ALAFIA RIVER COMPREHENSIVE WATERSHED MANAGEMENT PLAN

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TABLE OF CONTENTS

CHAPTER I - INTRODUCTION 1-1
SECTION 1. PURPOSE OF THE COMPREHENSIVE WATERSHED MANAGEMENT PLAN 1-1
1-1 COMPREHENSIVE WATERSHED MANAGEMENT 1-1
1-1.1 Coordination With Local Governments and Other Agencies 1-2
1-1.2 Community Coordination 1-5
1-1.3 Funding Commitments 1-6
1-1.4 Implementation 1-6
1-1.5 Future of CWM - A Watershed-based Partnership Approach 1-8
1-2 DISTRICT DIRECTIVES 1-8
1-2.1 Mission Statement 1-10
1-2.2 Primary Areas of Responsibility and Goal Statements . . 1-10

CHAPTER II - ALAFIA RIVER WATERSHED DESCRIPTION 2-1
SECTION 1. LOCATION 2-1
SECTION 2. CLIMATE 2-1
SECTION 3. LAND USE, DEVELOPMENT AND ECONOMY 2-2
SECTION 4. TRANSPORTATION 2-3
SECTION 5. PHYSIOGRAPHY 2-4
SECTION 6. HYDROGEOLOGY 2-5

CHAPTER III - WATER SUPPLY 3-1
SECTION 1. LITERATURE REVIEW 3-6
1-1 DISTRICT WATER MANAGEMENT PLAN 3-6
1-1.1 Part A. Issues Common to all Areas of Responsibility . . 3-7
1-1.2 Part B. Water Supply 3-9
1-1.3 Part C. Flood Protection 3-9
1-1.4 Part D. Water Quality 3-9
1-1.5 Part E. Natural Systems 3-9
1-1.6 Part F. Management Services 3-10
1-2 SURFACE WATER STUDIES RELATED TO WATER SUPPLY 3-11
1-3 GROUND-WATER STUDIES RELATED TO WATER SUPPLY 3-11
1-4 SOUTHERN WATER USE CAUTION AREA

INFORMATION REPORT 3-11
SECTION 2. AVAILABLE DATA 3-12
SECTION 3. OUTSTANDING PERMITTING ISSUES 3-13
3-1 THE SOUTHERN WATER USE CAUTION AREA (SWUCA) 3-17
3-1.1 Background to SWUCA 3-17
3-1.2 Historic SWUCA Perspective 3-19
3-1.3 The Future of SWUCA 3-19
3-1.4 Conclusion 3-20
3-2 NEW WATER SOURCES INITIATIVE & WATER SUPPLY DEVELOPMENT 3-21
3-3 SEAWATER DESALINATION 3-21
SECTION 4. REGULATORY AUTHORITY AND SPECIAL RULES 3-21
4-1 FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION ECOSYSTEM MANAGEMENT INITIATIVE . . . 3-22
4-2 TAMPA BAY WATER 3-22
4-3 SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT 3-22
SECTION 5. GOVERNMENTAL AND OTHER WATERSHED ACTIVITIES 3-23
5-1 TAMPA BAY WATER 3-23
5-1.1 Tampa Bay Water's Master Water Plan 3-23
5-1.2 Current Master Water Plan Projects 3-25
5-1.3 New Water Supply Project Funding 3-27
5-1.4 Master Water Plan Projects in the Alafia River CWM Area 3-27
5-2 SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT 3-30
5-3 TAMPA BAY SWIM PLAN 3-30
5-4 TAMPA BAY ESTUARY PROGRAM 3-33
SECTION 6. WATER SUPPLY ISSUES 3-34
6-1 ACTION PLAN: WATER SUPPLY 3-34

CHAPTER IV - FLOOD PROTECTION 4-1
SECTION 1. LITERATURE REVIEW 4-3
1-1 RIVERINE SYSTEM STUDIES 4-4
1-1.1 Archie Creek/Coastal Areas and Buckhorn Creek Watersheds: Stormwater Management Master Plan, Singhofen & Associates, Inc. (1988) 4-4
1-1.2 Floodplain Information on Buckhorn Creek, SWFWMD, (1984) 4-4

1-1.3 Pleasant Grove Floodway, SWFWMD, (1977) 4-4
1-1.4 Flood Frequency Elevations on Edward Medard Park and Reservoir and Downstream to Alafia River, SWFWMD, (1978) 4-4
1-1.5 Floodplain Information on the Alafia Tributaries: Bell Creek - Fishhawk Creek and the South Prong Alafia, SWFWMD, (1979) 4-5
1-1.6 Alafia River Corridor: Resource Evaluation (Save Our Rivers, Preservation 2000, Water Management Lands Trust Fund), SWFWMD, (1993) 4-5
1-1.7 Hydro-biologic Assessment of the Alafia and Little Manatee River Basins, Dames and Moore, (June 1975) . 4-5
1-1.8 Alafia River Watershed Management Program: Poley Creek Watershed Evaluation (K297) - Final Report, Keith and Schnars (December 2000) 4-5
1-1.9 Delaney Creek Stormwater Management Master Plan, Ghioto, Singhofen & Associates, Inc.(April 1986) 4-6
1-2 MINIMUM FLOWS AND LEVELS 4-7
1-3 COUNTY STUDIES 4-9
1-3.1 The Alafia River Study, Hillsborough County City-County Planning Commission, (May, 1988) 4-9
1-3.2 Report to the Board of County Commissioners, Hillsborough County, Florida, Attachment 2, (April 22, 1998) 4-9
1-4 FLOODPLAIN STUDIES 4-9
1-4.1 Flood Insurance Study; Hillsborough County, Florida, Unincorporated Areas, FEMA, Revised: August 3, 1992 . 4-9
1-4.2 Flood Profiles of the Alafia River, West-Central Florida, Computed By Step-Backwater Method, USGS, (March 1978) 4-10
1-5 WATERSHED MANAGEMENT PLANS 4-10
1-5.1 Alafia River Watershed Management Plan, Hillsborough County (anticipated completion date 2002) 4-10
1-5.2 Hillsborough County - Bullfrog Creek/Wolf Branch Watershed Management Plan - Final Report (October 2000) 4-10
1-5.3 Hillsborough County - Delaney Creek Area Watershed Management Plan 4-11
1-6 DAM BREAK ANALYSES 4-11
1-6.1 Edward Medard Park and Reservoir - Dam Break Analysis 4-11

1-6.2 Lake Grady Dam - Dam Break Analysis 4-12
1-6.3 Tampa Bay Regional Reservoir - Dam Break Analysis . 4-12
SECTION 2. AVAILABLE DATA 4-12
2-1 FLOOD PROTECTION WITHIN THE WATERSHED 4-12
2-1.1 The Edward Medard Park and Reservoir 4-12
2-1.2 Lake Grady Dam 4-13
2-1.3 Tampa Bay Regional Reservoir 4-14
2-1.4 The Mouth of the Alafia River 4-14
2-1.5 Flow Measuring Stations Within the Watershed 4-14
2-1.6 Land Use Within FEMA's 100-Year Floodplain 4-16
SECTION 3. REGULATORY AUTHORITY AND SPECIAL RULES 4-17
3-1 STATE/DISTRICT REGULATIONS 4-17
3-2 COUNTY REGULATIONS 4-17
3-3 CITY REGULATIONS 4-18
3-4 ARMY CORPS OF ENGINEERS (ACOE) REGULATIONS . . . 4-18
3-5 FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP) REGULATIONS 4-18
SECTION 4. GOVERNMENT AND OTHER WATERSHED ACTIVITIES . . . 4-18
4-1 FLOOD COMPLAINTS/RECORDS 4-18
4-2 LAND ACQUISITION PROGRAMS 4-19
4-3 LAND USE REGULATION 4-19
4-4 EMERGENCY MANAGEMENT 4-20
SECTION 5. FLOOD PROTECTION ISSUES 4-20
5-1 ACTION PLAN: FLOOD PROTECTION 4-21

CHAPTER V - WATER QUALITY 5-1
SECTION 1. SURFACE WATER QUALITY 5-1
1-1 THE SOUTH PRONG 5-5
1-2 THE NORTH PRONG 5-6
1-3 THE LOWER ALAFIA RIVER 5-6
1-4 BUCKHORN AND ARCHIE CREEK 5-7
1-5 LAKES 5-7
1-6 ATOMOSPHERIC DEPOSITION 5-9
1-7 POINT SOURCE POLLUTION 5-10
1-8 WATERSHED STUDIES 5-17
1-9 TOTAL MAXIMUM DAILY LOADS PROCEDURE 5-18
1-10 WATER QUALITY DATA 5-19
1-11 FLOW MEASURING STATIONS WITHIN THE WATERSHED 5-20
1-12 GOVERNMENTAL AND OTHER WATERSHED

ACTIVITIES 5-21
SECTION 2. SURFACE WATER QUALITY ISSUES 5-23
2-1 ACTION PLAN: SURFACE WATER QUALITY 5-23
SECTION 3. GROUND-WATER QUALITY 5-40
3-1 SURFICIAL AQUIFER 5-40
3-2 INTERMEDIATE AQUIFER 5-41
3-3 UPPER FLORIDAN AQUIFER 5-42
3-4 AREAS SUSCEPTIBLE TO GROUND-WATER CONTAMINATION 5-46
SECTION 4. AVAILABLE DATA 5-47
4-1 UNITED STATES GEOLOGICAL SURVEY 5-47
4-2 FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION 5-47
4-3 THE HILLSBOROUGH COUNTY ENVIRONMENTAL PROTECTION COMMISSION 5-48
4-4 SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT 5-48
4-5 TAMPA BAY WATER 5-48
SECTION 5. REGULATORY AUTHORITY AND SPECIAL RULES 5-48
5-1 DOMESTIC WASTEWATER RESIDUALS 5-48
SECTION 6. GOVERNMENTAL AND OTHER WATERSHED ACTIVITIES 5-49
6-1 MINERALIZATION OF THE COASTAL FLORIDAN AQUIFER 5-49
SECTION 7. GROUND-WATER QUALITY ISSUES 5-49
7-1 ACTION PLAN: GROUND-WATER QUALITY 5-49

CHAPTER VI - NATURAL SYSTEMS 6-1
SECTION 1. LITERATURE REVIEW 6-3
1-1 HYDROBIOLOGIC ASSESSMENT OF THE ALAFIA AND LITTLE MANATEE RIVERS 6-4
1-2 13th YEAR ANNUAL ELAPP REPORT - RECOMMENDATIONS CONCERNING HILLSBOROUGH COUNTY'S ENVIRONMENTAL ACQUISITION AND PROTECTION PROGRAM (ELAPP) 6-4
1-3 REGIONAL WILDLIFE HABITAT PLANNING IN THE TAMPA BAY REGION 6-5
1-4 CLOSING THE GAPS IN FLORIDA'S WILDLIFE HABITAT CONSERVATION SYSTEM 6-5
1-5 FISH AND WILDLIFE INVENTORY OF THE SEVEN COUNTY REGION INCLUDED IN THE CENTRAL FLORIDA PHOSPHATE INDUSTRY AREAWIDE ENVIRONMENTAL IMPACT STUDY . 6-5

1-6 ALAFIA RIVER CORRIDOR RESOURCE EVALUATION 6-6
1-7 ALAFIA RIVER CORRIDOR OVERLAY STUDY 6-6
1-8 ALAFIA RIVER WATERSHED MANAGEMENT PLAN 6-6
SECTION 2. AVAILABLE DATA 6-7
SECTION 3. GOVERNMENTAL AND OTHER WATERSHED ACTIVITIES . . 6-9
3-1 LAND ACQUISITION FOR NATURAL RESOURCE PROTECTION AND CONSERVATION 6-9
3-1.1 Conservation and Recreation Lands Program 6-9
3-1.2 Save Our Rivers Program 6-9
3-1.3 Preservation 2000 6-9
3-1.4 Florida Forever Program 6-10
3-1.5 Hillsborough County Environmental Lands Acquisition and Protection (ELAPP) Program 6-10
3-1.6 Polk County Environmental Lands Acquisition and Management Program 6-10
3-1.7 Florida Communities Trust 6-11
3-1.8 Nature Conservancy 6-11
3-1.9 Trust for Public Lands 6-11
3-2 ALTERNATIVE INITIATIVES FOR NATURAL RESOURCES PROTECTION 6-12
3-2.1 The Alafia River Basin Stewardship Council (ARBSC) . 6-12
3-2.2 The Alafia Watershed Land and Water Linkage Task Force (Task Force) 6-12
3-2.3 Southwest Florida Water Management District 6-12
3-2.4 Alafia River Task Force 6-13
SECTION 4. NATURAL SYSTEMS ISSUES 6-13
4-1 ACTION PLAN: NATURAL SYSTEMS 6-14

REFERENCES 7-1

ACRONYMS 7-23

FIGURES

Figure 1-1. CWM Watersheds in the Southwest Florida Water Management District 1-3
Figure 1-2. Comprehensive Watershed Management 1-4
Figure 1-3. Estimated Funding by Activity and Source 1-7

TABLES

Table 2-1. 1995 Land Use/Land Cover for the Alafia River Watershed 2-3
Table 2-2. 1996 Tampa Bay Region Employment by Category (in thousands) . . . 2-3
Table 3-1. Water Use in the Alafia River Watershed 3-1
Table 3-2. Public Supply Wellfields Within the Alafia River Watershed 3-2
Table 3-3. Total Quantities Authorized Under This Permit (in MGD) 3-14
Table 3-4. Master Water Plan Projects 3-27
Table 4-1. Gaging Stations within the Alafia, Delaney Creek and Bullfrog Creek Basins 4-15
Table 4-2. Summary of FEMA Peak Discharge Rates at Selected Locations . . . 4-16
Table 5-1. Basins within the Alafia River Watershed 5-2
Table 5-2. Surface Water Quality Data 5-4
Table 5-3. Monthly Bacteriological Data (Fecal and Total Coliform) Percent Non-Compliance of State Surface Water Quality Standards 5-5
Table 5-4. Lakes within the Alafia River Watershed 5-8
Table 5-5. Bulk Atmospheric Deposition Data Typical for the Alafia River Basin . 5-10
Table 5-6. Permitted Surface Water Discharges to the Alafia River 5-11
Table 5-7. Domestic Wastewater Treatment Facilities 5-12
Table 5-8. Industrial Waste and Long Term Petroleum Cleanup (PET) Sites . . . 5-14
Table 5-9. Estimates of Loading and Corresponding Percentages of the Total Loads for the Alafia River Watershed, Adapted from Zarbock Et al., 1994, “Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida 5-18
Table 5-10. USGS Gaging Stations within the Alafia Basin - (note-1975 data) . . . 5-21
Table 5-11. Water Quality in Selected Surficial Aquifer Wells 5-43
Table 5-12. Water Quality in Selected Intermediate Aquifer Wells 5-44
Table 5-13. Water Quality in Selected Upper Floridian Aquifer Wells 5-45
Table 6-1. Listed Wildlife Found in the Alafia Rive Watershed 6-3

CHAPTER I - INTRODUCTION

SECTION 1. PURPOSE OF THE COMPREHENSIVE WATERSHED MANAGEMENT PLAN

The purpose of the Comprehensive Watershed Management (CWM) plan is to coordinate various water resource related projects within the Alafia River Watershed. Potential projects include land acquisition and habitat restoration, water quality monitoring and assessment, floodplain mapping, hydrologic restoration in impacted areas, flood protection/storm water management, potable water conservation, potable water supply assessment and development, and many others. Existing data and analysis and input from local governments and other stakeholders form the basis for identifying problem areas and priorities within the watershed, and for developing action and funding strategies to address identified problems and prevent future ones.

