past and, if adequately funded and implemented, could help to correct these problems. Future development in the watershed will have to meet stringent requirements which should effectively prevent mistakes such as those which have plagued this lake in the past.

The Public Works Department completed a county-wide study of environmentally sensitive areas in 1989 which provided maps, discussion, and recommendations concerning the preservation of these areas through various regulatory and action-based programs. This effort has provided valuable information by identifying sensitive areas such as steep slopes, ravines, springs, wetlands, and unique upland habitat throughout the Lake Jackson watershed.

In response to public outcry over the continued degradation of Lake Jackson, Leon County, in conjunction with the District, held a colloquium in July 1989 to determine future needs for the management of Lake Jackson and its watershed. The Board of County Commissioners, responding to concerns expressed during the colloquium, appointed the Lake Jackson Action Team--a group made up of seven citizens and representatives of the DEP, FGFWFC, and the District. This group was charged with: 1) developing an action plan built on the findings of the colloquium and on agency programs already underway; 2) monitoring the plan after it has been developed; and 3) maintaining a high level of public awareness of what is done (Turnbull 1990).

After approximately four years of work, this group has successfully worked to develop and include special criteria relating to Lake Jackson in the Leon County Environmental Management Act and in the Tallahassee-Leon County 2010 Comprehensive Plan. The Action Team has also coordinated closely with the SWIM program through informal means as well as through participation in Technical Advisory Committee meetings. In 1990, the Action Team proposed that the SWIM plan revision be coordinated with their efforts in order to more comprehensively address management of the lake and watershed. The Action Team has been instrumental in helping to revise and expand the SWIM plan to the stage that it is now a joint SWIM/Action Team Plan which will be implemented by multiple entities. The Action Team continues advise the Leon County Board of County Commissioners on issues concerning Lake Jackson and monitors and assists with implementation of the plan.

City of Tallahassee

The City of Tallahassee is responsible for construction and operation of stormwater conveyance facilities within the city limits. Historically, the primary work performed in the Lake Jackson watershed by the city has been the maintenance and expansion of these facilities when necessary.

In 1989, the city constructed a regional stormwater treatment facility on Boone Boulevard which provides detention with vegetative filtration to runoff from the southern end of the watershed. Although the facility was required for nearby street improvements, it was constructed over three times larger than necessary to provide capacity for untreated stormwater not associated with the construction. The city also constructed a regional stormwater treatment facility on John Knox Road near the Tallahassee Mall. These regional facilities, in concert with the Tallahassee Mall stormwater retrofit have had a noticeable beneficial effect on the water quality and hydrology of the Megginis Arm basin.

The city is the major supplier of sanitary sewer services in the county and has ongoing sewer expansion projects planned in the Lake Jackson watershed. Two sewer projects have recently been implemented in the Lake Jackson basin, the first of which is a major upgrade to an existing pumping station at Megginis Arm Landing Road and I-10. The second project is a pumping station and force main which serves the developing areas of Summerbrooke and Ox Bottom Manor in the northeast portion of the watershed. The City of Tallahassee Master Sewer Plan has five additional projects identified in the Lake Jackson watershed, but funding for these extensions has yet to be secured.

The City of Tallahassee also has an environmental regulatory program which permits stormwater discharges, tree removal, wetland impacts, and all other components of land development. This program was started in 1990 and is guided by an environmental management ordinance that is similar to Leon County's Environmental Management Act.

Cooperative Efforts

Tallahassee-Leon County Comprehensive Plan

1990 - Tallahassee - Leon County Comprehensive Plan

The Tallahassee-Leon County 2010 Comprehensive Plan was submitted to the Department of Community Affairs in February 1990. The plan contains multiple objectives and policies which, when implemented, will help in efforts to preserve, restore, and appropriately manage Lake Jackson and its watershed. Some highlights of the plan which are related to Lake Jackson include:

- A special "Lake Protection" land use category which includes most of the less developed areas of the watershed. This land use category allows one residential unit per two acres or one unit per one acre clustered and allows minor office and commercial land uses to be approved through the PUD process if they follow stringent stormwater and intensity guidelines.
- Requires that a plan for retrofitting existing developments not in compliance with existing stormwater regulations be adopted by 1993.
- Requires that local government adopt ordinances to restore and preserve Lake Jackson specifically addressing: stormwater quality; on-site sewage systems; connection to central sewers; and buffer zones.
- Requires that a plan for retrofit of the stormwater systems in the developed areas of the watershed be developed and adopted. This plan must include priorities for implementation and must provide for funding of the necessary improvements.

The comprehensive plan also includes policies which provide for habitat protection; protection of endangered, threatened and species of special concern; acquisition of environmentally sensitive land; monitoring of surface water quality; environmental education; wetland protection; wildlife protection; and extensive inventories and mapping of environmental features.

City of Tallahassee and Leon County Stormwater Management Plan

The District, under contract with the City of Tallahassee and Leon County, developed a comprehensive stormwater management plan for the urbanized areas of the county. This plan addresses drainage problems in the major drainage basins and also addresses the water quality impacts on receiving waterbodies.

The primary tool which was utilized by this process is a computer-based watershed simulation model which is capable of predicting stormwater runoff quantities and pollutant loads. The model can be continually updated to reflect new stormwater detention/retention structures and to take into account the effects of increased development and other pertinent land use changes.

After development and calibration of the model, it was be transferred to the City and County for use as a planning tool to evaluate the impacts of future development and new stormwater management strategies.

The Lake Jackson SWIM program makes use of the City of Tallahassee and Leon County Stormwater Management Plan by assisting in implementation of the recommendations which it provides. Information generated by this project was also critical to the development of the Lake Jackson Regional Stormwater Retrofit Plan (Bartel et al 1992).

Excerpts from Selected Publications

- 1973 - Water Quality Management Plan, by William M. Bishop Consulting Engineers, Inc., and Tallahassee-Leon County Planning Commission

"If desirable biological conditions are to be maintained, a stringent restriction on pollutants of all forms into the lake must be enacted."

"It is recommended a routine sampling program be adopted by either state or local pollution control agencies..."

- 1974 - Lake Jackson Investigations - Job Completion Report, by R.C. Harriss and R.R. Turner, Florida Game and Fresh Water Fish Commission

"Intensive sampling and analysis of stormwater runoff in the major Megginis Arm tributary, both upstream and downstream of Interstate-10 in the last two years of this study clearly revealed the pollutorial loading of Megginis Arm, and documented a significant contribution of pollutants from both urban Tallahassee and Interstate-10 construction activities."

"A regular water quality surveillance program should be continued at not less than four representative sampling locations in the lake on at least a quarterly basis."

"Impact Zoning Principles should be adopted for all future land development in the Lake Jackson watershed."

- 1975 - Lake Jackson: A Management Report, by the Department of Administration, Division of State Planning, Bureau of Land and Water Management

"Urbanization of the Lake Jackson basin, if allowed to continue in the same manner as recent years, will result in significant alteration of the present hydrologic regime of the lake and can also seriously degrade water quality in Lake Jackson."

"In summary, Lake Jackson will lose its present recreational, aesthetic and natural value if urbanization continues without adequate regard for the natural functions of the watershed and without strictly enforced regulations relating to the quality and quantity of surface runoff entering the lake."

"A special land use plan for the Lake Jackson basin should be developed and adopted by Leon County within two years."

1982 - Lakes Talquin and Jackson Investigations, by Florida Game and Fresh Water Fish Commission

"Although a number of recommendations can be made regarding Lake Jackson, the most important one in terms of maintaining the lake in a natural and unpolluted state is the development and enforcement of adequate land use regulations."

1986 - Okeehoopkee Area Comprehensive Development Study, Leon County Department of Public Works

"No development should be allowed to interfere with the healthy functioning of wetland areas."

"Extra measures for erosion and sediment controls should be required through permitting, including provisions for performance bonds and "immediate stop work orders"."

"The five major springs within the study area should be closely monitored."

"Zoning densities should be limited adjacent to and upstream of these waterbodies, with consideration given to the acquisition of title or easements for these important waterbodies."

"The drainage system throughout the Okeehoopkee area is unsuitable for intensified upland development, unless drainage modifications are made."

"All future development requests should be conditional on improving downstream drainage conditions."

"...it is recommended that consideration be given to the establishment of a Water Management Area in the lower portion of Fuller Basin."

1988 - Lake Jackson Conservation Plan, Prepared for the Leon County Board of County Commissioners by the Department of Public Works, Environmental Management

Most of the fourteen recommendations of this plan are in various stages of implementation either through the SWIM program, the City's construction efforts, or the environmental ordinances being developed by the county. Most notable as not being implemented is the recommendation to establish a Lake Jackson Metropolitan Services Taxing Unit to fund needed improvements, ongoing water quality studies, and restoration and maintenance activities. An ongoing source of funding is essential if adequate facilities are to be built and maintained.

- 1988 - Environmentally Sensitive Areas of Leon County, Florida, Prepared for the Tallahassee-Leon County Planning Department by the Leon County Department of Public Works

"Designate the Megginnis Arm, Fords Arm, and Little Lake Jackson watersheds as conservation zones."

"Provide centralized water quality retrofitting for all existing development in the Megginnis Arm and Fords Arm watersheds and assess a fee based on square footage of impervious area to recover the costs of the water management areas".

- 1989 - U.S. 27 Study Report, Prepared by the Tallahassee-Leon County Planning Department, Accepted by the Leon County Board of County Commissioners on June 20, 1989

"Continue to support and implement the environmental and land use recommendations in the Okeeheepkee study area."