The watershed management plan will be coordinated with the Alafia River, Hillsborough River and Peace River Basin Board's five-year plans. The purpose of this coordination is to further long-range planning within the Alafia River watershed, to improve internal communications among local governments, watershed stakeholders, and the Boards and staff of the Southwest Florida Water Management District (SWFWMD or District). This plan is intended to be an action plan with ongoing implementation of identified projects. The Plan is also intended to encourage local governments and other appropriate entities to participate in the District's Cooperative Funding Program whereby the District's Basin boards provide matching funds for projects consistent with and which further the District's water resource management goals.

1-1 COMPREHENSIVE WATERSHED MANAGEMENT

The District's CWM initiative has been established to improve the management of water and related natural resources within the District. This initiative integrates a wide variety of resource activities to employ a watershed approach to resource management. In FY 1994, the District Governing Board made CWM a strategic initiative and consequently directed staff and funding resources to the effort. Additionally, the various Basin Boards have made watershed assessments a priority for future cooperative funding proposals and projects.

The District is applying this CWM approach to 11 watersheds to protect and/or restore their water resource assets. These 11 watersheds are an aggregate of the 16-county region recognized by the Resource Regulation Department. Staff from a variety of disciplines and departments make up "watershed teams" that have been assigned to

the watersheds (Figure 1). Local governments and other stakeholders within each watershed are also significant partners on these teams. The goals for the teams include:

2. Collect, integrate and analyze the existing information pertinent to each watershed and create a data base for analytical purposes;

3. Identify and prioritize existing and future water resource management issues relating to water supply, flood protection, water quality and natural systems (District Areas of Responsibility or "AORs");

4. Develop preventive or remedial management actions to address these resource management issues;

5. Identify funding sources and partnerships to support action plan projects; and,

6. Implement and monitor the effectiveness of selected actions and the overall process and recommend potential revisions.

Each team has been charged with the development of a watershed management plan reflecting the results of this process. The CWM watershed plans are complex in scope, but simple in intent and design. They analyze the wealth of information available in each area, identify issues and recommend actions to address these issues. The fundamental elements of the plans are the chapters that identify issues in each of the District's four AORs. Specific and realistic actions to address each issue are presented within each AOR chapter. Completed CWM plans become a part of the District Water Management Plan (DWMP) through incorporation by reference. These plans reflect a "snapshot-in-time" for the watershed and will be periodically updated.

1-1.1 Coordination With Local Governments and Other Agencies

A significant element of the CWM initiative is the active involvement of the local government(s) together with the District within a watershed. The District and local governments share the premise that resource management incorporates the desire for sustainability. Consequently, the need to revise their respective policies from time to time is on a parallel tract. Scientific knowledge serves as the backbone to this process and allows us to achieve the desired watershed condition (Figure 2). Local governments have the greatest influence over future growth through their

Figure 1-1.

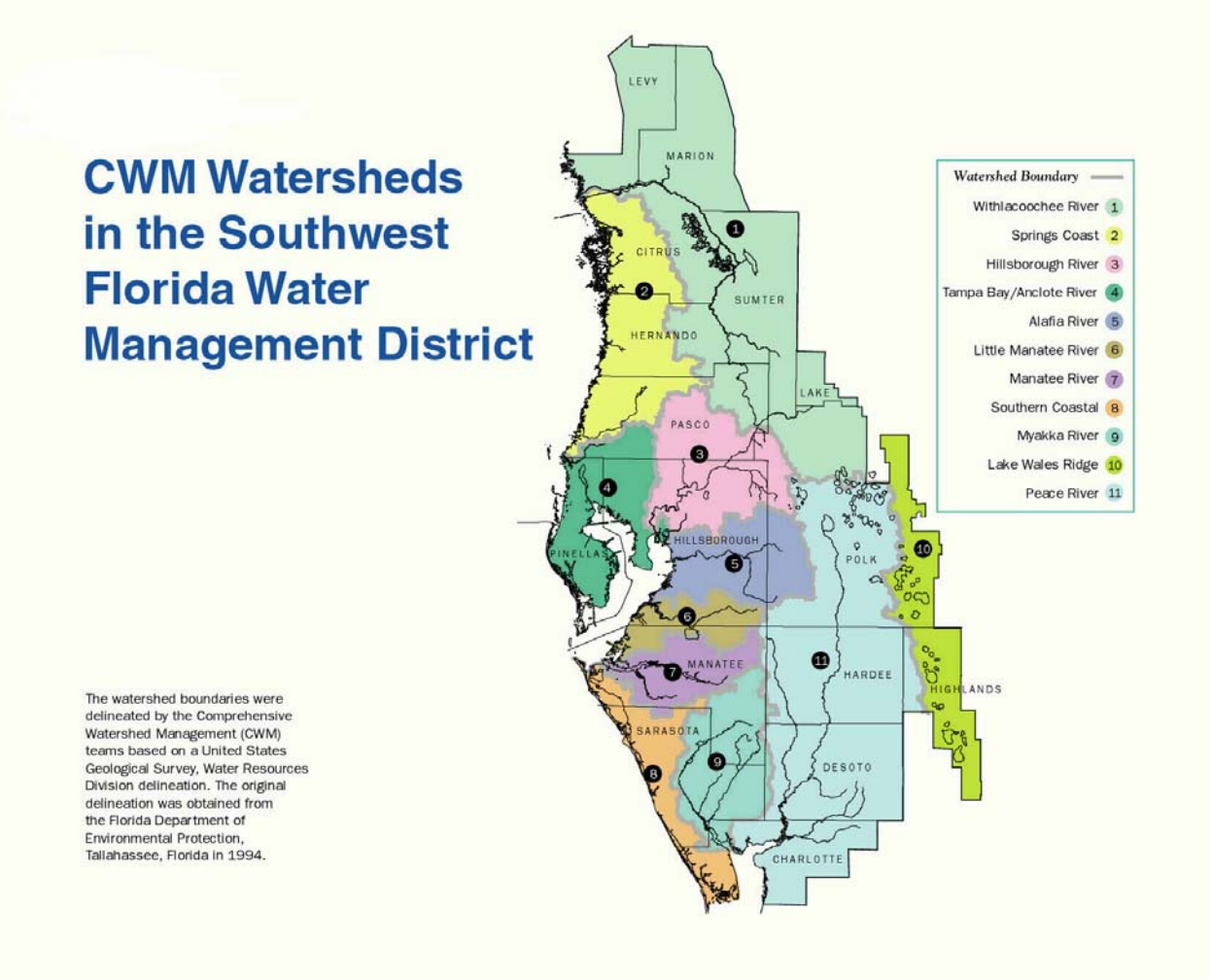
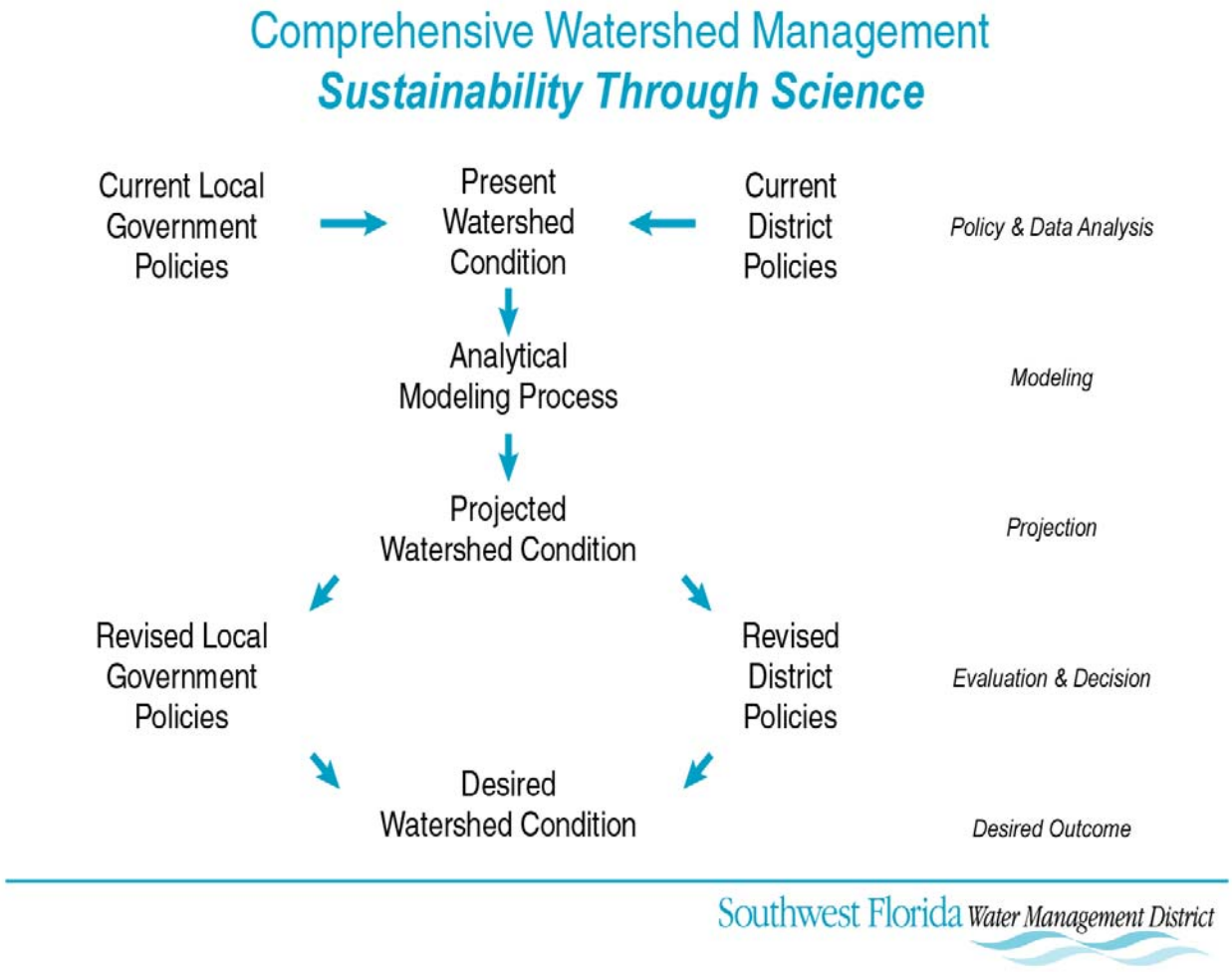

CWM Watersheds in the Southwest Florida Water Management District
The watershed boundaries were delineated by the Comprehensive Watershed Management (CWM) teams based on a United States Geological Survey, Water Resources Division delineation. The original delineation was obtained from the Florida Department of Environmental Protection, Tallahassee, Florida in 1994.
LEVY
MARION
CITRUS
SUMTER
HERNANDO
LAKE
PASCO
PINELLAS
HILLSBOROUGH
POLK
MANATEE
HARDEE
HIGHLANDS
SARASOTA
DESOTO
CHARLOTTE
Watershed Boundary
Withlacoochee River 1
Springs Coast 2
Hillsborough River 3
Tampa Bay/Anclote River 4
Alafia River 5
Little Manatee River 6
Manatee River 7
Southern Coastal 8
Myakka River 9
Lake Wales Ridge 10
Peace River 11

Figure 1-2.


Comprehensive Watershed Management
Sustainability Through Science
Current Local Government Policies
Present Watershed Condition
Current District Policies
Policy & Data Analysis
Analytical Modeling Process
Modeling
Projected Watershed Condition
Projection
Revised Local Government Policies
Revised District Policies
Evaluation & Decision
Desired Watershed Condition
Desired Outcome
Southwest Florida Water Management District

comprehensive plans and associated land development regulations. Partnering with local governments is essential to the success of the CWM initiative. Each CWM team will have active participation by the local government(s) within their watershed. This will include involvement in issue identification, development of preventative or remedial strategies and coordinated implementation. Agencies which are, or will be, requested to participate in the Alafia River CWM process include the Department of Environmental Protection, Department of Agriculture and Consumer Services, the Florida Fish and Wildlife Conservation Commission, Tampa Bay Regional Planning Council, Army Corps of Engineers, Tampa Bay Estuary Program, Hillsborough County, Hillsborough County Environmental Protection Commission, Hillsborough County City-County Planning Commission, Polk County, Tampa Bay Water, Cargill, CF Industries, Alafia Watershed Land and Water Linkage Task Force, the Alafia River Basin Stewardship Council and others.

The CWM initiative helps to ensure that comprehensive, coordinated analysis and decision-making take place. It fosters closer cooperation and partnership between the District, local governments and other stakeholders to help preserve and improve the quality of watersheds as growth and development take place in the future. It allows rational and logical resolution of problems based on science. Integrated plans are developed with actual implementation of strategies involving multiple parties.

1-1.2 Community Coordination

The Alafia River Basin Stewardship Council (ARBSC) was formed by concerned citizens and stakeholders to bring attention and public input to a number of initiatives within the Alafia River watershed. Those initiatives include water supply, land use, conservation, habitat enhancement and recreational needs. Members of this group represent business and property owners, recreational users, environmentalists and conservationists, as well as those involved through governmental agencies, including the District, and industry affiliations. Their goal is to protect, preserve and restore the Alafia River, its basin and estuary, thereby safeguarding its resources for future generations by providing direction to important land and water use projects that will impact the basin area.

The Alafia Watershed Land and Water Linkage Task Force (Task Force), members of the ARBSC, were active participants in the development of the Alafia River CWM plan through their participation in the Alafia Watershed Land and Water Linkage project. This project was funded by Hillsborough County and the District's Alafia River Basin Board to provide a forum for citizen involvement and input into development of the District's Alafia River CWM plan and Hillsborough County's growth management initiatives. The Task Force developed a report entitled Alafia Watershed Land and

Water Linkage Project that identifies priority issues, strategies and actions related to the District's four Areas of Responsibility (AORs): water quality, water supply, flood protection and natural systems as well as Hillsborough County's AOR, growth management. Those issues, strategies and/or actions recommended by the Task Force that fall under the water management responsibilities of the District are included in the Action Plan of each AOR chapter.