"Acquire the parcel or other adjacent parcels within the Okeeheepkee study area adjacent to Megginnis Arm and construct the proposed stormwater management facilities. Acquisition and construction of this facility should be coordinated and consistent with the North Florida Water Management District project to clean up Megginnis Arm."

Conclusions

It is quite clear that Lake Jackson has received an extraordinary amount of attention over the past twenty years. Numerous recommendations have been made addressing the management needs of the watershed, yet it has taken many years to begin implementing the recommendations. While there are as many reasons for lack of implementation as there are recommendations, some general trends are evident and are discussed below.

First, the lake may have suffered from too much attention in that many agencies were involved in the management of the lake and watershed, but no single agency was given, or chose to take, the lead coordination role. The

multitude of involved parties made it easy for each agency to assume that the others were addressing the problems.

Second, Lake Jackson has been managed in a somewhat unique way in comparison to other similar waterbodies throughout the state--probably as a result of being located in the state's capitol county. The characteristics of Lake Jackson--relatively small with the entire watershed in a single county--do not typically prompt state government to become involved in the management of the waterbody, since the local government has the ability to control all development and land uses which have the potential to degrade the lake. The management of most lakes similar in size to Lake Jackson which have their entire watersheds in a single county is usually solely the responsibility of local government. However, most of the management efforts for Lake Jackson which have been implemented were funded by state and federal sources and implemented by state government, thus leaving the local government somewhat confused over who should be playing the lead role in the management of the lake. Until recently, this led to a tendency for local government to bypass major funding and programming for preservation, restoration and management efforts in the Lake Jackson watershed.

Until recent years, implementation of stormwater management plans and stringent enforcement of development regulations at the local level has been virtually nonexistent. Only recently has local government become more stringent in enforcing environmental regulations, and implementation of stormwater plans has yet to occur. If Lake Jackson is to be successfully restored and preserved, it is imperative that the local government continue to enforce land development regulations and land use restrictions and fund proactive watershed management programs and restoration efforts.

This analysis has identified many missing links in the past management efforts and should be used in the development of future plans and programs for Lake Jackson. The following elements should be an integral part of all plans and programs which are intended to manage and restore the lake:

- Coordination between local, regional, and state government entities in the development and implementation of plans and identification of the lead agency or group.
- Specific tasks to be carried out by each government entity must be clearly identified.
- Funding needs for each task must be identified.
- A commitment from each government entity to fund and implement its designated tasks within the specified timeframe must be secured.

The current coordinated effort between the Lake Jackson Action Team and the SWIM program has worked to develop a plan which will meet the above criteria. The SWIM program has the staffing ability to act as the lead agency, the Lake

Jackson Action Team provides oversight to help ensure implementation of all programs identified in the Lake Jackson Management Plan; and the Lake Jackson SWIM Technical Advisory Committee will continue to provide technical assistance to the development and implementation of programs identified in the plan.

The assessment of present and future management efforts should continue to be monitored and documented to ensure that the processes which produce success are applied to new and continuing efforts.

LAKE JACKSON MANAGEMENT PLAN

APPENDIX 5

Annotated Bibliography for Lake Jackson

Developed by
Northwest Florida Water Management District
pursuant to
Surface Water Improvement and Management (SWIM) Program
in cooperation with
Florida Department of Environmental Protection

ANNOTATED BIBLIOGRAPHY FOR LAKE JACKSON

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--Identifies hydrologic characteristics of the Megginis Arm watershed after construction of the detention pond, filter system and artificial marsh system to be applied to the operation of the artificial marsh. Concludes that flow through the marsh is very dependent on the water level of the lake, and predicts the effects of various storms on the marsh system.

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Bartel, R., T. Macmillan and F. Ard. 1992. Lake Jackson Regional Stormwater Retrofit Plan. Water Resources Special Report 92-1. Northwest Florida Water Management District, 100 pp. [NFWFMD]

Bartel, R., R. Arteaga, N. Wooten, F. Ard and A. Benoit. 1991. City of Tallahassee and Leon County Stormwater Management Plan, Volume III: Lake Jackson Basin Management Plan. Water Resources Assessment 91-3. Northwest Florida Water Management District, 167 pp. [NFWFMD]

Bittaker, H.F. 1982. Complete Annotated Bibliography Utilized for Review of EPA/DER/NFWFMD Marsh Stormwater Renovation Project. Florida Department of Environmental Regulation Water Resources Restoration and Preservation Section, Tallahassee, Florida. [NFWFMD]

Burnett, W.C. and C.R. Donahue. 1982. Lake Jackson Water Quality Monitoring Project (1978 - 1981). Department of Oceanography, Florida State University, Tallahassee, Florida, 100 pp. [NFWFMD]

--A 3 1/2 year study of water quality with emphasis on Megginis Arm and Megginis Creek. Conclusions were similar to earlier studies documenting the degraded condition of Megginis Arm and the relatively healthy condition of the northern portions of the lake.

Burton, T.M., R.R. Turner, and R.C. Harriss. 1976. The Impact of Highway Construction on a North Florida Watershed. Water Resources Bulletin 12(3):529-538. [NFWFMD]

--Outlines methodology used to study the effects of I-10 construction on Megginis Arm water quality. Concludes that extensive damage to Megginis Arm resulted from construction of I-10 and that in the future, erosion control, highway routing, and construction scheduling procedures should be revised to prevent similar occurrences of environmental degradation.

Byrne, C.J. 1980. The Geochemical Cycling of Hydrocarbons in Lake Jackson, Florida. Thesis (Ph.D), Florida State University, Tallahassee, Florida, 168 pp.

Cailteux, R.L. 1990. Study VI., Lake Jackson Studies, Recreational Sportsfisheries Investigations, Wallop-Breaux Project F-37-8. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, pp. 43-80. [NFWFMD]

Canfield, D.E. Jr. 1981. Final Report, Chemical And Trophic State Characteristics of Florida Lakes in Relation to Regional Geology. Center for Aquatic Weeds, University of Florida, Gainesville, Florida, pp. 45-51. [NFWFMD]

--Includes a discussion of the geology of the Tallahassee Hills geographic region with a conclusion that the geology of the region influences the water chemistry of the lakes at least as much as atmospheric precipitation.

Casey, T.J. 1974. Urban Sediment in Lake Jackson...a Case Study. Unpublished prospectus for Master's Thesis. Florida State University, Tallahassee, Florida, 4 pp.

Cason, J.H. and D.H. Esry. 1977. Final Recommendations Concerning Reduction of Sediment and Nutrients into Megginnis Arm, Lake Jackson Project. Prepared by Northwest Florida Water Management District for the Florida Department of Environmental Regulation. [NFWFMD]

--Review of two reports concerned with stormwater improvements in the Lake Jackson Megginnis Arm Watershed. Concludes with recommendation to construct two ponds for sediment removal and an artificial marsh to provide nutrient uptake and additional settling of sediments.

Cason, J.H. and D.H. Esry. 1978. Results of Surveys and Appraisal of Property Proposed for Acquisition in Megginnis Arm Watershed. Prepared by Northwest Florida Water Management District for the Florida Department of Environmental Regulation. 8 pp. [NFWFMD]

--Outlines methodology used for property survey and real estate appraisal. Identifies necessary cooperative efforts, has recommendations concerning purchase of property and construction schedule. Property survey documents are appended.

Cason J.H. and A. Redmond. 1982. Summary of Pertinent Design Considerations for Lake Jackson Project Artificial Marsh. Northwest Florida Water Management District, 16 pp. [NFWFMD]

--Discusses physical and biological design of Lake Jackson Artificial Marsh, preparation for planting, rationale for plant establishment methods, and other pertinent considerations. A comparison of plant species considered for use in the marsh is appended, along with correspondence related to marsh size and morphology.

Dierberg, F.E., V.P. Williams, and W.H. Schneider. 1988. Water Quality Effects of Lake Enhancement Techniques Used in Florida. Final Report. Florida Institute of Technology, Melbourne, Florida, 80 pp. [NFWFMD]

--Includes a discussion of the success of the Megginnis Arm Stormwater Treatment Facility as measured by trophic state index. Concludes that the facility is functioning properly in removing suspended solids in stormwater but is not reducing algal nutrients. This finding was challenged by LaRock (1988), who pointed out that increases in chlorophyll *a* in Megginnis Arm were experienced due to sewage spills and untreated stormwater discharges from the Okeehoopkee sub-basin.

Dobbins, D.A. and R.W. Rosseau. 1981. Lakes Talquin and Jackson Investigations. Annual Progress Report, D-J Federal aid Project F-31-7 (Mimeo.). Florida Game and Fresh Water Fish Commission, Tallahassee, Florida

Dobbins, D.A., and R.W. Rousseau. 1982. Lake Jackson Investigations. Completion Report, D-J Project F-31. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, pp. 66-174. [NFWFMD]

--Final report of an eight year study which included monitoring of water quality, macroinvertebrates, aquatic vegetation, and fish populations. Documents degraded condition of the southern portion of the lake and recommends: 1) development and utilization of local land use regulations which protect the integrity of the system and minimize negative impacts resulting from development; 2) future studies of the effect of the natural dewatering on fisheries and water quality; and 3) establishment of an official mean high water mark by the state to protect and manage the lake bottom.

Dobbins, D.A., E.A. Long, J.J. Nordhaus, and B.R. Lubinski. 1987. Ochlockonee River Watershed Studies. Final Report. Wallop-Breaux Federal Aid Project. F-37-5 (Mimeo.). Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Dobbins, D.A., E.A. Long, J.J. Nordhaus, and B.R. Lubinski. 1988. Final Report for Investigations Project. Ochlockonee River Watershed Studies, Studies I and III. Federal Aid in Fish Restoration Wallop-Breaux Project F-37. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida. 99 pp. [NFWFMD]

--Final report of a five year study to determine the effects of an extreme natural dewatering of Lake Jackson on the sport fishery and lake ecosystem. Concludes that natural dewatering and lake level fluctuations are extremely beneficial to the sportfish population and aquatic ecosystem, but that these phenomenon will not offset the negative impacts of development within the watershed.

Ellis and Associates. 1980. Boring Logs and Laboratory Tests for Lake Jackson Pond I. Jacksonville, Florida

Environmental Science and Engineering. 1976. Water Quality Segmentation for Tallahassee/Leon County 208 Areawide Water Quality Management Program. Gainesville, Florida. [NFWFMD]

--Includes water quality information (multiple parameters) for both Lake Jackson and Megginnis Arm. Concludes that Lake Jackson is particularly sensitive to pollutant loading and that water quality degradation in Megginnis Arm is clearly related to stormwater runoff.

Environmental Science and Engineering. 1977. Final Report, Nonpoint Source Assessment for Tallahassee-Leon County 208 Areawide Water Quality Management Studies. Submitted to Tallahassee-Leon County Planning Council, Tallahassee, Florida, 57 pp.

Esry, D.H. 1979. Lake Jackson Restoration Project. Preprint No. 3703, American Society of Civil Engineers Convention and Exposition, Atlanta, Georgia, October 23-25, 1979. 14pp. [NFWFMD]

--An overview of progress on the development and construction of the Megginnis Arm stormwater treatment facility. Written approximately two years after commencement of the six year project.

Esry, D.H. and J.E. Bowman. 1984. Final Construction Report, Lake Jackson Clean Lakes Restoration Project. Prepared by Northwest Florida Water Management District for the Florida Department of Environmental Regulation, 61 pp. [NFWFMD]

- Discusses need for the project, system design, change orders during construction, contracts, and operation of the facility. Also includes a section which discusses things which would be done differently if the project were redone.

Esry, D.H. and D.J. Cairns. 1988. Effectiveness of the Lake Jackson Restoration Project for Treatment of Urban Runoff. Presented at the 1988 Joint Annual Meeting of the ASCE Florida Section/South Florida Section, 15 pp. [NFWFMD]

--Includes overview of the project, analysis of performance of both the filter system and artificial marsh, summarizes pollutant removal efficiency, and includes design recommendations for similar facilities. Concludes that project is quite successful, but that growth within the sub-basin will outpace the ability of the facility to function properly.

Farren, R. 1987. Trouble in Trophyland. In: Florida Sportsman, October, 1987, pp 148-156 [NFWFMD]

--Magazine article which discusses water quality problems and issues surrounding the management of Lake Jackson.

Fernald, E.A. and J.H. Cason. 1986. Development of an Artificial Marsh in Tallahassee, Florida: Lake Jackson, A Case Study. In: Land Use Impacts on Aquatic Ecosystems, The Use of Scientific Information. Edited by J. Lauga, H. Decamps, and M.M. Holland. pp 229-241 [NFWFMD]

--Discusses physical and cultural characteristics of the watershed; effects of development; historical responses to documented problems; considerations which guided development of the artificial marsh; and effectiveness of the system. Includes recommendations for redesign of the filter system and the artificial marsh and concludes that development restrictions should be used to prevent the necessity of stormwater retrofit projects such as the Lake Jackson project.

Florida Department of Administration. 1975. Lake Jackson: A Management Report. Bureau of Land and Water Management, Division of State Planning, Tallahassee, Florida, 18 pp. [NFWFMD]

--Describes physical, biological, and recreational aspects of the Lake Jackson watershed, outlines potential problems, and includes a comprehensive set of short and long-term recommendations for the management of the lake and its watershed.

Florida Department of Administration. 1975. Preliminary Management Alternatives and Proposals for the Lake Jackson Watershed. Tallahassee, Florida, 25 pp.

Florida Department of Environmental Regulation. 1989. Special Report to the Governor on Lake Jackson, Response to Executive Order 89-137. 6 pp. [NFWFMD]

--Summarizes various programs being implemented by the DER in relation to Lake Jackson including: SWIM, EPA Clean Lakes, Nonpoint Source, Permitting, Compliance/Enforcement, and Pollution Recovery Fund programs.

Florida Department of Natural Resources. 1991. Lake Jackson Aquatic Preserve Management Plan. Bureau of Submerged Lands and Preserves, Division of State Lands, Tallahassee, Florida, 100 pp. [NFWFMD]

Florida Department of Natural Resources. 1983. The Final Draft of a Report on the Ordinary High Water Elevation of Lake Jackson, Leon County, Florida. Bureau of Survey and Mapping, Division of State Lands, Tallahassee, Florida, 5 pp. [NFWFMD]

--Defines methodology used to determine the ordinary high water elevation of Lake Jackson at 88.2 feet NGVD.

Florida Game and Fresh Water Fish Commission. 1989. Lake Jackson. Prepared for the July, 1989 Colloquium on Lake Jackson sponsored by Leon County and the Northwest Florida Water Management District. Mimeo. Tallahassee, Florida, 11 pp. [NFWFMD]

--Discusses the various programs and studies which the Commission is associated with on Lake Jackson. These include: studies of lake quality indicators; routine fish population sampling and creel surveys; and analysis of fish for parasites and heavy metal contamination. Also discusses the Commission's support of and participation in the SWIM program.

Franklin, M.A. 1982. Methodology for Stormwater Runoff Investigation, Urban Leon County, Florida. U.S. Geological Survey Open-File Report 82-355, Tallahassee, Florida, 15 pp. [NFWFMD]

--Outlines methodology to be used in the development of a lumped-parameter, rainfall-runoff model for the urban areas of Leon County. The model can be used to estimate magnitude and frequency of discharges in the area of study. Report summarizes methods of collection, processing, and analysis of rainfall-runoff data to be used in the model.

Franklin, M.A. and G.T. Losey. 1984. Magnitude and Frequency of Floods From Urban Streams in Leon County, Florida. Water-Resources Investigations Report 84-4004, U.S. Geological Survey, Tallahassee, Florida, 37 pp. [NFWFMD]

--Estimates flood magnitudes for urban flow streams in Leon County for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years, utilizing a calibrated lumped-parameter rainfall-runoff model, pan evaporation data, and long-term unit rainfall records.

Franklin, M.A. 1984. Magnitude and Frequency of Flood Volumes for Urban Watersheds in Leon County, Florida. Water-Resources Investigations Report 84-4233, U.S. Geological Survey, Tallahassee, Florida, 20 pp. [NFWFMD]

--Estimates storm runoff volume for urban watersheds in Leon County for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years, utilizing a calibrated lumped-parameter rainfall-runoff model, pan evaporation data, and long-term unit rainfall records.

Franklin, M.A. and R.A. Orr. 1987. Analysis of Water-Surface Profiles in Leon County and the City of Tallahassee, Florida. Water-Resources Investigations Report 86-4327, U.S. Geological Survey, Tallahassee, Florida, 82 pp. [NFWFMD]

--Identifies water surface profiles for the 10-, 25-, 50-, and 100-year recurrence interval floods for streams in developing areas of Leon County. Regression equations were utilized to compute peak discharges and standard step-backwater procedures were used to determine water surface elevations.

French, B.J. and L.A. Olsen. 1976. Lake Jackson, Florida: Literature Review and Recommendations for Action by the D.E.R., Office of Lake Restoration, Florida Department of Environmental Regulation, Tallahassee, Florida, 16 pp. [NFWFMD]

--Identifies problems in the watershed, outlines findings of various water quality and sediment studies, and discusses governmental actions concerning Lake Jackson. Concludes with eleven recommendations for future management of the lake and watershed.

Galicki, A.M. 1977. An Application of the Lead-200 Geochronological Method in Cores from Lake Jackson, Leon County, Florida. Florida State University Dissertation, Tallahassee, Florida, 155 pp.

Gilbert, K. M. 1985. Botanical Analysis, Ordinary High Water Line Survey, Lake Jackson, Leon County, Florida: Community Assemblages. Florida Department of Natural Resources, Tallahassee, Florida, 27 pp. [NFWFMD]

Glooschenko, W.A. and C. Alvis. 1973. Changes on Species Composition of Phytoplankton due to Enrichment by N, P, and Si of Water from a North Florida Lake. Hydrobiologia Vol. 42, 2-3, pp 285-294.

--Determined that N and P were limiting to algal productivity and that addition of N and P, alone or in combination, causes an increase in algal populations in samples of Lake Jackson water. Si increases resulted in increased Diatom numbers as well as an increase in blue-green algae (*Anacystis cyanea*).

Goolsby, D. 1974. Distribution of Trace Metals in Lake Jackson, Florida, on May 5, 1973. In: Job Completion Report, Lake Jackson Investigations. R.C. Harriss and R.R. Turner (eds.), 1974. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, pp. 199-209. [NFWFMD]

--Identifies iron and manganese as the most abundant trace metals in Lake Jackson, with the highest concentrations occurring in Megginnis and Fords Arms. These metals are associated with the inorganic sediments which are found throughout the basin. Lead concentrations in Megginnis Arm were also higher than the rest of the lake--possibly a result of parking lot and roadway runoff.