1-1.3 Funding Commitments

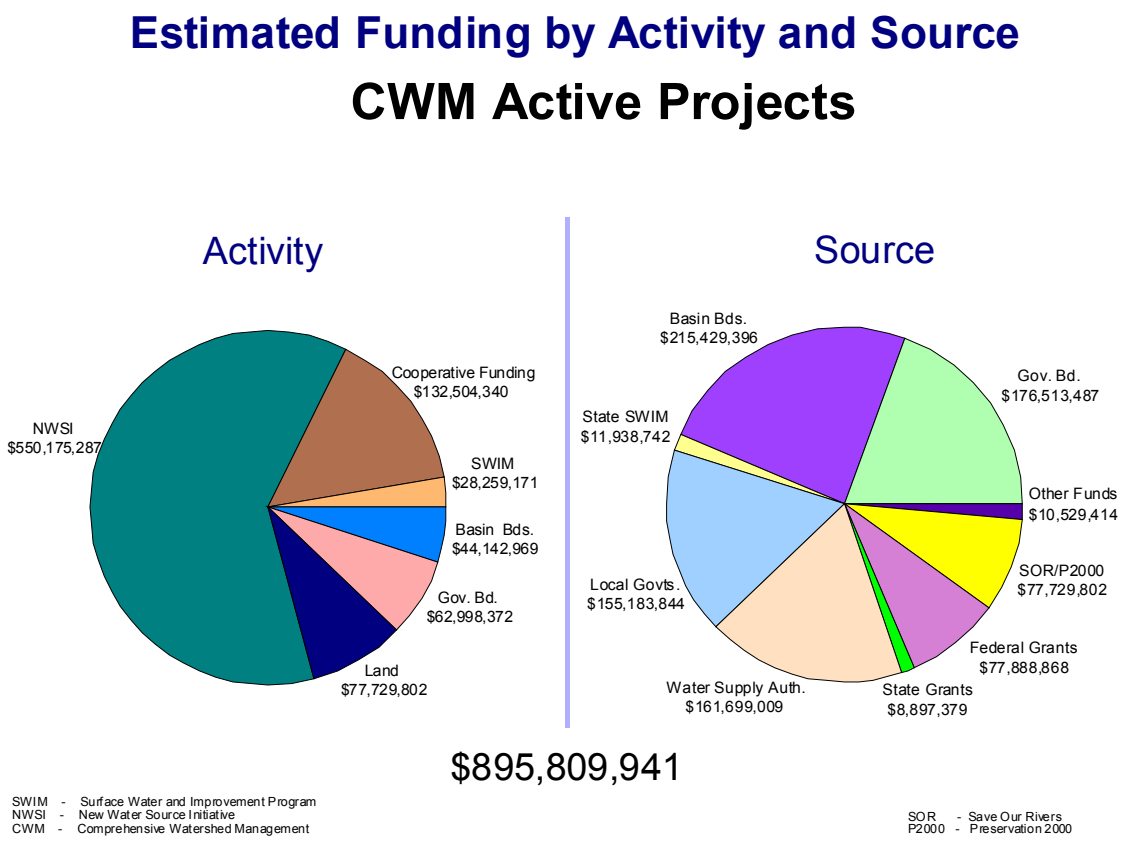
The District, in partnership with local, State and Federal governments, supports many significant water and related natural resource management projects and initiatives within each watershed. These efforts are currently contributing to effective management of water and related natural resources. Figure 3 summarizes the District's current efforts for the eleven primary watersheds as of FY 2000. This figure shows the types of projects and initiatives being funded, and the estimated sources of revenues. Approximately $896 million in water and related natural resource management projects, wholly or partially funded by the District, are currently underway within these watersheds. This does not include the many other resource management activities undertaken by local governments, the Department Environmental Protection (DEP) and others.

1-1.4 Implementation

Each watershed management team has suggested specific and realistic actions and tasks. Recommendations considered District responsibilities will be prioritized by a District senior management team (Steering Committee). The Steering Committee is responsible for determining priorities, directing them to the appropriate staff and board(s), and allocating staff time and resources. A significant means of implementation for the District is through the Basin Boards' cooperative funding programs. The recommendations from the CWM teams are incorporated into appropriate Basin Board five-year plans, which are updated annually.

As a result of the District's actions, it is anticipated that local governments and others will prioritize and implement resource management strategies within their areas of responsibility. A formal partnership or Memorandum of Understanding between the District and participating parties may be considered for coordinated implementation of these collaborative CWM planning efforts.

Figure 1-3.


Estimated Funding by Activity and Source
CWM Active Projects
Activity
Cooperative Funding
$132,504,340
NWSI
$550,175,287
SWIM
$28,259,171
Basin Bds.
$44,142,969
Gov. Bd.
$62,998,372
Land
$77,729,802
Source
Basin Bds.
$215,429,396
Gov. Bd.
$176,513,487
State SWIM
$11,938,742
Other Funds
$10,529,414
SOR/P2000
$77,729,802
Local Govts.
$155,183,844
Federal Grants
$77,888,868
Water Supply Auth.
$161,699,009
State Grants
$8,897,379
$895,809,941
SWIM - Surface Water and Improvement Program
NWSI - New Water Source Initiative
CWM - Comprehensive Watershed Management
SOR - Save Our Rivers
P2000 - Preservation 2000

CWM teams will review the implementation of recommended actions on a regular basis. These teams will report on implementation status for the Annual Report on the District Water Management Plan and provide a brief summary for each watershed. This information will be used within the Basin Boards' plans and in the District accountability and performance reporting.

1-1.5 Future of CWM - A Watershed-based Partnership Approach

One of the most significant tools available to watershed teams is the District's Geographic Information System (GIS). GIS is a database designed to efficiently store, retrieve, analyze and display mapped data. The ability to reference data by their location on the earth's surface provides an effective means of integrating data from many diverse sources. The GIS currently allows staff to integrate data from ground and surface water models, the District's regulatory and water management databases, and results from statistical analyses. This capability to integrate data from multiple sources allows staff to analyze previously undiscovered relationships between the data. For example, one might find a relationship between soil type, surface slope and vegetation cover that was not previously known. GIS also provides a means of integrating disparate data such as census information and Federal Emergency Management Agency (FEMA) flood maps, allowing, for example, the analysis of per capita income of individuals living within the 100-year floodplain. The power of GIS lies in its ability to integrate numerical, statistical, engineering and spatial models and then dynamically depict and visually present scenarios. The GIS allows the CWM teams to analyze the best available information in such a way as to not only understand current conditions, but to also anticipate future conditions through scenario modeling.

Utilizing the GIS as a tool in the comprehensive watershed management initiative represents an evolution in direction for the District, providing the opportunity to enhance coordinated action. This GIS-based analysis and planning has, to-date, been applied only to a limited degree in selected watersheds. It is a major objective of the District that the use of GIS, in conjunction with other modeling tools, be expanded and enhanced in a collaborative fashion with local governments and other participants for all eleven watersheds. Future updates to this Alafia River Comprehensive Watershed Management Plan will reflect progress made in the GIS-based partnership approach.

1-2 DISTRICT DIRECTIVES

The State of Florida has a unique relationship with water. As a peninsula, the State is nearly surrounded by the sea and has 11,000 miles of coastline. Moreover, the quality of life in Florida is inseparably linked with its water resources. The majority of today's population and the trend of present growth patterns reflect coastal settlement, where

freshwater is least abundant and natural systems such as estuaries and wetlands are most vulnerable. As a result, water management in the 2000s involves a challenge of sometimes conflicting priorities to provide adequate water supplies for human needs, appropriate flood protection, and sound management of water quality and natural systems. It is the State's five water management districts, and DEP, that must meet this challenge and address the unique water resource issues of the various regions of our State. Federal, state, regional and local agencies responsible for land planning and development also have a significant role to play in protecting water-related resources. The DWMP provides a comprehensive guide to the District in carrying out all of its water resource management responsibilities, including water supply and protection of natural systems.

The genesis of the DWMP is Chapter 373 of the Florida Statutes (F.S.). Specific intent for this planning is further delineated in State Water Policy (Chapter 62-40, Florida Administrative Code). The DWMP serves a number of purposes:

- To provide a road map for the SWFWMD in managing and protecting water and related natural resources. It is the stated desire of the Governing Board to accomplish long-range planning in the best interest of the resource;

- To enhance consistency and accountability among all five water management districts and FDEP through communication and coordination on common issues and responsibilities;

- To further the State Comprehensive Plan;

- To foster coordination among the many levels of government, and better public understanding of water management policies and decisions; and

- To provide a compendium of water resource information to assure sound management, including but not limited to a 20-year water supply needs and sources assessment, and identification and response to existing and potential areas where water resource problems have or will become critical.

The DWMP is a component of the Florida Water Plan. All five districts and DEP have worked closely together to achieve consistency among their plans. These plans reflect consensus on our four resource-based areas of responsibility (water supply, flood protection, water quality management and natural systems management), and the planning steps to be applied to each. In this way, the Florida Water Plan can accurately reflect regional differences, while communicating the basic policy direction for statewide water management.

1-2.1 Mission Statement

The Governing Board of the Southwest Florida Water Management District has adopted a formal Mission Statement, as follows:

The mission of the Southwest Florida Water Management District (District) is to manage water and related natural resources to ensure their continued availability while maximizing environmental, economic and recreational benefits. Central to the mission is maintaining the balance between the water needs of current and future users while protecting and maintaining water and related natural resources which provide the District with its existing and future water supply.

The Governing Board of the District assumes its responsibilities as authorized in Chapter 373 and other chapters of the Florida Statutes by directing a wide-range of programs, initiatives, and actions. These include, but are not limited to, flood protection, water use, well construction and environmental resource permitting, water conservation, education, land acquisition, water resource and supply development and supportive data collection and analysis efforts.

1-2.2 Primary Areas of Responsibility and Goal Statements

The District's mission is divided into four primary Areas of Responsibility (AORs). Goals have been developed to establish the long-term direction of programs and activities that address water resource issues. The missions within these AORs and their respective goals are as follows:

Water Quality: To protect water quality by preventing further degradation of the water resource and enhancing water quality where appropriate.

Flood Protection: To minimize the potential for damage from floods by protecting and restoring the natural water storage and conveyance functions of flood prone areas. The District shall give preference wherever possible to nonstructural surface water management methods.

Natural Systems: To protect, preserve and restore natural Florida ecosystems and to establish minimum water levels and flows necessary to maintain these natural systems.

Water Supply: To ensure an adequate supply of the water resource for all reasonable and beneficial uses, now and in the future, while protecting and maintaining the water and related resources of the

District (SWFWMD 1995).

These regional water management goals build a bridge between the divergent functions of the District, local, other regional, state and federal agencies. This bridge creates common ground for consistent, coordinated action in the best interest of Florida citizens. The predominant theme of this watershed management plan is the effective integration of land and water planning to achieve sound resource management and protection.

The AORs have been agreed upon by all five water management districts and DEP as representative of our collective water management agenda. This coordinated decision was a development step of the comprehensive, 20-year DWMP. The District's DWMP identified the issues that led to the creation of the Comprehensive Watershed Management initiative.

CHAPTER II - ALAFIA RIVER WATERSHED DESCRIPTION

SECTION 1. LOCATION

The Alafia River originates from several creeks which converge into a centralized riverine system flowing westward from Polk County through Hillsborough County to Tampa Bay. The two main creeks which feed the river include the North Prong, originating to the west of Plant City and south of Lakeland, and South Prong, originating in southeast Hillsborough County. The Alafia River flows 24 miles westerly into lower Hillsborough Bay, with an estimated drainage area of 270,000 acres. For the period 1933-1999, the river's yearly mean discharge was 340 cfs at the Lithia station (USGS, 2000).

The Alafia River watershed extends over parts of two counties, including much of the eastern portion of Hillsborough County and a smaller area in the west-central part of Polk County. It is bounded to the north by the Hillsborough River watershed, to the east by the Peace River watershed, to the south by the Little Manatee River watershed and to the southwest by the Tampa Bay watershed. It incorporates parts of Lakeland, Plant City, Mulberry, the community of Brandon and large expanses of rural or undeveloped farm and phosphate mining lands.

SECTION 2. CLIMATE

There are nine District rainfall stations in the Alafia River watershed: two in the eastern region of the basin, six in the center of the basin, and one to the west.

West-central Florida has a humid subtropical climate. The mean normal yearly temperature for Hillsborough County is 72.2^{o} F, generally ranging from a normal maximum temperature of 91^{o} F in July and August, to a normal minimum temperature of 49^{o} F in January. Evapotranspiration (ET) for the area encompassing the Alafia River watershed is approximately 39 inches per year (SWFWMD, 1994). Greatest ET rates occur in May and June, and nearly 60 percent of the total yearly ET occurs during the period between May and October.

The average annual normal precipitation for the Alafia watershed rainfall stations is 52.30 inches (SWFWMD Water Management Database). During the period 1915-1997 annual rainfall ranged from 37.56 inches in 1927 to 81.57 inches in 1959 (District). In a typical year, approximately 60 percent of the annual precipitation comes from convective thunderstorms during the four-month period between June through September. Periods of extremely heavy precipitation associated with the passage of

tropical low pressure systems may occur during summer and early fall.

SECTION 3. LAND USE, DEVELOPMENT AND ECONOMY

The landscape within the Alafia River watershed has been shaped and altered by mining, agriculture and urban development. Table 2-1 shows the distribution of generalized land uses and land cover for the watershed in 1995. As indicated in the table, mining consumes 28 percent of the watershed. Mining within the Alafia is primarily for the excavation of phosphate, and tends to be concentrated in the watershed's eastern half. Areas along both the South Prong and North Prong's, particularly the south side, have been extensively altered by the activity. All indications are that mining will continue to influence these areas.

Agriculture in Hillsborough and Polk counties includes citrus, poultry, dairy, strawberries and other rowcrops. In the Alafia watershed, agriculture controls approximately 27 percent of the total area. The activity is found throughout the watershed, but predominates on the north side of North Prong and some areas in the central part of the watershed.

Urbanization has been and continues to be a major change agent in the Alafia River area. Approximately 17 percent of the watershed is considered urban. The activity dominates the western half of the watershed and areas in and near Lakeland, Plant City, Mulberry, Brandon, Riverview and Gibsonton.

Natural lands include unaltered uplands and wetlands, and make up 21% of the watershed. These lands exist primarily along the river and some of the tributaries. Large public ownership areas occur in the vicinity of the river and its two major tributaries.

Services and retail trade have traditionally dominated the economy of the four-county area (i.e., Hillsborough, Pasco, Pinellas and Manatee counties) identified as the Tampa Bay region. U.S. Labor Department statistics indicate that in 1980, approximately 52 percent of the workforce in the region was employed within these two sectors. This percentage increased to 57 percent by 1996, with the largest percentage gains occurring in the service industries (Tampa Bay Regional Planning Council (TBRPC), 1999). Other significant employment categories in the TBRPC 1999 survey included government (10.67 percent), and financial/insurance/real estate (8.4 percent). Agriculture was the least represented employment category (1.7 percent) in the region. Table 2-2 gives a breakdown of the employment categories represented in the region.

Table 2-1. 1995 Land Use/Land Cover for the Alafia River Watershed.

Land Use/Land Cover	Total Acres	Percent
Urban and Built	58,814	17.3%
Agriculture	93,311	27.4%
Mining	94,933	27.9%
Rangeland	7,957	2.3%
Upland Forests	32,330	9.5%
Water	8,408	2.5%
Wetlands	37,818	11.1%
Barren Land	1,171	0.3%
Utilities	6,032	1.8%
TOTAL	**340,774**	**100%**

Source: SWFWMD Geographic Information System (GIS).

Table 2-2. 1996 Tampa Bay Region Employment by Category (in Thousands).