Harper, H.H., and M.P. Wanielista. 1984. An Investigation into Alum Application for Sediment Nutrient Inactivation in Megginnis Arm, Lake Jackson. University of Central Florida, Orlando, Florida, 151 pp. [NFWFMD]

--Recommends inactivation of sediments in Megginnis Arm through use of a combination of alum and sodium aluminate. Also recommends installation of an automatic alum injection system on Megginnis Canal to provide treatment for extreme storm events which bypass the Megginnis Arm stormwater treatment facility.

- Harriss, R.C., R.R. Turner, G.A. Berg and S.A. Moore. 1972. Annual Progress Report, Lake Jackson Studies. Job No. 5: Nutrients, Water Quality and Phytoplankton Productivity in Lake Jackson. Job No. 7: Data Analysis and Reporting. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, 85 pp.
- Harriss, R.C., and R.R. Turner. 1974. Study VI, Lake Jackson Investigations. Job Completion Report, Job No. 5: Nutrients, Water Quality and Phytoplankton Productivity in Lake Jackson. Job No. 7: Data Analysis and Reporting. D-J Project F-12-15. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, 231 pp. [NFWFMD]
- Final report of a three year study which sampled and analyzed trends in water quality, nutrients, and phytoplankton productivity. Documents degraded conditions of the southern portion of the lake and contains numerous recommendations for future research and implementation of various specific watershed management strategies.
- Hendry, C.W., Jr., and C.R. Sproul. 1966. Geology and Ground-Water Resources of Leon County, Florida. Florida Bureau of Geology Bulletin No. 47, 178 pp.
- Hughes, G.H. 1967. Analysis of the Water-Level Fluctuations of Lake Jackson Near Tallahassee. USGS Report of Investigations No. 48, 25 pp. [NFWFMD]
- Hughes, G.H. 1969. Hydrologic Significance of 1966 Flood Levels at Lake Jackson near Tallahassee, Florida. U.S. Geological Survey Hydrologic Investigations Atlas HA-363, 1 sheet. [NFWFMD]
- A photomosaic map showing Lake Jackson flooded at a level of 96.35 MSL on March 7, 1966. Includes text indicating that the apparent recurrence interval of this flood is at least 149 years and the lower limit of the true recurrence interval is probably about 100 years.
- Johengen, T.H. 1986. The Cycling of Nitrogen and Phosphorus Within an Artificial Marsh Designed to Treat Urban-Stormwater Runoff. Masters Thesis, Florida State University College of Arts and Sciences, Department of Oceanography. 50 pp. [NFWFMD]
- A detailed study which utilized isolation chambers to quantify the nutrient removal rates of various ecological components in the Megginnis Arm artificial marsh. Provides the ability to calculate types of loadings which can be handled by the system and the expected efficiency of treatment.
- Johnson, R.L. 1984. Geotechnical Investigations of In-Lake Sediment Treatment for Megginnis Arm of Lake Jackson. Masters Thesis. University of Central Florida, Orlando, Florida.

Landing, W. 1992. Chemical Analysis of Sediments in Ford's Arm, Lake Jackson. Prepared for Northwest Florida Water Management District. Department of Oceanography, Florida State University, Tallahassee, Florida, 23 pp. [NFWFMD]

Landing, W. 1989. SWIM: Chemical Analysis of Sediments in Meginnis Arm, Lake Jackson. Prepared for Northwest Florida Water Management District. Florida Department of Oceanography. [NFWFMD]

--A study of Megginnis Arm sediments which was performed to determine whether the sediments should be classified as "toxic waste" as defined by the U.S. Environmental Protection Agency. This study was necessary to obtain permits for the dredging of Megginnis Arm sediments. Concludes that: 1) all leachable metals fall well below the EPA "toxic waste" limits; 2) dredging should focus on the area nearest the creek mouth; and 3) recent sediments, especially near the creek mouth are significantly more contaminated than other sites.

LaRock, P. and W. Landing. 1991. Diagnostic Study on Lake Jackson, Florida: Sources, Sinks, and Solutions, Final Report. Prepared for Florida Department of Environmental Regulation. Department of Oceanography, Florida State University, Tallahassee, Florida, 3 Vol. [NFWFMD]

--Volume I summarizes total loadings to the lake in the context of a mass balance for several water quality parameters. Volume II includes all sampling data and the results of a nutrient uptake experiment. Volume III assesses the behavior of heavy metals and the components of conductivity. Concentrations of metals and nutrients in sediments and plant tissues are evaluated.

LaRock, P. 1990. Long-Term Water Quality Data for Lake Jackson, Florida, Final Report. Prepared for Northwest Florida Water Management District. Department of Oceanography, Florida State University, Tallahassee, Florida, 243 pp. [NFWFMD]

--Compiles the results of all water quality sampling studies in Lake Jackson during the period 1971-87. Included was a statistical smoothing of data to permit trend analysis.

LaRock, P. 1988. Evaluation of the Lake Jackson Stormwater Treatment Facility, Final Report, Contract No. LR70(A), Florida Department of Environmental Regulation. Department of Oceanography, Florida State University, Tallahassee, Florida, 247 pp. [NFWFMD]

LaRock, P., and W. Landing. 1988. The Maintenance of Lake Water Quality and the Effectiveness of an Artificial Marsh and Impoundment to Remove Nutrients, Metals, and Components of Conductivity. Department of Oceanography, Florida State University, Tallahassee, Florida, 13 pp. [NFWFMD]

--Outlines the need for additional information concerning inputs of components of conductivity and heavy metals to Megginnis Arm and proposes research measuring influent and effluent loadings to the Megginnis Arm artificial marsh.

LaRock, P. 1988. Evaluation of the Lake Jackson Stormwater Treatment Facility, Final Report, Contract No. LR70(A), Florida Department of Environmental Regulation. Department of Oceanography, Florida State University, Tallahassee, Florida, 247 pp. [NFWFMD]

--A comprehensive review of the effectiveness of the Megginnis Arm stormwater treatment facility. Includes chapters concerning the dynamics of nutrient removal by an artificial marsh and the effects of bypass on the quality of effluent.

Lehman, M. 1989. Lake Jackson Action Team: An Interim Report With Recommendations to the Leon County Board Of County Commissioners. 7 pp. [NFWFMD]

--Contains specific ordinance and policy recommendations to be included in the Leon County Environmental Management Act and the Tallahassee-Leon County 2010 Comprehensive Plan. Also recommends a county commitment to stringent enforcement and implementation of the ordinances and plans.

Leon County Department of Public Works. 1986. Okeeheepke Area Comprehensive Development Study. Tallahassee, Florida, 29 pp. [NFWFMD]

--Identifies and assesses problems and sensitive environmental features including soils, slopes, wetlands, waterbodies, floodplains, floodways, natural areas, and drainage systems in the Okeeheepke sub-basin. Includes priority ranked recommendations to the Board of County Commissioners concerning regulatory solutions, water management improvements, zoning, land acquisition, and funding.

Leon County Department of Public Works. 1987. Stormwater Management Facility Maintenance Report. Environmental Management Section, Tallahassee, Florida, 77 pp. [NFWFMD]

--Study inspected a sample of permitted stormwater management facilities in Leon County and analyzed a number of variables which affect the performance of such facilities. Most of the facilities had some type of maintenance or design problems. Includes recommendations of methods to address such problems.

Leon County Department of Public Works. 1988. Lake Jackson Conservation Plan. Tallahassee, Florida, 47 pp. [NFWFMD]

--Outlines problems Lake Jackson is experiencing and provides fourteen recommendations for future management of the lake and its watershed. The recommendations were developed by a technical advisory committee comprised of staff from a number of local, regional and state agencies.

Livingston, R.J. 1993. The Ecology of the Lakes of Leon County, Florida. First Year Report. Center For Aquatic Research and Resource Management, Florida State University, Tallahassee, Florida, 5 Volumes. [NFWFMD]

--Comprehensive database and assessment of water quality conditions in Lake Jackson and other nearby lakes. Lake Jackson receives additional focus in terms of analysis of productivity, lakewide dissolved oxygen levels, macroinvertebrate populations, distribution of toxics, and presence of diseased fish.

Livingston, R.J. 1988. Lake Jackson Research: Current Studies and Proposal for Future Work. Center For Aquatic Research and Resource Management, Florida State University, Tallahassee, Florida, 10 pp. [NFWFMD]

--Outlines research currently being performed and proposes ongoing research for: 1) baseline data; 2) micro-algae and submerged aquatic vegetation and; 3) extended water/sediment chemistry. Estimates cost of proposed research at \$190,000 per year.

Livingston, R.J. 1988. The Ecology of Lake Jackson, An Interim Report. Florida State University Center for Aquatic Research and Resource Management, Special Publication Series No. 88-01. [NFWFMD]

--Identifies Lake Jackson ecosystem problems resulting from past and present development in the watershed. Concludes that portions of the lake are in an advanced state of hypereutrophication; fishes in the lake are being affected by toxic substances; dissolved oxygen is extremely low in areas of the lake as a result of increased plant biomass; and that the lake "is currently being used as a septic tank for stormwater runoff in the basin."

- Long, E.A. 1988. Federal Wallop-Breaux Performance Report, Project No. F-37-6. Ochlockonee River Watershed Studies, Study Number VI: Impact of Hydrilla Control on Sportfish Population in Lake Jackson. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, 18 pp. [NFWFMD]
- Annual report of a study to determine the response of the largemouth bass and other centrarchid communities in Lake Jackson to the management of hydrilla. Recommends implementation of a slot limit for bass in order to: 1) reduce exploitation of bass in specific age categories; 2) increase the catch rate for bass; 3) increase the number of quality sized bass in the population; and 4) increase predation on sub-harvestable bluegill. Also recommends continuance of the study.
- Macmillan, T.L. and D.J. Cairns. 1989. Management and Restoration of Lake Jackson, A Special Report to the Governor. Northwest Florida Water Management District Water Resources Special Report 89-2, 38 pp. [NFWFMD]
- Describes Lake Jackson watershed, outlines past and current activities of the Northwest Florida Water Management District concerning Lake Jackson, discusses the Megginnis Arm stormwater treatment facility, and summarizes the Surface Water Improvement and Management (SWIM) program for Lake Jackson.
- Macomber, R.H. and E. Crittenden. 1954. Fish and Fishing in Leon and Gasden Counties, Florida. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, pp. 10-11
- Maristany, A.E., J.R. Wagner, and M. Moustakas. 1984. Statistical Summary and Inventory of Streams and Lakes in Northwest Florida. Northwest Florida Water Management District, 198 pp. [NFWFMD]
- Inventories streamflow and lake level recording stations, and summarizes lake levels and stream flows throughout the Northwest Florida Water Management District. Data included for Lake Jackson and its tributaries.
- Maristany, A.E., R. Arteaga, J.A. Rodriguez, and D.H. Esry. 1988. City of Tallahassee and Leon County Stormwater Management Plan, Preliminary Report. Northwest Florida Water Management District Water Resources Assessment 88-2, 255 pp. [NFWFMD]
- Presents preliminary (two years of study) findings of a comprehensive stormwater plan being prepared for Tallahassee and Leon County by the Northwest Florida Water Management District. Provides recommendations for implementation of structural and non-structural interim measures to reduce flooding and water quality impacts. Also includes findings of a stormwater opinion survey undertaken in 1987 as part of the project.

Maristany, A.E., R. Arteaga, J.A. Rodriguez, and D.H. Esry. 1988. City of Tallahassee and Leon County Stormwater Management Plan, Preliminary Report, Executive Summary. Northwest Florida Water Management District Water Resources Assessment 88-2, 28 pp. [NFWFMD]

--Executive summary of previous reference.

Mason, D.R. and T.V. Belanger. 1977. Lake Jackson Water Quality Monitoring Study, Nov. 1976-Dec. 1977: Report to the Florida Department of Environmental Regulation. Department of Environmental Science and Engineering, Florida Institute of Technology, Melbourne, Florida.

Musgrove, R.J., J.H. Cason, and J.E. Bowman. 1981. Multifiltration Concepts for Stormwater Sediment Control. Presented at 1981 Winter Meeting, American Society of Agricultural Engineers, 12pp. [NFWFMD]

--Discusses design and predicts effectiveness of Megginis Arm stormwater filtration and artificial marsh system.

Musgrove, R.J. and E. Bowman. 1981. Engineering Design for Lake Jackson/Megginis Arm Restoration. Northwest Florida Water Management District Report 81-1, 18 pp. [NFWFMD]

--Summarizes the design of the filtration impoundment and artificial marsh. Includes construction cost estimates and discusses operation and maintenance requirements.

Neuman, L.A. 1985. Botanical Analysis, Ordinary High Water Line Survey, Lake Jackson, Leon County, Florida: Dendrology. Florida Department of Natural Resources, Tallahassee, Florida, 17 pp.

Nordhaus, J.J. 1989. Federal Wallop-Breaux Performance Report, Project No. F-37-7. Ochlockonee River Watershed Studies, Study Number VI: Impact of Hydrilla Control on Sport Fish Population in Lake Jackson. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, 11 pp. [NFWFMD]

--Annual report of a study to determine the response of the largemouth bass and other centrarchid communities in Lake Jackson to the management of hydrilla. Recommends implementation of a slot limit for bass in order to: 1) reduce exploitation of bass in specific age categories; 2) increase the catch rate for bass; 3) increase the number of quality sized bass in the population; and 4) increase predation on sub-harvestable bluegill. Also recommends continuance of the study.

Northwest Florida Water Management District. 1990. Contract Documents and Technical Specifications for Lake Jackson SWIM - Megginnis Arm Sediment Removal Project. [NFWWMD]

--Bid documents, conditions of the contract, and technical specifications for the sediment removal project. Includes a summary of sediment and geotechnical investigations and grain distribution curves.

Northwest Florida Water Management District and Center For Aquatic Research and Resource Management, Department of Biological Science, Florida State University. 1988. Water and Sediment Quality in Lake Jackson, Florida; Broad Scale Profiles for Basin Management of Toxic Agents. 8 pp. [NFWWMD]

--A proposal to FDER for quarterly lakewide sampling of water, sediments, and animal tissue to be analyzed for metals, polynuclear aromatic hydrocarbons (PAHs) and other hydrocarbons. Project was not funded.

Northwest Florida Water Management District. 1988. Surface Water Improvement and Management Plan for the Lake Jackson Watershed. Draft. 47 pp. [NFWWMD]

--Outlines SWIM program, describes the Lake Jackson watershed, surveys existing and current research activities and describes the five SWIM projects and their budgets.

Northwest Florida Water Management District. 1987. Alterations/Renovations to the Artificial Marsh Section of the Lake Jackson Clean Lakes Restoration Project: Technical Specifications and Contract Documents. [NFWWMD]

--Technical specifications and contract documents for renovation work on artificial marsh which involved: replacement of rock dikes between cells one and two with concrete wiers; excavation of channels in cells one and two; culvert reinstallation; correction of erosion problems; and construction of access ramps to each cell.

Northwest Florida Water Management District. 1985. Stormwater Drainage Evaluation of the Lake Lafayette, Lake Munson, Lake Jackson, and Fred George Basins, Plan of Study. 42 pp. [NFWWMD]

--Plan of study for joint City-County comprehensive stormwater management plan. Outlines methodology for literature review, data collection, development of regional unit hydrograph equation, evaluation of pollutant loading, application of hydrologic model, formulation of management strategies, and implementation of the hydrologic model as a planning tool. Estimates costs and time table for the project and identifies the project team.

Northwest Florida Water Management District. 1981. The Lake Jackson Restoration Project: Update. Public Information Circular 81-3. 1 Sheet. [NFWWMD]

Northwest Florida Water Management District. 1981. Bid Documents and Technical Specifications For Lake Jackson/Megginnis Arm Restoration. [NFWFMD]

--Technical specifications for: dam construction; spillway and impoundment excavation; rapid sand filter and reject retention pond; intermittent filter; diversion structure; artificial marsh; and landscaping.

Paisley, C. 1981. From Cotton to Quail. University Presses of Florida: Gainesville, Florida, 162 pp.

Pascale, C.A. and J.R. Wagner. 1982. Water Resources of the Ochlockonee River Area, Northwest Florida. U.S. Geological Survey Water-Resources Investigations Open-File Report 81-1121.

Post, Buckley, Schuh, and Jernigan. 1976. Preliminary Review of the Leon County Master Drainage Plan and Analysis of Retention Basins. Mimeo, 11 pp.

Post, Buckley, Schuh, and Jernigan. 1976. Evaluation of the Master Drainage Plan and Conceptual Development of Improvements. Miami, Florida.

Post, Buckley, Schuh, and Jernigan. 1977. Tallahassee-Leon County 208 Study-Stormwater Control Alternatives for the Megginnis Arm Basin. Miami, Florida.

Reynolds, Smith and Hills. 1980. Ponding Concepts for Stormwater Treatment, Megginnis Arm - Lake Jackson. Prepared for the Northwest Florida Water Management District, 45 pp. [NFWFMD]

--Reviews eight ponding alternatives including filtration systems, construction and operation and maintenance costs, and comparisons of sediment and nutrient removal effectiveness. Also includes alternatives for site landscaping and multi-use potential.

Rivers, E.G., and C.J. Allen. 1974. Silt Barriers as Erosion Pollution Control in a Large Recreational Lake. Florida Department of Transportation, Tallahassee, Florida, 48 pp.

--Discusses the use of impermeable floating silt barriers in Megginnis and Fords Arms to reduce turbidity in the main body of Lake Jackson resulting from I-10 construction. Outlines silt barrier design and evaluates performance.

Schamel, S. 1974. Urban Sediment in Lake Jackson, Leon County, Florida, Initial Report. Department of Geology, Florida State University, Tallahassee, Florida. [NFWFMD]

--An investigation of the character and distribution of sediment in Lake Jackson and the changes in sedimentation processes and rates resulting from urbanization and construction of Interstate 10.

Sellards, E.H. 1914. Some Florida Lakes and Lake Basins in Sixth Annual Report. Florida Geological Survey, Tallahassee, Florida.

Schmidt, W., E. Bishop, S. Spencer, K. Campbell, R. Hoenstine and E. Lane. 1985. Geological Analysis, Ordinary High Water Line Survey, Lake Jackson, Leon County, Florida. Florida Department of Natural Resources, Tallahassee, Florida, 25 pp.

Smith, H. 1988. Vertebrate Wildlife Resources in and Surrounding Lake Jackson, Draft Report (unpublished), Florida Department of Natural Resources, Tallahassee, Florida. [NFWFMD]

--Identifies vertebrates of the immediate Lake Jackson watershed including species and habitats of special significance (endangered, threatened and species of special concern).

Smith, S.L. 1974. Lake Management and Research, Lake Jackson Investigations, Final Report, D-J Report. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida, 93 pp.