Employment Category	Percent
Manufacturing	7.60%
Mining	0.07%
Construction	5.25%
Transportation/Public Utilities	4.02%
Financial/Insurance/Real Estate	8.40%
Retail Trade	18.23%
Wholesale Trade	5.01%
Services	38.32%
Agriculture/Forestry/Fish Services	1.47%
Government	10.67%
Farm	0.97%
TOTAL	**100%**

Source: Tampa Bay Regional Planning Council, 1999 and REMI Policy Insight, 1999.

SECTION 4. TRANSPORTATION

The major north-south routes in the watershed are Interstate 75, U.S. Highway 301, U.S. Highway 41 and State Road 39. Major east-west routes include State Road 60 and County Road 640 (Lithia Pinecrest Road). Just north of the watershed are Interstate 4, U.S. Highway 92 and the Leroy Selmon (Crosstown) Expressway to Tampa.

There is no commuter rail service in the watershed. Bus service is provided in the Brandon area by Hillsborough County. Port Tampa (Sutton), a major shipping port, is located on Hillsborough Bay, between Archie and Delaney creeks. There are significant commercial rail services for the commercial and industrial land uses extending south from Port Tampa. The TECO Big Bend Power Plant is just south of the Alafia watershed.

SECTION 5. PHYSIOGRAPHY

The Alafia River watershed lies within two physiographic provinces: the Gulf Coastal Lowlands, and the Polk Upland (White, 1970). The lower portion of the watershed flows over the Gulf Coastal Lowlands province, a relatively flat plain extending eastward with a gentle slope upward to the border with the Polk Upland physiographic province. The northern edge of the watershed drainage basin borders an area locally known as the Brandon Karst Terrain, an internally drained basin (SWFWMD, 1993). The western edge of the Polk Upland is defined by the presence of the first of several paleoshoreline scarps associated with the Pleistocene Ice-Age sea level fluctuations. This physiographic feature is known as the Pamlico Scarp or shoreline. Elevations in this part of the Gulf Coast Lowlands province range from sea level to 25 feet.

The remainder of the Alafia River watershed is situated in the Polk Upland province. Elevations in the extensive Polk Upland range up to between 100 and 130 feet. The Alafia watershed's elevations, however, are mostly between 25 and 75 feet. Eastward of the Pamlico Scarp the river banks attain a narrower, steeper profile and some spots are bluff-like with 20-25 feet of relief from the river's water level. In the vicinity of Riverview and Bell Shoals, the physiography adjacent and south of the river is composed of low sand hills which attain elevations of 75-80 feet. The Talbot and Penholoway paleoshorelines pass through this area in a north-south orientation, with their surface features having elevations of 42 and 75 feet, respectively.

In the Polk Upland province, near the town of Lithia, the river travels over the clay-rich Bone Valley Member (Pliocene). This is the lithologic unit that is extensively mined for phosphate minerals in the eastern portion of the watershed. The river banks in this region become less steep with many low relief floodplain or wetland areas surrounding the river. The watershed and its tributaries drain an area of the Polk Upland where the Pleistocene marine sands (overburden), and the underlying ore-bearing Bone Valley Member and Hawthorn Group rocks have been disturbed by phosphate mining in many areas. Outstanding physiographic features in this region include many water-filled, former mine pits and large, bermed clay-settling areas of various rectilinear configurations easily observable on maps and aerials photos. Most of these "open water" natural systems, particularly in the eastern half of the basin, resulted from

phosphate mining.

Primary soil groups in the Alafia River watershed include the Myakka-Basinger-Holopaw association, which predominates in the upland areas in the northern and southern portions of the watershed. The Candler-Lake association occurs in the vicinity of the Brandon/Bloomingdale area, while the Winder-Chobee-St. Johns occur along the main stem of the river including the main tributaries. A significant area of Arent-Haplaquent-Quartzipsamment soils, considered soils of manmade areas, occupies an area extending from southern Dover through the Medard Park/Reservoir and Lithia area, and to areas on the east side of State Road 39 in the Turkey Creek drainage basin (SCS, 1989). This area coincides with former phosphate mining activities. In the Polk County part of the Alafia River watershed, this disturbed soil type dominates the entire area except for small remnants of flatwoods (Myakka association) near the watershed divide with river systems to the north and east.

SECTION 6. HYDROGEOLOGY

The Alafia River watershed is underlain by water-bearing limestones and dolomites of Eocene to Miocene age, covered by a 0-100 foot layer of unconsolidated sands and sandy clays of Pliocene, Pleistocene and Recent origin. Five primary hydrogeologic units have been identified in the west-central Florida region. In order of descending depth, these are the surficial aquifer, the intermediate aquifer and confining beds, the upper Floridan aquifer, middle confining unit, and lower Floridan aquifer (Wolansky and Thompson 1987). The surficial aquifer is unconfined and composed of variable amounts of clean quartz to clayey sand. At the base of the surficial aquifer, there may be phosphate pebbles and clays present that have been reworked from the underlying phosphate-bearing Bone Valley Member (Upchurch, 1985). The intermediate aquifer is made up of the permeable lithologies present in the Hawthorne Group except for the lowermost limestone unit (Tampa Limestone). In the Alafia River watershed, the intermediate aquifer serves as a locally important source for small potable water and irrigation wells for individual homeowners.

The upper Floridan aquifer interval is the primary artesian aquifer throughout Florida and much of the southeastern United States. It includes all the limestone and dolomite layers of Eocene to Miocene age that lie below the upper confining layer that separates it from the overlying intermediate aquifer. The average thickness of the upper Floridan aquifer system is approximately 1100 feet in the Alafia River watershed area (Wolansky and Thompson 1987). The middle confining unit and the lower Floridan aquifer are in the non-potable zone at very deep depths.

Two large springs discharge to the Alafia River and contribute to its flow. Lithia Springs

discharge ranges between 30 cfs and 55 cfs. Mean discharge for Water Year 1996 was 42 cfs, while during Water Year 1997 the mean discharge was 34 cfs. Buckhorn Springs also discharges into the Alafia River via Buckhorn Creek, with the period of record average flow being approximately 15 cfs. Mean discharge for Water Year 1996 was 15 cfs. Both Lithia and Buckhorn springs are fed by Floridan aquifer groundwater.

CHAPTER III - WATER SUPPLY

The mission of the District is to manage and protect water resources for human and environmental needs. This is accomplished through both regulatory and non-regulatory means, including but not limited to, water resource development, water use and environmental resource permitting, comprehensive hydrologic monitoring and long-range planning. The Alafia River watershed contains important ground water and surface water resources which provide water for agricultural, public supply, mining, industrial, and recreational water use (Table 3-1). These water supply sources may be subject to additional pressures as both population and industrial growth occur within the basin. One of the most important initiatives for the future of the water resources in this region is development of a comprehensive water supply plan which addresses both the economic and environmental effects of water supply development on all potential users and sources.

Table 3-1. Water Use in the Alafia River Watershed.

Use Sector	1998 Groundwater Withdrawals (MGD)	1998 Surface-Water Withdrawals (MGD)	1998 Total Withdrawals (MGD)	Percent of Total
Agriculture	28.2	1.6	29.8	30%
Commercial/ Industrial	11.1	4.4	15.5	15%
Mining/ Dewatering	27.6	0.3	27.9	28%
Public Supply	24.9	0.00	24.9	25%
Recreation	0.9	0.6	1.5	2%
Total	**92.7**	**6.9**	**99.6**	**100%**

Source: SWFWMD, 1999.

An estimated 99.6 MGD of ground and surface water were withdrawn from within the Alafia River watershed in 1998. Table 3-1 summarizes 1998 withdrawal estimates by source and use. The largest water use in the watershed is agriculture which accounted for approximately 30 percent (29.8 MGD) of the total water use. The second largest use is mining/dewatering which accounted for approximately 28 percent (27.9 MGD) of

the 1998 water use. The combined public supply, commercial/industrial, and recreation

categories accounted for the remaining 42 percent of the 1998 water use estimates.

At least one major public supply wellfield, permitted for 24.1 MGD annual average withdrawal, is located within the watershed. It is known as the South Central Hillsborough Regional Wellfield. This wellfield's groundwater serves the Hillsborough County South Central Hillsborough Water Demand Planning Area, a water supply service area. The system serves residents in the Brandon, Bloomingdale, Riverview, Ruskin, Apollo Beach, and Sun City Center communities. The Brandon Urban Dispersed Wellfield (BUDW) water use permit issued on September 29, 1999, is also located partially within the northwest corner of the watershed. This wellfield provides additional water to this South Central Hillsborough water service area.

Table 3-2. Public Supply Wellfields Within the Alafia River Watershed.

Well Field	Operator	Service Area	Connected to Tampa Bay Regional System	Permitted Use Avg.	Peak (MGD)
South Central Hillsborough	Tampa Bay Water/Hills. Cnty.	South County	no	24.1	33.0
Brandon Urban Dispersed	Tampa Bay Water	South County	no	6.0	9.24
Plant City	City of Plant City	Plant City	no	6.09	7.89

In addition to the groundwater sources listed in Table 3-2, a new public supply surface water withdrawal is proposed for the Alafia River at the Bell Shoals road crossing. Although the water use permit has been issued, the withdrawals from the river have not yet been initiated. This project is further described under the surface water supply section below. The water withdrawn from this river withdrawal will be used in the Tampa Bay Water regional supply system.

In addition to traditional ground- and surface-water sources, reclaimed or reuse water use totaled 3.4 billion gallons (285 million gallons/month average) in Hillsborough County's central service area in water year 2000. Reclaimed water is water that has received at least secondary treatment and is reused after being treated at the domestic wastewater treatment facility. Reclaimed water provides numerous benefits, most notably by providing an alternate source of water which offsets the demand for ground and surface water sources. Uses for reclaimed water include urban and agricultural irrigation, golf course irrigation, industrial processes, and power plant cooling. One ongoing project will increase the use of reclaimed water and beneficially affect the Alafia River. The Hillsborough County Central Reuse System will be interconnecting the

Valrico and Falkenburg advanced wastewater treatment facilities and the South County System to provide approximately 15 MGD of reclaimed water to residential, commercial, and industrial customers at build-out. Included in the scope of work are the associated pumping facilities, storage and a telemetry system to allow remote operation.

Another alternative water source is seawater desalination. A proposed seawater desalination plant is planned for installation adjacent to the Big Bend Power Plant by a private entity which will transfer the fresh water produced to Tampa Bay Water. It is currently expected to produce 25 MGD of potable water to be delivered to the Tampa Bay Water regional distribution system.

Ground-water Withdrawals

The Alafia River watershed covers an area where there are many groundwater withdrawals from the Floridan and intermediate aquifers. Much of the agricultural, public supply, mining, and industrial groundwater withdrawals in eastern Hillsborough and western Polk Counties are located within the Alafia River watershed or its main tributaries such as English Creek and Turkey Creek.

The headwaters region of the Alafia River contains a significant portion of the central Florida phosphate district. This phosphate area has many large industrial and mining ground-water withdrawals. Prior to the advent of the water use permitting regulations, large groundwater withdrawals for use in the phosphate mining industry accounted for significant lowering of Floridan aquifer water levels in certain regions. New water use permitting regulation of these withdrawals contributed to the reversal of these declining aquifer trends to some degree, through both water conservation via new mining methods, and conversion to recycled or re-circulated surface water sources.

Although public supply wellfield withdrawals increased at a slower rate than the pre-existing mining industry withdrawals, they are currently a significant portion of the total ground-water withdrawal quantity. Tampa Bay Water has a regional supply wellfield located near the center of the watershed at the confluence of the North Prong and South Prong of the Alafia River. Known as the South Central Hillsborough Regional Wellfield, it is permitted for 24.1 MGD annual average withdrawal. The wellfield currently produces about 23.6 MGD annual average.

The affect of ground-water withdrawals on the flow in the Alafia River has been assessed by Tampa Bay Water and the District during the South-Central Hillsborough Regional wellfield evaluation, and again with the Brandon Urban Dispersed wellfield. No significant effect on the flow in the main river has been identified. There are fewer lakes and wetlands in the South Central Hillsborough Regional wellfield area than in the stressed wellfield areas of northwest Hillsborough County, and, in addition, there is a great difference in the subsurface lithologic materials between the two areas. In the Alafia River watershed area, particularly in the area of the South Central Hillsborough

Regional wellfield, there is a much greater thickness of low-permeability confining materials between the Floridan aquifer production zone and the surficial aquifer wetland/lake systems at the land surface. Also, the presence of the intermediate aquifer serves as a buffer to the Floridan aquifer withdrawals and potential leakance from the surface wetland systems. This geologic situation contributes to the effects of groundwater pumpage on lakes and wetlands. There is ongoing wetland and water level monitoring required by the permits at the South Central Hillsborough Regional and Brandon Urban Dispersed wellfields, but there has been no wetland or other surficial aquifer system impacts documented by the monitoring. However, the deeper aquifer water levels in the wellfield area have been affected by the drawdown caused by groundwater withdrawals. Water level drawdowns caused by these groundwater withdrawals have caused pressure and yield (dry wells) problems for existing homeowner and irrigations wells. District regulation through permit-based well-mitigation condition requirements has resulted in restoration of all eligible impacted individuals since the wellfield started withdrawing groundwater in 1986.

Surface Water and Spring Withdrawals

Other than Tampa Bay Water's proposed Alafia River Pump Station at Bell Shoals Road, no major surface water withdrawals currently exist on the Alafia River. In conjunction with the Alafia River Pump Station project, there is a large project on-going at this time that will create a large reservoir site. As far as existing withdrawals, there are probably many small exempt lawn irrigation withdrawals along the residential stretches of the river. Two major withdrawals do exist on two of the Alafia River tributaries. One is at Buckhorn Springs at the head of Buckhorn Creek and the other is at Lithia Springs, which discharges into to a short creek run to the Alafia River. Both these withdrawal sites have water use permits and pump water through a pipeline to the Cargill, Inc., chemical processing facility at U.S. 41 on the River. The Buckhorn Springs withdrawal is lesser of the two, with a running average annual withdrawal of between 0.40 MGD and 0.27 MGD for the annual year 2000. The Lithia Springs running average annual withdrawal was between 4.1 MGD and 4.6 MGD for annual year 2000. The spring's average flow was 34 cfs for water year 1999.

The Alafia River Project is a component of Tampa Bay Water's Master Water Plan and the Partnership Agreement. This proposed project includes a large surface water withdrawal facility on the Alafia River at Bell Shoals, as well as various pipelines and storage facilities remote from the river. The permit (issued 7/1999) will allow a range of 8 to 52 MGD of withdrawal quantities from the Alafia River during flow regimes above a minimum river flow of 124 cfs (Tampa Bay Water, 2000). Minimum flows in the Alafia River are a major concern, and these were evaluated during the assessment of the viability of these withdrawals. These river withdrawals will be routed directly to the new water treatment plant, called the Tampa Bay Regional Surface Water Treatment Plant located at Broadway Avenue and U.S. Highway 301. Any excess river withdrawal will

be pumped to the new regional reservoir, called the Tampa Bay Regional Reservoir. It will cover an area of 1,100 acres and have a volume of 15 billion gallons. It will be located between Boyette and Picnic, adjacent to the Doe Branch of Fishhawk Creek, a tributary of the Alafia River. Water Use Permitting is currently in progress for this reservoir facility.