Smith, S.L. 1975. Standing Crop, Success and Harvest in a Trophy Bass Lake, Lake Jackson, Florida. Proceedings of the Annual Conference, Southeast Association of Fish and Wildlife Agencies, 29: 135-141

State of Florida, Office of the Governor. 1989. Executive Order Number 89-137. 4 pp. [NFWFMD]

--Order executed by Governor Bob Martinez on July 11, 1989. Directs agencies to closely examine all development proposals in the watershed and allow only those which will not degrade the lake; requires that the SWIM program restore Megginis and Fords Arms; appropriates \$200,000 to the District from the Pollution Recovery Trust Fund; requests the city and county to protect the lake through stormwater master plans and the local comprehensive plan; requires the DCA to review the comprehensive plan with particular scrutiny to the management of the watershed; expedites completion of the DNR Aquatic Preserve Management Plan; and requests ongoing research and management by the FGFWFC.

Stringfield, V.T. 1966. Artesian Water in Tertiary Limestone in the Southeastern States. U.S. Geological Survey Professional Paper 517, pp. 82-89.

Swanson, H.R. et al. 1988. Environmentally Sensitive Areas of Leon County, Florida. Leon County Department of Public Works, Tallahassee, Florida, 101 pp. [NFWFMD]

--Describes project for identifying and mapping environmentally sensitive areas in Leon County. Identifies, maps and discusses drainage, floodprone areas, wetlands, uplands, and severe grades in the Lake Jackson Watershed.

Tallahassee-Leon County Planning Department. 1976. Plan of Study 208: Tallahassee-Leon County Areawide Waste Treatment Management Study, 237 pp.

Tallahassee-Leon County Planning Department. 1976. Plan of Study 208: Tallahassee-Leon County Areawide Waste Treatment Management Study, Section 6.30, Planning Process 237 pp.

Tallahassee-Leon County Planning Department 1989. U.S. 27 Study Report. Tallahassee, Florida, 39 pp. [NFWFMD]

--Analyzes environmental, transportation, and land use issues for an area which includes the Okeeheepkee sub-basin. Provides recommendations to the Leon County Board of County Commissioners concerning these issues.

Tuovila, B.J., T.H. Johengen, P.A. LaRock, J.B. Outland, D.H. Esry, and M. Franklin. 1987. 'An Evaluation of the Lake Jackson (Florida) Filter System and Artificial Marsh on Nutrient and Particulate Removal from Stormwater Runoff'. In: K.R. Reddy and W.H. Smith (eds.). Aquatic Plants for Water Treatment and Resource Recovery. Magnolia Publishing Company, Orlando, Florida, pp. 271-278. [NFWFMD]

--Outlines the methodology and equipment used for measuring the effectiveness of the Megginnis Arm stormwater treatment facility. After one year of study, it was found that the system is capable of removing a large percentage of suspended solids and dissolved and particulate nutrient material and that the limiting factor in regard to effectiveness of the facility is its holding capacity.

Turnbull, M.R. 1990. 'Can We Save Lake Jackson' in: Tallahassee Magazine, January-February 1990, pp. 9-12. [NFWFMD]

--Discusses Lake Jackson's pollution problems and Leon County's method of approaching these problems through development of the "Lake Jackson Action Team" - a task force made up of citizens and the top executives of four major state agencies.

Turner, R.R. and T.M. Burton. 1974. The Effect of Urban Land Use on Nutrient and Suspended Solids Export from North Florida Watersheds. In: Job Completion Report, Lake Jackson Investigations. R.C. Harriss and R.R. Turner (eds.), 1974. [NFWFMD]

--A comparison of runoff characteristics from two sub-watersheds of similar size within the Lake Jackson watershed--one which is forested-agricultural (Ox Bottom), and one which is urbanized (Megginnis Arm). Identifies effects of urbanization and recommends the development of monitoring programs for urbanizing areas and the development of techniques to properly manage stormwater quality.

Turner, R.R. and T.M. Burton. 1975. The Effects of Land Use on Stormwater Quality and Nutrient and Suspended Solids Export from Three North Florida Watersheds. In: Proceedings: Storm-Water Management Workshop, February 26-27, 1975. Florida Technological University, Orlando, Florida. pp. 121-146. [NFWFMD]

--A comparison of runoff characteristics from three sub-watersheds within the Lake Jackson watershed--one which is forested-agricultural (Ox Bottom), one which is urbanized (Megginnis Arm) and one which is undergoing development and is considered suburban (Fords Arm). Identifies effects of urbanization and recommends treatment of stormwater through the use of regional holding ponds, marshes, greenbelt areas, and site-specific treatment for the shopping malls.

Turner, R.R., T.M. Burton and R.C. Harriss, 1977. Lake Jackson Watershed Study. In: Watershed Research in Eastern North America, a Workshop to Compare Results, Volume 1. Edited by D.L. Correll, Cheseapeake Bay Center for Environmental Studies, Edgewater Maryland, pp. 19-32

U.S. Department of Agriculture, Soil Conservation Service. 1976. Special soil survey report (Lake Jackson Drainage Basin). Maps and Interpretations. Leon County, Florida, 62 pp.

U.S. Environmental Protection Agency. 1983. Final Environmental Impact Statement, Tallahassee-Leon County Wastewater Management. EPA Publication 904/9-83-106, Atlanta Georgia. [NFWFMD]

--Examines five alternatives for expansion of the Tallahassee municipal wastewater management system. Recommends no further federal grants be made for expansion of the system, thus requiring new development in Leon County which is outside the sewer service area to be served by on-site and small community systems.

U.S. Geological Survey. 1989. Lake Jackson Stage Record. Tallahassee, Florida, 1 Sheet. [NFWFMD]

U.S. Geological Survey. 1988. Lake Jackson Stage Record. Tallahassee, Florida, 1 Sheet. [NFWFMD]

Wagner, J.R., and R.J. Musgrove. 1983. Hydrologic Assessment of Lake Iamonia and Iamonia Sink, Leon County, Florida. Northwest Florida Water Management District, Water Resources Special Report 83-1, 50 pp. [NFWFMD]

--Analyzes the acceptance rate of Iamonia sink to determine whether drawdown of the lake can be attained through use of the sink. Concludes that at the current rate of acceptance, it would take approximately 2.5 years of extremely dry weather to drop the lake to the desired level.

Wagner, J.R. 1984. Hydrogeological Assessment of the October 1982 Draining of Lake Jackson Leon County, Florida. Northwest Florida Water Management District, Water Resources Special Report 84-1, 38 pp. [NFWFMD]

--Determines relationship between surface and ground water in Lake Jackson. Concludes that prolonged drought occurring when lake level is about 82 feet or less will enable the ground water to capture the remaining volume of the lake.

Wanielista, M.P., H.H. Harper, and S-S. Kuo. 1984. Bottom Sediments Megginnis Arm, Lake Jackson, Tallahassee, Florida, Final Report. College of Engineering, University of Central Florida, Orlando, Florida, 104 pp. [NFWFMD]

--An intensive survey of the bottom sediments and lake water of Megginnis Arm. Recommends the use of alum to inactivate the sediments and improve water quality.

Ware, F.J. and S.L. Smith. 1973-1974. Final Report for Investigations Project. Lake Management and Research. Lake Jackson Investigations, Study VI. Florida Game and Fresh Water Fish Commission

Watkins C.E., J.M. Buss., E. Livingston and P. LaRock. 1992. Management of Nonpoint Source Pollutants Using a Marsh-Impoundment Stormwater Management Facility, in Proceedings of the First Annual Southeastern Lakes Management Conference, March 19-21, 1992, Marietta, Georgia, C. E. Watkins, H. McGinnis, and K. J. Hatcher, eds. North American Lake Management Society.

--A summary of a five-year study that assessed the effectiveness of the Lake Jackson stormwater treatment facility. Mass balances for five storm events indicate that the system removes more than 96% of the inorganic and organic solids, but it only 50% of total nitrogen and 60% of total phosphorous.

William M. Bishop Consulting Engineers Inc. and Tallahassee-Leon County Planning Commission. 1973. Tallahassee-Leon County Water Quality Management Plan. Tallahassee, Florida, 253 pp. [NFWFMD]

--A comprehensive water quality management plan which assesses existing sources of pollution and includes alternatives and recommendations for management of pollution sources.

William M. Bishop Consulting Engineers Inc. 1975. Environmental Inventory, Appendix A, Tallahassee-Leon County, Florida 201 Facilities Plan. Tallahassee, Florida, 19pp. [NFWFMD]

--Includes an assessment of Lake Jackson with a recommendation that a routine sampling program be adopted to monitor pollutant input.

Yon, J.W. 1972. Environmental geology and hydrology of the Tallahassee Area, Florida. Bureau of Geology, Florida Department of Natural Resources, Special Publication No. 16., Tallahassee, Florida, 61 pp.

LAKE JACKSON MANAGEMENT PLAN

APPENDIX 6

**Progress of the Lake Jackson Management Plan
1990 through 1993**

This Progress Report developed and completed by
Northwest Florida Water Management District
pursuant to
Surface Water Improvement and Management (SWIM) Program
in cooperation with
Florida Department of Environmental Protection
and the
Lake Jackson Action Team

PROGRESS OF LAKE JACKSON MANAGEMENT PLAN

1990 THROUGH 1993

Introduction

The Lake Jackson Management Plan was adopted in December 1990, and since then substantial progress has been made toward its implementation. This section provides brief project-by-project reports of implementation activities. Readers may wish to consult the project descriptions found in the 1990 Lake Jackson Management Plan for additional information concerning the scope of each project.

Water Quality Program

Project Q-1: Evaluation and Application of Water Quality Data--District staff has utilized data compiled through a SWIM contract with the Florida State University Department of Oceanography and through a recent U.S.EPA Clean Lakes study to analyze historic and current water quality conditions of the lake. This information is useful for tracking plan implementation, for development of pollution load reduction goals, and for integration with other data to determine changes in the ecological characteristics of the lake.

Project Q-2: Long-Term Water Quality Monitoring--Leon County has contracted with the Florida State University Center for Aquatic Research and Resource Management (CARRMA) to monitor a number of lakes in the county, including Lake Jackson. A report covering the first year of this effort was produced in the summer of 1993. Continuation of such monitoring is essential to determine the results of water quality improvement strategies.

Project Q-3: Citizen Water Quality Monitoring--This project has not been implemented, largely because a more reliable water quality monitoring program has been underway.

Project Q-4: Regional Stormwater Retrofit Planning and Implementation--The Lake Jackson Regional Stormwater Retrofit Plan (Bartel et al 1992) was completed by the District in the spring of 1993 and submitted to Leon County and the City of Tallahassee for adoption pursuant to a local comprehensive plan policy. Some major retrofit projects were completed in the Megginnis Creek subbasin, including the SWIM/Leon County/DOT I-10/Megginnis Creek Pond (see project Q-4a below); and the City of Tallahassee John Knox Road Facility. As a condition of permits needed for a major expansion project, a stormwater retrofit of the approximately 100-acre Tallahassee Mall property was completed by the mall owners. These retrofits, in concert with the District's existing Megginnis Arm treatment system have had noticeable effects on the quantity and quality of stormwater runoff which flows to Megginnis Arm. In the upcoming plan cycle, the SWIM program will monitor these systems to document and quantify the hydrologic and water quality changes which have resulted from their construction.

Through the SWIM Retrofit project, District staff has explored a number of strategies for funding land acquisition and construction of facilities recommended in the Retrofit Plan. Progress was also made on the retrofit of Yorktown pond (see project R-7 below).

Project Q-4a: I-10/Megginnis Creek Pond--The District SWIM program, Leon County and the Florida Department of Transportation worked together to construct a regional stormwater treatment facility to enhance operation of existing facilities and treat runoff from a 120-acre basin. This component of the Regional Stormwater Retrofit Project (Q-4), was completed in 1993. A detailed description of the facility and the development, funding, and implementation of this project can be found in the NWFWMMD publication: I-10/Megginnis Creek Stormwater Treatment Facility: Project Completion Report (Macmillan 1993).

Project Q-5: Improvement of Megginnis Arm Facility--In 1991, the District utilized SWIM funds to improve the sand filter and irrigation system of the District's stormwater treatment facility. This effort also included an unsuccessful attempt to seed the surface of the filter with grass to prevent clogging by fine clay particles. Following the refurbishment of the filter, data was collected to be used in the development of an operation and maintenance manual and permit.

Project Q-6: Megginnis Arm Facility Operation and Maintenance--In 1991, approximately 9,000 cubic yards of accumulated material was removed from the facility heavy sediment basin. Other routine maintenance tasks were performed during the three year plan cycle.

Project Q-7: Onsite Design Criteria & Effectiveness--This project was not implemented during the plan cycle. The project was intended to determine the effect of recent stormwater management system design criteria changes to local environmental ordinances. Since relatively few new stormwater systems have been constructed in the Lake Jackson watershed since the ordinances were revised, it may be desirable to delay implementation of this project until 1995 or 1996.

Project Q-8: Retrofit of Nonconforming Sites--This project has not been implemented as designed, however, some nonconforming sites have been retrofitted through expansion or redevelopment projects.

Project Q-9: Evaluation of Septic Tank and Sewer Issues--Due to funding limitations, this project had minimal work performed during the plan cycle, however, it will be implemented through SWIM beginning in fiscal year 1993-94.

Project Q-10: Agricultural Impacts--Because of perceived minimal impacts from agricultural activities in the watershed, this project was not implemented during the plan cycle.

Project Q-11: Recreational Impacts--A literature review performed through SWIM concluded that determination of water quality impacts from recreational activities would require site-specific research.

Restoration & Preservation Program

Project R-1: Long-term Monitoring of Habitat--The Florida Department of Natural Resources (now Department of Environmental Protection) developed a GIS map of the Lake Jackson watershed which provides baseline habitat information. The Tallahassee-Leon County Planning Department, Environmental Planning Section began a county-wide upland and wetland habitat assessment project in 1993 which will provide valuable habitat information in the next few years.

Project R-2: Megginnis Arm Sediment Removal--This major restoration project (\$1.13 million) involved removal of approximately 112,000 cubic yards of contaminated sediments from Megginnis Arm. It was implemented in 1990 through 1992, utilizing funds from SWIM, U.S. EPA, the Florida Pollution Recovery Trust Fund, a special legislative appropriation, and local government. The success of this project will be evaluated through SWIM in fiscal years 1993-94 through 1995-96.

Project R-3: Additional Megginnis Arm Restoration--In 1992, this project was successful in securing a \$300,000 U.S. EPA grant to further restore Megginnis Arm by replanting portions of the arm with desirable native vegetation. The project also provided administrative support for completion of the sediment removal project.

Project R-4: Fords Arm Restoration--SWIM funding was used in 1991-92 to contract with Dr. William Landing of Florida State University to determine interrelationships between sediments and water quality in Fords Arm. The District also performed work which documents historic conditions of the arm and its watershed. Both of these efforts will be used in the development of future restoration strategies.

Project R-5: Restoration of Upland & Aquatic Areas--Other than the Megginnis Arm project, no major restoration projects have been implemented in the watershed. The Tallahassee-Leon County Planning Department recently began gathering information which will be helpful in the identification of areas needing restoration.

Project R-6: Timberlane Creek Berm Removal--Through SWIM, the District performed a detailed analysis of conditions in Timberlane Creek between Meridian and Timberlane Roads. The study concluded that removal of a spoil berm on the creek bank would provide only minimal benefits. See NFWMD document titled: Timberlane Creek Berm Removal Analysis (Arteaga 1992) for additional information on this project.

Project R-7: Yorktown Pond Restoration--In 1993, Leon County and homeowners adjacent to Yorktown Pond developed a plan to restore the pond to provide treatment of stormwater runoff. This plan will be implemented in 1994, utilizing funds from SWIM, Leon County, and the homeowners.

Watershed Management Program

Project M-1: Ecological Analysis of Lake Jackson Watershed--Through the Leon County contract with CARRMA (see Project Q-2 above) substantial information is being collected on the ecology of the lake, however, substantial additional funding would be required to perform a watershed ecological analysis as envisioned by this project.

Project M-2: Land Acquisition--The committee to recommend land acquisition for the Lake Jackson watershed was not activated, however two major parcels of land were acquired during the plan cycle. The District and the City of Tallahassee purchased the 670-acre Phipps parcel in the summer of 1992. The parcel was eligible for purchase through the District's Save Our Rivers program because of Lake Jackson's SWIM priority status. The District's interest in the purchase was to preclude development of this waterfront site which includes an extensive natural ravine system. The City of Tallahassee was interested in the purchase because the parcel included an existing recreational soccer complex and areas which could be used for additional active recreational uses (baseball fields). A second major (890± acres) parcel, the Lake Overstreet property, is slated for purchase in the near future by the Department of Environmental Protection and the City of Tallahassee. These two large purchases will preserve a continuous swath of land between the lake to the west and Thomasville Road to the east. This area is one of the most rapidly growing portions of the Leon County and, if developed, would have resulted in increased pollution to Lake Jackson from stormwater runoff.

Project M-3: Park Design Committee--The Leon County Public Works Department agreed to set up ad hoc committees to assist in the design of parks in the Lake Jackson watershed. At the time that the Public Works Department begins planning for a new park or for major renovations to an existing park, a committee will be appointed to assist with the design and ensure that the park will be developed in an environmentally sensitive manner.

Project M-4: Aquatic Preserve Management--The Lake Jackson Aquatic Preserve Management Plan was completed and adopted by the Governor and Cabinet on July 23, 1991. Since there is no dedicated funding for the Lake Jackson Aquatic Preserve, no proactive management activities have been implemented. Staff from the statewide Aquatic Preserve program respond to permit requests and have assisted Leon County in the development of design criteria for new docks.

Project M-5: Fish and Wildlife Management and Research--The Florida Game and Fresh Water Fish Commission has been implementing a study of the effect of a protective slot limit on largemouth bass population structure and angler yields. To date, results of the study indicate that the slot limit is having a favorable impact on the population size structure, and that angler catch success is excellent.

Project M-6: Aquatic Plant Management--The Florida Department of Environmental Protection (DEP) continued routine treatment of the lake for the nuisance aquatic plant water hyacinth. The DEP has also been treating portions of the lake for hydrilla, another nuisance exotic, since 1987, with the most recent treatments in 1992 and 1993. Recent reductions in funds available for the aquatic plant management program have required the DEP to

request funds from local governments to continue this relatively expensive (approximately \$75,000/year) program.

Project M-7: Regulatory Assessment & Coordination--District staff has coordinated with local government and other agencies in the development and review of various regulatory strategies for protecting the lake.

Project M-8: Regulation of Recreational Uses--District staff performed a review of programs which regulate recreational uses. A short report summarizing existing regulations for a number of recreational activities was prepared. The report was reviewed by the Lake Jackson Action Team, and the Action Team felt that enhanced enforcement of existing regulations would be preferable to developing new regulations.