Water Conservation Initiative

In May 2000, the Governing Board initiated the Water Conservation Initiative (WCI) to increase conservation activities at the District and local levels. To guide the effort, a Water Conservation Strategic Plan has been developed that outlines goals and specific tasks for achieving them. The District has assembled a staff work group to carry out tasks of this plan. In addition, a Water Conservation Task Force, consisting of representative members of user groups, local governments, and others, has been formed to provide input and direction for accomplishment of the conservation initiatives.

Cooperative efforts between the District and local governments and with major private water users are an important element of properly using and conserving water supplies in the Alafia River Basin. These efforts also seek to ensure a reliable future water supply for all users. The Alafia River Basin Board's water conservation priorities and projects are presented in the Conservation Action Plan of their Five-Year Basin Plan.

The Alafia River Basin Board has recognized the District's newly created Water Conservation Initiative (WCI) as a priority. The initiative is driven by the Water Conservation Strategic Plan which outlines goals and specific tasks for accomplishing them. Goals identified by this plan include:

- Provide resources to raise awareness of water conservation techniques.
- Identify user groups and develop appropriate conservation education vehicles.
- Engage local governments and user groups in a District-wide conservation information exchange program.
- Provide the assistance required to create links between local and regional economic growth and development and water conservation.
- Develop incentives for water conservation implementation.

Implementation of the strategic plan has been assigned to a District staff work group. A Water Conservation Task Force, consisting of representative members of user groups, local governments, and others, also has been assembled to provide input and direction for accomplishment of the conservation initiatives. In addition to the Task Force, other

activities underway include developing a virtual conservation resource library which will make the resources of the District and other agencies available via the District's web site on the Internet, and planning for the first water conservation summit (April 2001), which will serve as a forum for water users and local governments to share information, new ideas and technologies, and different perspectives on water conservation.

SECTION 1. LITERATURE REVIEW

A number of planning documents and technical reports pertain to water supply issues in the Alafia River watershed. These documents are summarized briefly below:

1-1 DISTRICT WATER MANAGEMENT PLAN

The July 2000 District Water Management Plan (the Plan) represents the first five-year update of the Southwest Florida Water Management District's "comprehensive plan." This twenty-year Plan is consistent with the requirements of Section 373.036, Florida Statutes (F.S.) and Section 62-40.510, Florida Administrative Code (F.A.C.), as well as the standard format devised by the five water management districts, the Florida Department of Environmental Protection (DEP) and the Executive Office of the Governor (EOG).

The primary purpose of the Plan is to serve as a comprehensive guide to the District in carrying out its water resource management responsibilities, including those for water supply, flood protection, water quality and natural systems. Just as importantly, its preparation and updating represent a significant interactive process with the District's Governing and Basin Boards, standing advisory committees, various interest groups and the public.

The various sections that make up the Plan are briefly described below while the reader is referred to the full document for a more complete understanding of the content.

Chapter I: District Overview. This section provides a background understanding of the District in order to create perspective on water management needs within specific regions. This includes the District's history, cultural and natural resources, water use and publicly owned lands. It culminates with an assessment of the major accomplishments and changes since the original Plan was completed in 1994.

Chapter II: Water Management Goals and Policies. This section offers the District's vision, mission and goals that establish the long-term ends toward which programs and activities are directed. It also includes the core performance measures developed by the districts, DEP and the EOG, an important addition to the updated version of the Plan.

Chapter III: Water Management Responsibilities. This section provides a resource assessment (including comprehensive program descriptions), and the identification of issues, policies and strategies for each of the District's areas of responsibility (water supply, flood protection, water quality, natural systems and management services). A set of issues, common to all our responsibilities and how they will be addressed, is also included. The common issues, and "main messages" of each responsibility are as follows:

1-1.1 Part A. Issues Common to all Areas of Responsibility

Comprehensive Watershed Management Initiative (CWM)

The Comprehensive Watershed Management Initiative has been established in an effort to improve the management of water and related natural resources within the Southwest Florida Water Management District (SWFWMD or District). Started in 1994, the CWM Initiative employs a watershed-based approach to water and related natural resource management. Staff from a variety of disciplines and departments make up "watershed teams" that have been assigned to eleven primary watersheds within SWFWMD. Local governments and other stakeholders within each watershed are also significant partners on a number of these teams. The goals for the teams include:

- Collect, integrate and analyze the existing wealth of information pertinent to each watershed and create a data base for analytical purposes;

- Identify and prioritize existing and future water resource management issues relating to water supply, flood protection, water quality and natural systems (District areas of responsibility);

- Develop preventive or remedial actions to address these resource management issues;

- Implement and monitor the effectiveness of selected actions and the overall process and recommend potential revisions.

The CWM Initiative helps to ensure that comprehensive, coordinated analysis and decision-making take place. It fosters closer cooperation among the District's local governments and other stakeholders to help preserve the qualities of watersheds as growth and development take place in the future.

Linking Water Management and Land Use Planning

The water management activities of the District and the land-use planning and management activities of local governments must be coordinated in order for either to be effective and efficient in accomplishing their respective objectives. The land use

decisions of local governments, can have a variety of water management ramifications. Similarly, the water management efforts of the District, can have implications for local government land use planning. Since local governments have exclusive authority over land use decisions, it is important that their planning and actions be closely tied to the carrying capacity of natural resources such as water, and the agencies that manage them.

Collection, Coordination and Distribution of Technical Information

The District is constantly attempting to improve its understanding of the hydrologic system and human influences upon this system. This is particularly true for the groundwater system, which provides over 80 percent of the water supply in the District, and how it interacts with surface waters. However, the District does not have the luxury of waiting until it has all the desirable information and technical capabilities to make informed, rational resource management decisions. Rather, the District is required by statute to make current decisions based upon the best available information. Local governments and others rely on the District as a source of such information for their short- and long-range planning and implementation activities.

Compliance and Enforcement of Regulations

In order for the District's rules and regulations to effectively accomplish the objectives for which they were established, compliance with these rules and regulations must be ensured. The District must have a means by which to monitor compliance, and enforcement initiatives must be reviewed and updated as necessary.

Public Communication and Outreach

Water resources education is an essential part of each of the District’s areas of responsibility. It is a goal of the District to provide all citizens, local governments, visitors, and organized interest groups within the 16-county area with information about its current activities and future plans, thereby increasing the public’s awareness of their connection to, their dependence on, and their responsibility to participate in the protection of Florida’s water resources.

1-1.2 Part B. Water Supply

A number of new legislative requirements and expectations have emerged to guide the District in ensuring an adequate supply of the water resources for all existing and future reasonable and beneficial uses. The District’s efforts are characterized by sound planning and ongoing support for source development, with an emphasis on alternatives to traditional groundwater supplies which are reaching, or have exceeded sustainable limits throughout much of the District. This is being done in the Tampa Bay area

through the innovative “Partnership Agreement”, the key example to date of the District’s strategy to create water resource management partnerships. A remaining challenge now being addressed is assuring water supplies and source protection in the Southern Water Use Caution Area (SWUCA).

1-1.3 Part C. Flood Protection

The focus is on retaining vigilance in the face of climatic variation and other uncertainties such as those associated with the 1997-98 El Niño pattern. A clear preference for nonstructural solutions is being implemented through close coordination and clear role development with local governments, regional agencies such as 298 districts and others. Of particular importance is the linkage of land and water responsibilities through joint planning and investment that assures opportunities to prevent flood damage are seized.

1-1.4 Part D. Water Quality

The District’s Comprehensive Watershed Management initiative is being applied to all our responsibilities, but is especially pertinent to management of water quality. It supports the twin strategies of prevention and restoration while emphasizing collaboration to achieve coordinated monitoring networks, implementation of Total Maximum Daily Loads (TMDLs), restoration of SWIM and other key water bodies and addressing emerging issues such as nitrate contamination.

1-1.5 Part E. Natural Systems

Strategic land acquisition and management continue as a major tool to protect natural resources, including prudent use of less-than-fee simple techniques. The establishment of minimum flows and levels helps to define the limits of various water resources to meet growing water supply needs. The CWM initiative provides the ecosystem view necessary to manage complex systems. Restoration remains a requisite element in addressing such issues as the Flatford Swamp, degraded water bodies and expanding human land uses. This area of responsibility is characterized by partnerships as well, including those for land acquisition and management, and substantial progress in SWIM water bodies such as Tampa Bay and Lake Panasoffkee.

1-1.6 Part F. Management Services

The District’s support functions are recognized as the foundation upon which successful resource management is built. Advancements in data management, communications and technology assure continuous improvement in service efficiency and effectiveness. Accountability is enhanced through performance measurement, planning and high quality budget reporting, including extensive work with the EOG.

Chapter IV: The Integrated Plan. The purpose of the Integrated Plan is to enhance the overall linkage of land and water management responsibilities through the creation of county-by-county water management plans. Each county plan will serve as a technical information resource that can be used to enhance local government comprehensive plans by linking local water resource planning to the best available data and other resources of the District. These stand-alone documents will be developed following completion of the overall Plan, and will be made a part of the Plan by reference.

Chapter V: Watershed Management. This chapter brings together all the water resource-related elements in a place-based focus, integrating issues and strategies from the four major areas of responsibility on a watershed basis. This is being accomplished at the District through the CWM initiative, an ongoing effort for the eleven major watersheds in the District. As these CWM plans are completed they will become part of the overall Plan by reference.

Chapter VI: Implementation Coordination. Water management, particularly at the regional level, requires a close partnership among all levels of government (as well as both public and private entities) to assure that activities are conducted in a manner consistent with the long-term protection needs of Florida's water resources. This chapter covers current efforts that relate to implementation coordination and the District's strategy for enhancing such efforts.

Chapter VII: Procedures for Plan Development. This section documents the significant process used by the District in updating the Plan. The chapter provides sections on public and governmental organization participation, definitions for terms commonly used in water management and information on evaluation procedures for the Plan.

This Plan, though not self-implementing, serves as an important tool for the District. Actions by the Governing Board and the Basin boards, as well as staff activities, can now be viewed in terms of how they relate to an overall, comprehensive picture of water resource management. This will assist the District, and others, in assuring their actions are in the best interest of water and related natural resources.

1-2 SURFACE WATER STUDIES RELATED TO WATER SUPPLY

Other than the planning studies mentioned above, the water yield studies done by Tampa Bay Water's consultants have only been presented in public meetings, technical memorandums, and as part of permit applications. Permit-driven studies required by the permit conditions, similar to the hydrobiological monitoring studies performed for the Tampa Bypass Canal and Hillsborough River Water Use Permits, have not yet been published. However, several are in the development process right now, and it is

anticipated that these will be submitted to the public record when required once the permit is issued. The "Outstanding Permitting Issues" section below provides some additional details.

1-3 GROUND-WATER STUDIES RELATED TO WATER SUPPLY

Many groundwater studies were done during the assessment and siting of the existing South Central Hillsborough Regional Wellfield during the period of time between 1980 and 1987. The area considered in these studies extends throughout a large part of the river basin in the vicinity of the confluence of the north and south prongs of the Alafia River, and Turkey and English Creeks. These studies addressed the issues of aquifer yield, local geologic conditions, hydrologic monitoring programs and the extent of potable water zones (Geraghty and Miller, 1982,Geraghty and Miller, 1984, Geraghty and Miller, 1986, Geraghty and Miller, 1988, SDI, Inc., 1990). The ground-water withdrawal affects on the surficial, intermediate, and Floridan aquifer within the Alafia River watershed were addressed in these studies (SDI, Inc., 1990). The wellfield's affects on Lithia Springs and the flow in the Alafia River were addressed during these evaluations. The SWFWMD has performed a regional water resource assessment project for the Eastern Tampa Bay Water Use Caution Area, which includes much of the Alafia River watershed (SWFWMD, 1992).

1-4 SOUTHERN WATER USE CAUTION AREA INFORMATION REPORT

This report provides a concise summary of the history, current conditions and future plans for the Southern Water Use Caution Area (SWUCA) within the Southwest Florida Water Management District (SWFWMD, or the District). It describes the background leading to the designation of the area, management activities such as the SWUCA Rule and challenges to it, where the District is today in its planning and the approach to assuring water resource management and protection. The Alafia River basin lies primarily within the SWUCA. The area north of highway 60 lies within the Northern Tampa Bay WUCA.

SECTION 2. AVAILABLE DATA

Local, regional, and state agencies compile data pertaining to ground and surface water resources in the Alafia River watershed. The District has a comprehensive hydrologic conditions monitoring program. Conditions that are monitored include rainfall, evaporation, lake levels, groundwater levels, spring flow, water quality, and river discharge and stage elevation.

Hydrologic and environmental monitoring data are also collected by the wellfield operators through regulatory permitting requirements. Current wellfield Water Use Permits issued by the Southwest Florida Water Management District require the establishment of environmental monitoring programs (EMPs) to monitor ecological and

hydrological conditions within and near public supply wellfields. EMPs are designed to monitor and evaluate hydrological and ecological conditions in relation to potential environmental perturbations that could occur naturally (e.g., climatic events, abiotic and biotic disturbances) or from human activity (e.g., wellfield production, ditching, and drainage). Overall EMP goals are to assess the presence and magnitude of any potential impacts on ecological systems resulting from groundwater withdrawals by Tampa Bay Water. Key EMP items include: twice monthly water level measurements; analysis of hydrologic data; semi-quantitative wetland ecological assessments at wetland/surface water monitoring stations; limited quantitative plant transects and quadrants; incidental wildlife observations; semi-annual data analyses and reports; aerial photo-interpretation; a monitoring methodology manual; and comprehensive annual environmental assessment reports of findings. Data evaluations are performed on an annual or semi-annual basis.

For all other water use permits, permittees located in the Eastern Tampa Bay Water Use Caution Area (ETBWUCA) are required to report ground water and surface water withdrawals where their permitted quantity exceeds an annual average of 100,000 gallons per day (gpd). Outside the ETBWUCA, in the Polk County portion of the watershed, permittees are required to report ground water and surface water withdrawals where their withdrawals exceed 500,000 gpd annual average. Other selected water use permits are also required to report water levels and water-quality data.

The United States Geological Survey has monitored the stage, discharge, and water quality of the Alafia River since the 1950s. There are four monitoring stations along the river. The United States Geological Survey has also conducted studies on the Alafia River, such as evaluating the relationship between freshwater flow and salinity distributions in the river, and evaluating the nutrient loading to Hillsborough Bay from the Alafia River.

The Hillsborough County Environmental Protection Commission (EPC) has monitored the water quality of the Alafia River since 1974. There are five monitoring stations on the Alafia River, with one station at the Bell Shoals Road crossing near where the surface water withdrawal site is proposed.

SECTION 3. OUTSTANDING PERMITTING ISSUES

The District's Partnership Agreement and its associated wellfield permitting requirements are the most outstanding water use permitting issues within the entire District at the present time. Although it does not directly regulate wellfields in the Alafia River watershed, such as the South Central Hillsborough Wellfield, the requirements within the Partnership Agreement (Joint Board Approved Version, April 20, 1998) which call for the development of 38.0 MGD of new water supply by December 31, 2002, may directly affect the water resources in the Alafia River watershed. The proposed effect

from this New Water Plan (Part 2.A. New Water Plan of the Partnership Agreement) is reflected in the Alafia River Project. The most outstanding permitting issue that directly affects the water resources of the river is the Alafia River Project.