Project M-9: Ordinary High Water Line--This project had no activity during the plan cycle.

Project M-10: Action Team as an Oversight/Advocacy Committee--The Lake Jackson Action Team has served in an oversight/advisory capacity throughout the plan cycle. This has included review and coordination of various aspects of the Plan, and providing advisory recommendations to the Leon County Board of County Commissioners (BCC) and the agencies involved in implementation of the plan. In February 1993, the Action Team prepared and presented to the BCC a status report with a series of recommendations.

Project M-11: Coordinate & Update Management Plan--District staff has continued to administer the SWIM portions of the Lake Jackson Management Plan through this project. Ongoing tasks include project development and budgeting; development of requests for matching funds from local government; coordination with the Lake Jackson Action Team and local and state agencies; revision of the Lake Jackson Management Plan; and general program oversight, administration and coordination.

Project M-12: Contingency Management Plan for Natural Drawdown--This project was not implemented during the plan cycle.

Public Education & Awareness Program

Project E-1: Planning & Administration--The Public Education Working Group organized the Lake Jackson Action Day in 1992. The group's work has contributed substantially toward increasing the public understanding of Lake Jackson.

Project E-2: Printed Materials--"Looking at the Big Picture: The Lake Jackson Watershed" poster/brochure was published and about 7,000 copies were distributed. More than 1,800 Leon County public school teachers were slated to receive the brochure and a flyer advertising the availability of field trips to the District's stormwater treatment facility. A pamphlet entitled "Lake Jackson and Clean Water...You Can Make a Difference", was published in 1992.

Project E-3: Media Relations--The program has attracted attention to the lake because several good contacts with the local media have paid off. WCTV, the

Tallahassee Democrat and Public Radio covered the official opening of the I-10/Megginnis Creek Pond Stormwater Treatment Facility. Public Radio also aired a story on the Megginnis Arm Sediment Removal Project. Staff wrote articles published in the Tallahassee Democrat in September 1991 on native shoreline plants, and an article on Lake Jackson and how SWIM projects have helped the lake for "Florida Water", a magazine published as a joint effort by all five water management districts.

Project E-4: Corporate/Private Sponsorship--The Tallahassee Mall donated \$5,000 to Leon County for the working group to use for environmental awareness and education programs, which was used to supplement the projects developed in 1992. Additional sponsorships may be developed depending on need.

Project E-5: Miscellaneous Awareness Activities--This program has incorporated several tours, including field trips by Leon County students, to the District's stormwater treatment facility. Staff held a legislative event in January 1994 at the Klapp-Phipps Park so state and local officials could become aware of the plans to protect Lake Jackson. About 50 people attended a ribbon-cutting ceremony for the I-10/Megginnis Arm stormwater treatment facility.

Project E-6: School Programs--Coordination with schools continued. Flyers advertising a field trip to the District's stormwater runoff treatment facility was sent to teachers in conjunction with the "Big Picture" brochure. The WaterWays middle school educational video on water resources and concerns included Lake Jackson information.

Project E-7: Educational Materials--EnviroScape I, a tabletop model that demonstrates how stormwater runoff degrades waterbodies and how best management practices can clean it up, was purchased and used at several events and locations. Among some of the events the model was shown included EcoFest I, an event organized by the Department of State and attended by over 350 Boy Scouts and Girl Scouts from several counties; Springtime Tallahassee; and the Leon Association for Science Teaching Conference, which was attended by approximately 800 teachers.

Project E-8: Outdoor Educational Displays--Outdoor educational signs were installed at five Lake Jackson boat landings and there are plans for additional signs at the Old Bainbridge Road Park. The informative signs, which are about Lake Jackson, its plant and animal life, stormwater runoff and its effects and responsible personal and recreational behaviors, were installed in 1992 at Sunset Landing, Highway 27 Landing, Megginnis Arm Canoe Landing, Rhoden Cove Landing and Miller's Landing. Funding for the signs was provided by a \$20,000 grant from the U.S. EPA. A news release was issued at the completion of this project and two local television stations aired a segment of the signs. Arrangements were made with Leon County for the maintenance and repair of the signs.

Project E-9: Community Activities--Springtime Tallahassee, an event attended by thousands, has been a good forum during the last three years for exhibits on Lake Jackson and using the EnviroScape model using the effects of stormwater runoff to the lake. Staff will continue to attend the annual event to inform people about the lake. Another event was the Lake Jackson Action Day in October 1992. Attempts will be made in 1994 to organize another action day.

Project E-10: Citizen Water Quality Monitoring--This project has not been implemented.

Project E-11: Public Awareness Survey--This project has not been implemented but will become a target for the next plan cycle.

Project E-12: Lake User Survey--Project not implemented.

LAKE JACKSON MANAGEMENT PLAN

APPENDIX 7

Proposed Public Education and Awareness Activities

Developed by
Northwest Florida Water Management District
pursuant to
Surface Water Improvement and Management (SWIM) Program
in cooperation with
Florida Department of Environmental Regulation

This appendix provides a convenient reference of specific public education and awareness activities that have been proposed or suggested for the various projects in the Public Education and Awareness Program, and they will be considered by the Public Education Working Group for implementation in the next three years.

PUBLIC EDUCATION AND AWARENESS PROGRAM

Proposed Activities

The Public Education and Awareness Program may include any number and variety of activities, depending on the needs of the local areas and the availability of staff and funds for implementation. Projects E-01 through E-12 provide the direction and framework for the program. Listed below are specific activities that may be accomplished as part of one or more of these projects.

Provide information to bait and tackle stores, marine supply stores, tourist information centers, and landscape and garden shops. This activity may begin with a simple "how to help the lake" brochure and may lead to workshops for interested parties.

Develop and distribute a homeowner's guide to on-site stormwater treatment which explains how to design and construct an individual home system and why it is necessary. Provide technical assistance to homeowners as requested.

Distribute informational brochures or leaflets to utility customers through monthly water, electricity, gas, or telephone bills.

Provide information to Welcoming Services for new residents.

Produce and distribute an educational publication about the Lake Jackson watershed that addresses priority issues, personal responsibilities, and management roles.

Develop and distribute a Lake Jackson resource information/alert publication to inform the reader/user about the appropriate agency to contact for information, the way to report a violation, and when and how to request an inspection.

Develop and distribute a citizen's guide to the rules and regulations affecting Lake Jackson which includes an environmental glossary. This publication may be distributed to legislators, policymakers, the media, and the general public.

Update and print the general SWIM brochure.

Publish and print annual program reports on implementation of the Lake Jackson Management Plan.

Develop a periodic newsletter or bulletin that includes information about accomplishments of the Lake Jackson Management Plan which can be distributed to area residents, legislators, and local policymakers.

Pursue the publication of environmental articles or special inserts in local newspapers.

Submit articles about Lake Jackson and the issues listed in this project to local newspapers and magazines, as well as magazines which are distributed statewide.

Submit articles about Lake Jackson and the issues listed in this project to state, regional and national recreational and sportfishing magazines.

Pursue newspaper, television, and radio public service announcements about Lake Jackson.

Pursue guest appearances on television and radio to discuss Lake Jackson and the issues outlined in this plan.

Encourage television stations to use a slide or series of slides which depict Lake Jackson for individual station identification breaks.

Encourage radio and television stations to include a series of informational messages about Lake Jackson preservation and restoration efforts in individual programming.

Pursue individual sponsorship of special events to assist in promotion of Lake Jackson activities, such as a Lake Awareness concert.

Determine the feasibility and use of outdoor advertising for Lake Jackson preservation messages.

Continue specialty advertising, including t-shirts, sweatshirts, buttons, and notepads.

Organize a Lake Awareness concert.

Include photographs, drawings or sketches of Lake Jackson with simple preservation messages in local calendars.

Pursue the use of printed messages about Lake Jackson on place mats or tray liners for use in fast food chain stores within the watershed.

Display Lake Jackson information at community events.

Coordinate with Tallahassee Community College (the region's environmental education clearinghouse) in the development of a comprehensive inventory of public awareness/education projects. Use this information to eliminate duplication of efforts and to determine what additional programs are needed. This information will be used in developing future public education and awareness programs.

Respond to requests for public speaking.

Provide periodic workshops for policymakers.

Develop an activity booklet specific to Lake Jackson for elementary school levels which includes simple lake-related activities that students can perform as a group at school or individually at home.

Develop a companion piece to the District's "WaterWays" middle school educational program which is currently in use in public middle schools in the watershed's counties. This companion piece will address Lake Jackson and the specific water quality, habitat and management issues in greater detail than what is currently provided through "WaterWays."

Provide information and assistance about Lake Jackson for school science fairs.

Develop a short weekend field course for youth and adults.

Develop a slide show on Lake Jackson which includes information on priority issues in the watershed, the Lake Jackson Management Plan, and the principles of stormwater treatment and watershed management. The slide show shall be designed for multiple audience adaptations.

Produce a video about Lake Jackson that can be broadcast on television and used for public speaking.

Produce a video about the SWIM Program in general which can be used statewide and may feature Lake Jackson.

Showcase specific sites that illustrate good watershed management practices. This may include design and construction for installation on public or private property which may or may not currently be developed. This showcase should illustrate environmentally sound landscaping techniques, good littoral zone management, or aesthetically pleasing stormwater management areas.

Local clean-up/awareness days for Lake Jackson coordinated with statewide and national efforts.