The Alafia River Project Water Use Permit Application No. 2011794.00 was issued in July 1999. The Alafia River Project Water Use Permit provides additional new water supply quantities for Tampa Bay Water's Interconnected Regional Water Supply System. The allocation of the water use quantities for replacement and rotation purposes is pursuant to the Northern Tampa Bay New Water Supply and Ground Water Withdrawal Reduction Agreement (Partnership Agreement) effective May 27, 1998. Withdrawals are regulated using a schedule which is directly linked to the flow of the Alafia River. The minimum flow required before withdrawals can be made is 80 Million Gallons Per Day (124 Cubic Feet Per Second) as estimated at Bell Shoals Road. Withdrawals are limited to 10% of the flow over 80 Million Gallons Per Day (124 Cubic Feet Per Second) with a maximum withdrawal of 52 Million Gallons Per Day (80 Cubic Feet Per Second). Monitoring will be required as special conditions to observe the physical and biological environments within the river prior to operation and to detect changes during operation. The District anticipates establishment of a Minimum Flow for the Alafia River during the term of this permit. Once the Minimum Flow is adopted, this water use permit may be subject to comprehensive review by the District and will be modified, if necessary, to be consistent with the adopted Minimum Flow. Table 3-3 summarizes the permit.

Table 3-3. Total Quantities Authorized Under This Permit (in MGD).

Withdrawal Rate	Alafia River Flow at Bell Shoals Road
0 MGD	< 80 MGD
8 MGD to 52 MGD (10% of flow)	80 MGD to 520 MGD
52 MGD Maximum	**> 520 MGD**

During times of low flow in the river, the proposed plan does not allow withdrawals. When river flow is below 124 cfs, no withdrawals are allowed. During high flow periods there is a cap, or limit of 80 cfs (52 MGD), no matter how high the river flow rises. At flow regimes between these two end members, the withdrawal quantity is based on a maximum withdrawal of 10% of the flow. Annual Average yields were calculated to be approximately 17.5 MGD for the period of flow data from 1977 to 1996. An Annual Average yield ranged from a low of 7.21 MGD (1990) to a high of 28.95 MGD (1979). No Annual Average withdrawal quantity is assigned to this permit in order to allow for

maximum flexibility. The withdrawal schedule has been approved and water production will begin in December 2002.

This Alafia River Project is partially integrated with another Tampa Bay Water Master Plan project: the Tampa Bypass Canal/Hillsborough River Project. This integrated planning approach is presented in separate technical memorandums for those projects by Tampa Bay Water's consultants (HDR Engineering, Inc., 1998). The TBC/Hillsborough River and the Alafia River projects are part of an integrated system referred to as the Enhanced Surface Water System (ESWS). The ESWS is designed to manage and optimize withdrawals, conveyance, and storage of surface water supply. As discussed above, water use permits (WUPs) issued by the District for the TBC/Hillsborough River and Alafia River Water Supply Projects specify withdrawal schedules that vary with available flows (i.e., withdrawals increase with increasing flows up to a permitted maximum, no withdrawals below a designated low flow). Anticipated long-term annual average withdrawals are 29.5 mgd from the TBC/Hillsborough River and 17.5 mgd for Alafia River. During the dry season when water cannot be withdrawn from the rivers, the new Regional Reservoir will be used for supply.

Environmental concerns related to the planned withdrawals reflect the natural areas and recreational/aesthetic values provided by these waterbodies, as well as their contribution to the Tampa Bay ecosystem. Although withdrawal schedules were developed to minimize hydrologic and ecological impacts to the riverine systems and to ensure that flows remain within the range of natural variability, the permits also required the development of a comprehensive Hydrobiological Monitoring Program (HBMP). Due to similar project development schedules, close proximity, and the integrated nature of the two projects, a single unified HBMP was developed to address permit requirements for both projects simultaneously. To maximize stakeholder communication and the use of available technical resources, a consensus-based focus group, consisting of consultant and university experts, representatives of federal, state, and local environmental agencies, and various environmental organizations, was established to help design the HBMP. This group will also convene annually to evaluate monitoring data.

Potential withdrawal impacts, if any, will first be manifested in the rivers and upper bay segments; these areas are defined as HBMP reporting units: lower Hillsborough River, lower Alafia River, lower Palm River, McKay Bay, and Hillsborough Bay. The HBMP defines monitoring program elements for each reporting unit including hydrology/water quality, biota, and habitat/vegetation; critical indicators; and associated criteria such as the monitoring parameters, sampling methods, and data analysis. Overall HBMP goals are to ensure that post-implementation flows do not deviate from the normal rate and range of fluctuation to the extent that water quality, vegetation, animal populations, salinity patterns, or recreational/aesthetic qualities are adversely impacted. Specific HBMP objectives are to: document existing conditions; enable the detection of changes; determine if any detected changes are attributable to freshwater flow reduction and

permitted surface water withdrawals; determine whether the detected changes constitute, or could result in, unacceptable adverse impacts; and recommend appropriate management actions or operational changes to mitigate unacceptable adverse impacts, if they occur or are expected to occur. The HBMP also defines a process by which adverse impacts can be determined and includes a hierarchy of management actions for response to any detected hydrobiological changes.

The HBMP was implemented in Spring 2000 so that baseline data could be collected prior to initiation of new surface water withdrawals (expected to begin in late summer 2002). Additional information, including monitoring reports and the detailed HBMP design document, is available from HBMP website.

Located at the northwest corner of the Alafia River watershed is the proposed Brandon Urban Dispersed Wellfield. Although, actually located adjacent to the Alafia River watershed, the potential hydrologic effects being evaluated extend into the area of the Alafia River watershed. This water use permit is one of the Tampa Bay Water Master Plan projects, and it will play a role in the development of the desired New Water Plan sources within the Partnership Agreement. The project will refurbish or re-drill production wells located through the Brandon area on dispersed parcels of existing County-owned property. These sites were previously well sites for the original subdivision supply wells before Hillsborough County acquired and linked-up the potable water distribution system in the area in the late 1970's and early 1980's. The permitted (8/1999) withdrawal quantity for the Brandon Urban Dispersed wellfield is 6.0 MGD Annual Average. Drawdown impacts evaluated are very similar to those addressed during the permitting of the South Central Hillsborough Regional Wellfield. Connection of the Brandon Dispersed well field to the regional potable supply distribution system is planned.

As discussed previously (see Section 2), current WUPs require development of an EMP. The Brandon Project EMP was developed and implemented in the summer of 2000. Specific EMP objectives are to establish ecological monitoring sites, conduct an initial year of baseline monitoring, and then perform ongoing monitoring during production to detect any potential ecological and hydrological impacts associated with Brandon Project pumping activities. EMP implementation activities included identifying sites without significant existing impacts, setting of vegetation and soil normal pool elevations, mapping habitat and Karst features within the 108-square mile study area, installing staff gages, piezometers, and quantitative vegetative monitoring transects, and collecting topographic data to develop stage inundation curves. Hydrologic data collected and analyzed for the Brandon project include: well pumpage; lake and pond levels; spring, stream, and river stage and discharge; well water quality; surficial, intermediate, and Floridan aquifer water levels; rainfall; and pan evaporation. To monitor ecological conditions, a total of 23 wetland, lake, stream, sinkhole, or spring sites were selected for twice-monthly water level measurements. Monitoring activities for many of these sites include semi-annual wetland assessment procedure (WAP)

monitoring, and three sites were selected for quantitative vegetation data collection and analysis every other year. Incidental wildlife observations are recorded during all monitoring events. Changes in land use, vegetation, and surface water levels are also monitored using color-infrared photography (spring) and satellite imagery (fall). Environmental assessment reports documenting aspects of hydrologic and ecologic conditions are prepared on a semi-annual and annual basis.

In addition to the above, the existing South Central Hillsborough Regional Wellfield has been pumping at approximately 80% of its permitted capacity. The wellfield's projected connection with the regional public supply system may cause an increase in actual wellfield pumping up to its permitted rate. Although potential drawdown impacts from these permitted rates of withdrawal have been simulated and evaluated prior to permit issuance, the existing monitoring network will need to be observed closely for any changes to the environmental systems and aquifer water levels. This also includes the monitoring of flow in the Alafia River, and the flow in Lithia and Buckhorn Springs which are fed by Floridan aquifer sources.

As discussed previously (see Section 2), current WUPs require development of an EMP. Ecological and hydrological monitoring of the South Central Hillsborough Regional Wellfield (SCHRWF) area began in 1983. Historical monitoring activities have been performed as part of a Regional Monitoring Program; implementation of an EMP-based approach was initiated in 2001. Overall monitoring program objectives are to detect possible hydrological and ecological effects attributable to wellfield pumpage. Hydrologic data collected and analyzed for the SCHRWF project include: wellfield pumpage; pond levels; spring and river stage and discharge; well water quality; surficial, intermediate, and Floridan aquifer water levels; rainfall; and pan evaporation. To monitor ecological conditions, monthly water level and wildlife use data, and semiannual qualitative WAP data, are collected at 14 sites. In addition, quantitative species composition and percent cover data (herbaceous vegetation, shrubs and trees) are collected every other year at four sites. Infrared aerial photography is analyzed twice a year (spring and fall) to assess changes in land use, vegetation, and surface water levels. Comprehensive environmental assessment reports are prepared annually to document hydrologic and ecologic conditions.

3-1 THE SOUTHERN WATER USE CAUTION AREA (SWUCA)

The outstanding ground-water issue in the southern portion of the District, including the Alafia River watershed is ground-water use in the Southern Water Use Caution Area (SWUCA). The following is a summary of the Southern Water Use Caution Area (SWUCA) information report (SWFWMD, 1998). This report provides a concise summary of the history, current conditions and future plans for the SWUCA within the District. It describes the background leading to the designation of the area, management activities such as the SWUCA Rule and challenges to it, where the District is today in its planning and the approach to assuring water resource management and

protection. The Alafia River watershed lies wholly within the SWUCA.

The SWUCA was declared a "water use caution area" (where water resources are or will become critical in the next twenty years) in 1992 by the District Governing Board, encompassing an area of about 5,100 square miles, covering the southern half of the District. It includes all of Manatee, Sarasota, Hardee and DeSoto counties and portions of Hillsborough, Charlotte, Polk and Highlands counties. Water resource concerns associated with the SWUCA involve the decline of lake levels along the Highlands Ridge and advancing coastal saltwater intrusion in the Floridan Aquifer. A Water Use Caution Area, also known as a Water Resource Caution Area (WRCA), is defined by State law as an area where water resources are, or are expected to, become critical within the next twenty years. A number of WRCAs exist throughout the State, including several in the District.

3-1.1 Background to SWUCA

The mission of the District is to manage and protect water resources for human and environmental needs. This is accomplished through both regulatory and non-regulatory means, including but not limited to, water resource development, water use and environmental resource permitting, comprehensive hydrologic monitoring and long range planning. During the mid to late 1980s, long-term declines in hydrologic conditions were observed in three specific geographic regions of the District; Highlands Ridge, Northern Tampa Bay and Eastern Tampa Bay. More intensive data collection and analysis (a Water Resource Assessment Project, or WRAP) were initiated in each area to ascertain the probable causes of the declines and the modified or new resource management programs that might be needed.

Each area was designated as a WUCA in 1989 and specific water use permitting rules were implemented for the Highlands Ridge and Eastern Tampa Bay WUCAs in 1990. Major rule provisions emphasized water conservation and water use monitoring, including per capita goals for public suppliers, crop efficiency standards for agriculture and specific conservation plans for recreation, industrial and mining uses. Metering was also required for all uses greater than 100,000 gallons per day.

The decision to designate the Highlands Ridge and Eastern Tampa Bay WUCAs was validated by the subsequent results of the Districtwide Needs and Sources Report (1992). It showed the greatest projected percentage increase in water use by 2020 would be in the southern area of the District, where significant stress already existed on the Floridan Aquifer. It verified that current and anticipated demands would create water resource problems in the Highlands Ridge (HR) and Eastern Tampa Bay (ETB) WUCAs that needed to be addressed.

The results of the Eastern Tampa Bay WRAP Report showed that ground water resources of the ETB and HR WUCAs are interdependent and must be addressed from

a basin-wide or regional perspective. This led to the establishment of the Southern Water Use Caution Area in 1992, encompassing the two existing WUCAs and all the area between them. Specifically, the SWUCA encompasses an area of about 5,100 square miles and covers the southern half of the District, including all of Manatee, Sarasota, Hardee and DeSoto counties and portions of Hillsborough, Charlotte, Highlands and Polk counties.

The water resource concerns associated with the SWUCA involve the decline of lake levels along the Highlands Ridge and advancing saltwater intrusion in coastal regions. Data show the potentiometric surface in the Floridan Aquifer has declined significantly during the past 40 years. Information provided by the United States Geologic Survey (USGS) reveals seasonal declines as great as 50 feet in 1989. Water quality monitoring shows increasing trends for sulfates, total dissolved solids and chlorides across the coastal counties. Many lake levels in the Highlands Ridge area have also declined significantly, in some cases as much as 20 feet.

3-1.2 Historic SWUCA Perspective

Historically, there has been excessive ground water pumping in the southern half of the District. This imbalance is illustrated by USGS potentiometric change maps for 1969–1975, and reflects extensive drawdowns in this part of the District from ground-water pumping. The WRAPs performed by the District would eventually show that these significant Floridan Aquifer level declines remained in the late 1980s and early 1990s, and that saltwater intrusion and lowered lake levels were linked to this fact.

Water use permitting in Florida is a relatively recent phenomenon. In fact, water use permits were not required in the SWFWMD until 1977. Moreover, a large portion of the SWUCA was not included in the original District boundaries. Most of the Eastern Tampa Bay and Highlands Ridge Water Use Caution Areas were not a part of the District until the late 1970s, with water use permits not required there until 1980.

In effect, the District inherited a resource that was severely stressed prior to implementing regulation and other management activities. This fact, coupled with the lack of hydrologic data within the area in the 1970s, resulted in the initial permitting activity being more of an inventory of use that was already there than a true allocation of available resources.

3-1.3 The Future of SWUCA

The conditions that resulted in the need for specialized water resource management in the SWUCA have not gone away. Saltwater intrusion persists and lowered lake levels remain. Seeing a window of opportunity created by changing circumstances, the Governing Board has determined there is a need to reevaluate its management plan in light of recent court rulings. This opportunity is based on a number of factors:

- Significant portions of the SWUCA Rule were ruled invalid by an Administrative Law Judge;

- A reduction in ground water usage has occurred since the SWUCA process began, resulting in lower water use projections for the future;

- 1997 legislation on minimum flows and levels allows a “recovery strategy” when actual levels are below the minimum levels; and

- 1997 aquifer levels recovered in most areas to the minimum level proposed by the earlier plan but the current drought has lowered levels to or below this minimum level.

The water resource problems of the SWUCA are long-term in nature. Solutions must also be long-term. There is not an immediate crisis now, and an effective resource management approach will assure one is avoided. The variability of water use, resultant effects on aquifer levels and the need to achieve and maintain sustainable supplies indicate both short term and long-term strategies are necessary.

The District’s overall strategy will attempt to balance regulation with technical and financial incentives (e.g., implementation of a minimum aquifer level with water resource development for alternatives to ground water use) while closely monitoring water use, water levels and water quality. The intent is to achieve effective resource protection without negatively affecting the local economy.

3-1.4 Conclusion

The methodology used in establishing the minimum aquifer level for the SWUCA is not necessarily applicable to other parts of the District or State. Development of a regional aquifer level was chosen as a result of the geohydrologic configuration of the SWUCA and the large number of permits contributing to the overall conditions. The method to use in establishing any minimum flow or level (by rule, permit or Board Order) should be determined only after evaluating a series of factors including, but not limited to, the nature of current and projected impacts, the number of current and future permits and the specific hydrogeology and ecology of the area.

The District methodically employed a highly inclusive management process, and carefully followed proper rule making. Over a seven-year period, the agency held numerous workshops to seek public input, conducted dozens of in-depth studies costing several million dollars, held peer review sessions over a number of years and allowed interested parties repeated opportunities to address the Board. Yet, in the final analysis, the establishment of a minimum flow or level draws a clear line between the needs of man and the environment. These decisions will inevitably result in conflict as it

did in the SWUCA and has in Northern Tampa Bay. The growth of Florida will depend on the availability of water, and therefore each minimum flow and level established throughout the State will influence the rate and cost of any such growth. The stakes are high, and all major water users can be expected to contend in any forum possible to secure their portion of the remaining water resources of Florida.

It is the intention of the District to effectively manage and protect those resources, while recognizing the need for full involvement of all parties, as we move toward sustainable use that assures the region's future quality of life.

3-2 NEW WATER SOURCES INITIATIVE & WATER SUPPLY DEVELOPMENT

The District Governing Board in 1994 initiated a financial incentive program known as the New Water Sources Initiative (NWSI). NWSI was created as an effort to assist in the development of non-traditional alternatives to ground-water use. Since its inception, the Governing Board has budgeted $10 million annually, an amount matched by the affected Basin Boards for specific projects. The total District contribution is then matched by the cooperator to develop water supplies.

The Alafia River Basin Board is helping to address water supply issues in the Northern Tampa Bay portion of the District. The Board has teamed up with the other two Basin Boards in Hillsborough County and local cooperators, for example, to assure implementation of the historic Tampa Bay Partnership Agreement. The Basin Board will continue to address Tampa Bay issues (with a focus on demand management or water conservation). The Basin Board's NWSI priorities, including those encompassed by the Partnership Agreement are contained in the New Water Sources Initiative Action Plan portion of this five-year plan.

3-3 SEAWATER DESALINATION

One alternative source offering great potential in the west-central portion of the District is seawater desalination. This source is attractive because of its sustainability - an almost unlimited supply of untapped seawater is available for conversion, making desalination a drought - proof resource. In the Tampa Bay area, Tampa Bay Water is finalizing implementation of a seawater desalination facility at the Big Bend facility of the Tampa Electric Company in southern Hillsborough County through a private/public partnership. In July of 1999, Tampa Bay Water awarded a contract for a 25-million gallon seawater desalination plant to Stone and Webster of Boston, Massachusetts. The plant is expected to be providing 25-million gallons of potable water a day to Tampa Bay Water by December 2002.

The District has agreed to contribute up to 90 percent of the proposed capital cost of the facility as part of the $183 million pledged through 2007 via the Partnership Agreement. This investment, estimated to be about $85-90 million, will not only bring an additional 25 MGD of water supplies by the end of 2002, but will aid in keeping the cost of this new supply comparable to other alternative sources and traditional supplies. The planned facility is designed to allow for additional cost-effective units to expand production up to 35 MGD as needed by 2007.

SECTION 4. REGULATORY AUTHORITY AND SPECIAL RULES

The section below describes other governmental activities in the Alafia River watershed that are related to water supply.

4-1 FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION ECOSYSTEM MANAGEMENT INITIATIVE

Ecosystem management as defined by the Florida Legislature in House Bill 2111 is: "A concept which includes coordinating the activities of state and other governmental planning, land management, environmental regulatory programs, and voluntary programs, together with the needs of the business community, private landowners, and the general public, as partners in a streamlined and effective partnership for the protection of Florida's environment."

To demonstrate the viability of ecosystem management, state agencies are conducting several projects in Florida. The Cone Ranch sponge demonstration project is part of this initiative. The team permitting process that was used to evaluate the Tampa Water Resource Recovery Project (TWRRP) was also part of this initiative. With team permitting, all regulatory agencies meet together to discuss and resolve project issues. State and local permits are combined into a single permit which is issued by the FDEP.

4-2 TAMPA BAY WATER

As discussed previously, Tampa Bay Water has formulated a Resource Development Plan. The plan identifies the need for new water sources to meet the public supply demands of the tri-county region (WCRWSA, 1994). The New Water Plan (WCRWSA, 1998) identifies sources that include ground water, surface water, storm water, brackish water and seawater desalination, and inter-regional sources. The Plan contains several water supply alternatives that are located within the Alafia River watershed, including the Brandon Dispersed Wells and Pipeline Project, an offstream reservoir and a seawater desalination project.

4-3 SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

The District is conducting numerous activities which pertain to water supply in the Alafia River watershed. One of these is to provide funding for the development of alternative water sources. The District's New Water Source Initiative Program will fund up to 50 percent of the cost of alternative water sources which have regional water resource benefits. The Central Hillsborough Reuse Project is a New Water Source Initiatives. The District also provides funding for new water sources through the Cooperative Funding program and through Basin Board Initiatives, which are used for a broader scope of projects.

In 1998, the District, Tampa Bay Water, and its member governments developed a Partnership Plan. Under the Partnership Plan, the District will provide $183 million in funds to Tampa Bay Water to assist in developing alternative water sources. These sources are needed to alleviate environmental impacts caused by existing ground-water withdrawals and to meet the future needs of the tri-county area. Sources identified in the Partnership Plan include reclaimed water, purified water, and seawater desalination. The Partnership Plan also calls for a reduction of 17 MGD in water use through demand management, with the District Basin Boards providing $9 million a year through cooperative funding.

SECTION 5. GOVERNMENTAL AND OTHER WATERSHED ACTIVITIES

The section below describes other governmental activities in the Alafia River watershed that are related to water supply.

5-1 TAMPA BAY WATER

Tampa Bay Water is a special state district created by inter-local agreement among member governments consisting of Hillsborough County, Pasco County, Pinellas County, St. Petersburg, New Port Richey and Tampa. Tampa Bay Water provides wholesale water to member government utilities that, in turn, provide water to nearly two million people in the tri-county area. Tampa Bay Water was created in 1998, with assistance from the Florida Legislature and Governor, by restructuring the West Coast Regional Water Supply Authority.

Tampa Bay Water's mission is to provide members with reliable supplies of high-quality water to meet present and future needs in an environmentally and economically sound manner. Tampa Bay Water provides an average of 176 million gallons of water to members every day. Currently, that water is produced from 13 regional ground-water facilities. Tampa Bay Water also owns and operates two water treatment facilities and one surface water augmentation facility.

Tampa Bay Water is committed to environmentally sustainable water supplies. New water supplies must be developed to accommodate these pumping reductions while still meeting members' needs. For this reason, Tampa Bay Water has developed a Master

Water Plan that combines new sources like desalinated seawater and surface water with limited additional groundwater and aggressive conservation. These Master Water Plan projects will ensure adequate supplies for the Tampa Bay region through the year 2014 and beyond.

5-1.1 Tampa Bay Water's Master Water Plan

Through an integrated resource planning process, Tampa Bay Water, its Members, the District, and numerous other local government agency representatives developed the Resource Development Plan (RDP) in 1994. The RDP establishes a schedule, based on existing and projected conditions, to ensure the development of future sources through 2030. Additionally, the RDP provided specific recommendations for developing new water supplies. Tampa Bay Water's Board of Directors approved one of the RDP's recommended plans in December 1995 as the Master Water Plan. Under the Master Water Plan, water supply options are studied, analyzed and compared. The Board of Directors selects projects for implementation that are technically feasible and environmentally and economically sound.

The Partnership Agreement between Tampa Bay Water, its Members and the District was approved on May 14, 1998. The key objectives identified in the Agreement are the development of new water supply, the phased reduction of groundwater withdrawals from the existing 11 wellfields in Northern Tampa Bay, the ending of litigation, and financial assistance from the District for new water supply development and conservation. The phased reductions included in the Agreement specify that the combined production from the 11 wellfields shall be limited to an annual average daily quantity of 158 mgd until December 31, 2002, at which time the quantity will be reduced to 121 mgd. As of December 31, 2007, the permitted annual average quantity from the 11 wellfields shall be further reduced to 90 mgd.

Public information and involvement and an aggressive demand management component to reduce demand across the region are also included in the Master Water Plan. Tampa Bay Water is working closely with its member governments to ensure that average annual demand is reduced by 10 mgd in 2000 and a total of 17 mgd in 2005.

Section 2.A. of the Partnership Agreement requires Tampa Bay Water to prepare and submit to the District a New Water Plan that describes the proposed water supply projects that, upon construction, will provide at least 85 mgd of new supply to the region by the end of 2007. The Partnership Agreement states that Tampa Bay Water must have one or more projects permitted, constructed, in operation and providing at least 38 mgd of new supply by December 31, 2002. Furthermore, by December 31, 2007, Tampa Bay Water must have the remaining necessary projects permitted, constructed, in operation and providing an additional 47 mgd, for a total of at least 85 mgd of new water supply for regional distribution to its members. The District Governing Board unanimously approved Tampa Bay Water's New Water Plan in August 1998.

In November 1998, the Board approved a configuration of Master Water Plan projects to meet the quantity requirements of the Partnership Agreement and to meet regional demand through 2010. The Board also approved submittal of these projects to the District as New Water Plan projects. Approved projects are currently in one of the following three developmental stages:

- **Stage A:** Feasibility studies, preliminary design & preparation of Water Use Permit application: water supply projects will be presented to Tampa Bay Water's Board of Directors to consider which projects to implement upon completion of Stage A.

- **Stage B:** Final design, engineering, construction permitting and property acquisition: Tampa Bay Water's Board has approved a number of Stage B projects for development.

- **Stage C:** Bidding, final permitting, contractor mobilization, construction and operation of facilities through start-up, testing and final acceptance.

Tampa Bay Water's Board of Directors has approved further development or elimination of several New Water Plan projects based on information obtained during initial evaluations. In July and August 1999, the Board approved the Brandon/South-Central Connection, Two Rivers Ranch and Seawater Desalination II as new Stage A Master Water Plan projects. In October 1999, the Board eliminated Two Rivers Ranch from the Master Water Plan. On April 10, 2000, the Board approved Aquifer Storage and Recovery as a Stage A project alternative, and approved Stage A funding for Seawater Desalination II (now called Gulf Coast Desal). On July 10, 2000, the Board directed staff to no longer pursue Aquifer Storage and Recovery as an alternative to the Reservoir. All of the new Stage A projects were Board-approved as part of the New Water Plan. In July 2001, the Board selected a configuration of Stage A projects to produce an additional 45-50 mgd by 2008 (System Configuration II/III).

5-1.2 Current Master Water Plan Projects

In July 2001, the Tampa Bay Water Board of Directors reaffirmed the current Master Water Plan & New Water Plan projects as follows:

Master Water Plan and New Water Plan Stage B and C Projects

Stage B includes Final Design, Permitting, Property Acquisition; Stage C includes Bidding & Construction. All projects are in Stage C except as noted.

- Enhanced Surface Water System:
  - Alafia River
  - Tampa Bypass Canal/Hillsborough River High Water

  - Tampa Bay Regional Reservoir (Stage B)
  - Tampa Bay Regional Water Treatment Plant
  - South-Central Hillsborough Intertie

- North-Central Hillsborough Intertie
- Brandon Urban Dispersed Wells
- Seawater Desalination
- Clearwater Wells (Stage B)
- Loop 72 Phase A (Stage B)
- Brandon/South-Central Connection (Stage B)

Master Water Plan and New Water Plan Projects

Stage A includes Feasibility Studies and Preliminary Design.

- Gulf Coast Desalination
- Crystals International

Stage B includes Final Design, Permitting, Property Acquisition.

- Mid-Pinellas Brackish Water Desalination
- Eagles Wells
- Cypress Bridge II
- Cone Ranch
- Cargill Reclaimed Exchange

In addition, the Morris Bridge Sink Project was approved in July 2001 for Stage B evaluation as an emergency water supply project.

Both phases of the Master Water Plan together will provide additional capacity of 53 mgd per day by 2003 and a total capacity of 140 mgd by 2008, providing enough water to serve the region through 2014. This will help meet demand created by the wellfield cutbacks and regional growth, while allowing the environment to recover by reducing pumping at stressed regional facilities.

5-1.3 New Water Supply Project Funding

The District has agreed to provide $183 million to assist Tampa Bay Water with development of the new water supply projects. These funds are to be used for projects that the District deems "eligible" and shall be used for "eligible" project costs. Eligible project costs are identified in the Agreement as those for design, engineering and construction.

Five of the Board-approved Master Water Plan projects are eligible for District co-funding: the Enhanced Surface Water System, Seawater Desalination, North-Central Hillsborough Intertie, Brandon/South-Central Connection and Loop 72 Transmission Main. The Enhanced Surface Water System combines common elements (treatment, transmission and storage) for three surface water sources: Tampa Bypass Canal/Hillsborough River High Water and Alafia River. The system includes the Tampa Bay Regional Reservoir, the Tampa Bay Regional Water Treatment Plant and the South-Central Hillsborough Intertie. The Enhanced Surface Water System is eligible for a maximum co-funding of $120 million. The Seawater Desalination project is eligible for a maximum co-funding of 90 percent of the total capital cost. The North-Central Hillsborough Intertie, Brandon/South-Central Connection and Loop 72 Transmission Main are eligible for 50 percent District co-funding. The Board- approved projects also contain a groundwater project that is not eligible for District co-funding.

5-1.4 Master Water Plan Projects in the Alafia River CWM Area

Tampa Bay Water's Master Water Plan projects located within the District Alafia River CWM boundary are shown in Table 3-4 and described in the following paragraphs.

Table 3-4. Master Water Plan Projects.

Project	Began	WUP Issued	Complete	On-Line
Alafia River Project	Oct 1996	July 1999	Nov 2002	Dec 2002
South-Central Hillsborough	Feb 1997	NA	Nov 2002	Dec 2002
Tampa Bay Regional	Oct 1996	NA	June 2004	June 2005
Brandon Urban Dispersed	Nov 1996	Sept 1999	Dec 2001	Jan 2002
Brandon/South-Central	July 1999	NA	July 2003	Aug 2003
Seawater Desalination	June 1996	NA	Nov 2002	Dec 2002
Cargill Reclaimed	July 2001	NA	Dec 2004	Jan 2005

Alafia River Project

The Alafia River project is an element of the Enhanced Surface Water System, along with the Tampa Bypass Canal Water Supply project (including the Hillsborough River

High Water Source), the South-Central Hillsborough Intertie, the Tampa Bay Regional Water Treatment Plant and the Tampa Bay Regional Reservoir. The withdrawal schedule for the Alafia River project was developed to minimize impacts to the overall riverine system by not withdrawing water during lower river flow periods. The minimum flow selected corresponds to the 80th percentile, or the flow level that is exceeded 80 percent of the time during an average year. Proposed withdrawals will only occur when the river flow is at 124 cubic feet per second (cfs) or greater, at which time only 10 percent of the flow will be withdrawn. The proposed maximum withdrawal is 80 cfs or 52 mgd. The proposed withdrawal location is the south side of the Alafia River at Bell Shoals Road, which is a tidally-influenced area.

South-Central Hillsborough Intertie

The South-Central Hillsborough Intertie project involves the construction of approximately 71,800 feet of 72-inch diameter pipeline from the Alafia River Pumping Station to the Tampa Bay Regional Water Treatment Plant. The pipeline is sized to convey excess flow from the re-pump station at the water treatment plant site to the Reservoir, or to carry up to 66 mgd by gravity feed back from the Reservoir to the water treatment plant. Water from the Alafia River Pumping Station (up to 52 mgd) can also be conveyed to the water treatment plant through the South-Central Hillsborough Intertie or to the reservoir through the 84-inch Reservoir Pipeline. The project is being constructed in two parts, Contract #1 (north half of the pipeline) and Contract #2 (south half of the pipeline).

Tampa Bay Regional Reservoir

The Reservoir will provide storage during high flow periods so that it can be utilized as potable water when surface water is not available for withdrawals. The Reservoir's anticipated storage capacity is approximately 15 billion gallons (48,000 acre-feet). Structurally, it will be an earthen embankment with an average height of 45 feet and an average water depth of 40 feet. The Tampa Bay Regional Reservoir project is made up of two components. The first is the Reservoir that will be located near the Picnic area in southeastern Hillsborough County. The second is approximately 8 miles of 84-inch transmission main that will connect the Reservoir to the South-Central Hillsborough Intertie near the Alafia River withdrawal location.

Brandon Urban Dispersed Wells Project

The Brandon Urban Dispersed Wells (Brandon) project redevelops a groundwater resource in the urban area of Brandon. The Brandon facility includes five production well sites to produce 6 mgd on an average annual basis, with a peak quantity of 9.24 mgd per month. The well sites are located on property owned or controlled by Tampa Bay Water. The raw water collection system consists of approximately 71,000 linear

feet of 8 to 36 inch pipeline, which will be used to deliver water to the Tampa Bay Regional Water Treatment Plant and/or Hillsborough County's Lithia Water Treatment Plant (following completion of the Brandon/South-Central Connection).

Brandon/South-Central Connection

This project consists of approximately 6.3 miles of 30-inch diameter pipe to connect the proposed Brandon Urban Dispersed Wells project to the existing South Central Hillsborough Wellfield. This bi-directional pipeline is needed to provide water from the regional system to Hillsborough County for use in its South-Central Service Area. The pipeline will also integrate the South Central Hillsborough Wellfield as a new component of the regional system.

Seawater Desalination Project

Tampa Bay Water's Seawater Desalination project is a key component of the agency's Master Water Plan. To meet the region's water needs, Tampa Bay Water must tap into new sources of water other than groundwater. The plan calls for the creation of 53 million gallons a day (mgd) of new water sources by 2003 and a total of 111 mgd by 2008. The seawater desalination project is one piece of the water supply solution and will provide 10 percent of the region's overall water supply by 2008. Desalination takes the salt out of seawater so it can be used for drinking water. Desalinated seawater is a drought-proof, alternative water supply that can be produced in an environmentally and economically sound manner. The seawater desalination project is being developed under contracts with private developers to Design, Build, Own, Operate and Transfer (DBOOT) the facility, and deliver water to the regional water supply system. The desalination plant will initially produce 25 mgd of water and may be expanded in the future to produce 35 mgd. It will be the largest desalinated seawater facility in North America.

The desalination plant will be built on Tampa Electric Company's Big Bend Power Station site in southern Hillsborough County, and will use cooling water that has already circulated through the Big Bend Power Station. This approach eliminates the potential for trapping marine life in the desalination plant's filters or membranes, and minimizes potential discharge impacts to Tampa Bay. Although the reverse osmosis desalination process produces a concentrated seawater brine, several studies performed as part of project development and permitting concluded that dilution prior to discharge will ensure the plant will not increase the salinity of the bay beyond normal seasonal variations, or harm marine life. The seawater concentrate will be diluted with up to 1,400 million gallons a day (mgd) of cooling water from the power plant before it is returned to the bay. This cooling water will provide a 70:1 dilution ratio, and, as a result, the salinity of the discharged water will be less than 3 percent higher than the background salinity of Tampa Bay. Construction for the desalination facility should be complete by October 1, 2002; the facility will be operational by December 31, 2002.

Cargill Reclaimed Exchange

In addition to the current Master Water Plan projects, one potential System Configuration II project is located within the Alafia River CWM boundary. This project, the Cargill Reclaimed Exchange, involves exchanging 1 mgd of reclaimed water with Cargill Fertilizer for an equivalent portion of their current spring water use. This project includes water treatment, pumping and interconnected pipelines. Tampa Bay Water is currently evaluating the feasibility of this project as part of investigations for the Stage A Developmental Projects. In July 2001, the Board selected this project as part of the System Configuration II/III projects for development by 2008.

5-2 SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

The District is conducting numerous activities which pertain to water supply in the Alafia River Watershed. One of these is to provide funding for the development of alternative water sources. The District's New Water Source Initiative Program will fund up to 50 percent of the cost of alternative water sources which have regional water resource benefits. The Tampa Water Resource Recovery Project, and the Central Hillsborough Reuse Project are all New Water Source Initiatives.

Under the Partnership Agreement, the District would provide partial funding to Tampa Bay Water to assist in developing *alternative* water sources for rotational capacity. These sources are needed to alleviate environmental impacts caused by existing ground-water withdrawals and to meet the future needs of the tri-county area. Sources identified in the Partnership Agreement include conservation, surface water, reclaimed water, purified water, and seawater desalination.

5-3 TAMPA BAY SWIM PLAN

In recognition of the need to place additional emphasis on the restoration, protection and management of the surface water resources of the State, the Florida Legislature, through the Surface Water Improvement and Management (SWIM) Act of 1987, directed the state's water management districts to "design and implement plans and programs for the improvement and management of surface water" (Section 373.451, F.S.). The SWIM legislation requires the water management districts to protect the ecological, aesthetic, recreational, and economic value of the state's surface water bodies, keeping in mind that water quality degradation is frequently caused by point and non-point source pollution, and that degraded water quality can cause both direct and indirect losses of habitats.

In accordance with the law and strongly supported by the Agency on Bay Management (ABM), the District selected Tampa Bay to be included in its list of priority water bodies for the SWIM Program and was designated as the top priority. A management plan was

originally prepared and approved in 1988 based on The Future of Tampa Bay, a management plan generated from the 1985 Tampa Bay Management Study Commission. The SWIM Plan was revised in 1992 and is being revised again following the completion of the Tampa Bay National Estuary Program's (now Tampa Bay Estuary Program - TBEP) Comprehensive Conservation and Management Plan (CCMP).

For the Tampa Bay SWIM Plan, the ABM's and TBEP's previous activities and the CCMP are the basis for the SWIM Plan's strategies for the protection and restoration of Tampa Bay. In fact, much of the supporting information was taken verbatim from The Future of Tampa Bay and the CCMP. In preparing the SWIM Plan, staff reviewed the goals, initiatives, and strategies for restoring and protecting Tampa Bay and then focused on activities identified for the District that can be accomplished within the legislative charge of SWIM - improving or protecting water quality and natural systems.

The Tampa Bay SWIM Plan has incorporated the following goals from the TBEP CCMP:

- Cap nitrogen loadings to Tampa Bay at existing levels (1992-1994 average) to encourage the regrowth of an additional 12,350 acres of seagrass.

- Protect relatively clean areas of the bay from increases in toxic contamination, and minimize risks to marine life and humans associated with toxic contaminants to impacted areas.

- Increase and preserve the quantity, quality and diversity of seagrass communities. The long-term goal is to restore 12,350 acres of seagrass and protect the bay's existing 25,600 acres.

- Restore and optimum balance of wetland and associated upland habitats for fish and wildlife, while protecting and enhancing existing habitats. Specific targets include:

- Restoration of a minimum of 100 acres of low-salinity tidal marsh every five years, for a total increase over time of 1,800 acres, and the preservation of the existing habitat.

  – Protection and enhancement of the bay's mangrove and salt marsh communities which total nearly 14,000 acres.

  – Restoration over time of 150 acres of salt barren habitat.

A Pollutant Load Reduction Goal (PLRG) has been established for the bay. The consensus of the scientific community in Tampa Bay is that the nitrogen concentrations are presently acceptable and the management approach is to "hold the line" on nitrogen. Nitrogen loadings are expected to increase 7 percent by 2010, or about 17

tons per year, as a result of population growth. Therefore, local governments and industries will need to offset loadings to the bay by this amount to maintain existing nitrogen loadings. As such, the PLRG for Tampa Bay is:

- Reduce nitrogen concentration in Tampa Bay by 7 percent by 2010, or about 17 tons per year or as necessary to offset loadings to the bay as a result of population growth.

Strategies to achieve the goals include primarily stormwater retrofit projects and habitat restoration projects. Stormwater retrofit projects are designed to provide treatment for stormwater from previously untreated urban and industrial areas. The stormwater treatment process of detaining runoff into holding ponds, biological assimilation and physical removal reduces the amount of nutrients (primarily nitrogen and phosphorus) and toxic materials entering the receiving waters. The habitat restoration goals, and to a lesser degree the nitrogen removal goals, will be achieved through construction of "habitat mosaics" designed to include as many different habitat types as the site allows, including oligohaline (low-salinity) habitats.

This revised Tampa Bay SWIM Plan provides details for twelve (12) habitat restoration projects; two (2) assessment projects; two (2) monitoring projects; two (2) identified stormwater retrofit projects and place holders for additional projects opportunities that are identified each year from local governments or other groups. The projects identified are consistent with the Tampa Bay Estuary Program's Comprehensive Conservation and Management Plan.

The District has many tools available to implement the legislative intent of the SWIM program, including but not limited to, integrated planning and coordination, regulatory authority, land acquisition programs and the SWIM program itself. Each of these areas provide opportunities to assist in the management of Tampa Bay, one of the prominent natural systems within the District.

With adequate funding and implementation, the SWIM Plan for Tampa Bay will be one of the vehicles through which the District and the State of Florida contribute to ongoing efforts to restore and protect Tampa Bay.

5-4 TAMPA BAY ESTUARY PROGRAM

The Alafia River drains into Tampa Bay, which is one of 22 estuaries in the United States that are a part of the National Estuary Program (NEP). The NEP was created under the Clean Water Act and is administered by the USEPA. The Tampa Bay Estuary Program (TBEP) was established in 1991 to assist the community in developing a comprehensive plan to restore and protect Tampa Bay. The management committees are composed of private and public agencies and organizations. The document, "Charting the Course" management plan outlines the proposed action plans

to address water and sediment quality, and natural systems issues in Tampa Bay and its watershed (TBEP 1996).

Water quality reached a low-point in Tampa Bay during the mid- to late-1970s, when widespread blooms of algae clouded the bay waters. The algae blooms decreased the depth to which light penetrated, resulting in the loss of large areas of seagrass. Increased loading of nitrogen was identified as the cause of the algae blooms in the bay. Water quality has since improved. Most water quality gains have been attributed to advanced wastewater treatment, which can remove up to 90 percent of the nitrogen discharged to the bay. Municipal sewage treatment facilities now contribute nine percent of the total nitrogen loadings to the bay, down from 40 percent in the mid-1970s. As the contribution of point sources has declined, NPS have assumed greater importance. NPS of nitrogen will likely increase over the coming decades, as the population of the Tampa Bay region continues to grow (TBNEP 1996).

The TBEP management objectives for water quality in Tampa Bay are to maintain and gradually reduce in-bay loadings of nitrogen and TSS. To achieve these objectives, the TBEP Management Plan presents action plans addressing the stormwater runoff, wastewater, atmospheric deposition, and toxic contaminant components of bay pollution. A schedule and cost estimate is presented with each action plan, and the key or lead implementing agencies are identified (TBEP 1996). Federal funding of the TBEP ended in 1997 with the completion and adoption by local governments of the Comprehensive Conservation Management Plan outlined in "Charting the Course". However, the implementation of the plan will continue under the locally funded TBEP.

Contributing to the goals of the TBEP, the FDEP recently finalized TMDLs for each of the Tampa Bay segments. For Hillsborough Bay, the TMDL for total nitrogen is 7951 lbs/day (Decision Document for Technical Approval/Disapproval of TMDL Submittal for Tampa Bay, Florida, approved and signed by Robert F. McGhee, Director, Water Management Division, USEPA Region 4, June 18, 1998).

The Tampa Bay SWIM program and the TBEP are complementary programs, and have worked together on all aspects of Tampa Bay restoration. Ultimately, PLRGs will be set for Tampa Bay sub-basins. The process of setting PLRGs brings together federal, state, district and local regulatory agencies to agree upon the pollutant reductions necessary to achieve predetermined restoration goals. The process for implementing PLRGs has not been determined, but creative methods for achieving compliance with the sub-basin specific PLRGs, and for apportioning the pollutant reductions among the various contributors should be possible.

SECTION 6. WATER SUPPLY ISSUES

6-1 ACTION PLAN: WATER SUPPLY

Below are water supply issues, goals and actions identified by the Alafia Watershed Land and Water Linkage Task Force that fall under the water management responsibilities of the District:

Task Force Issues:

- Consequences of Lithia Springs Park being pumped (5 MGD).
- Three new sources of water from the Alafia River.
- Impacts of pumping on recreation.
- Impacts of pumping on individual wells.
- Competing uses for water.
- Impacts of pumping water on salinity wedge in estuary (freshwater flow to Tampa Bay and reductions in estuary size as it moves upstream into narrow areas).
- Impacts of pumping water on salinity wedge in estuary.
- Estuary freshwater inflows.
- Saltwater Intrusions.
- Estuary freshwater inflows.

Task Force Goals:

- To provide adequate water at the lowest environmental cost.
- To encourage natural landscaping to reduce water usage.
- To implement the current Hillsborough County Position Statement on the Southern Water Use Caution Area (SWUCA).
- To protect private wells from ground-water withdrawals through wellfield pumping by Tampa Bay Water and its successors.

Task Force Actions:

- To limit Tampa Bay Water's withdrawals from the Alafia River and ground-water projects to current 1999 permitted levels, quantities and rates, provided that Hillsborough County Independent Monitoring Program shows no deleterious effects at those levels.

- Hillsborough County, Tampa Bay Water, and the Southwest Florida Water Management District will manage resources to eliminate the need for the Southern Water Use Caution Area designation.

- To make the Tampa Bay Water intake structure on the river be more natural looking and camouflaged and not impact navigation, safety, recreation and the local hydrogeology.

Below are water supply issues, goals and actions identified by the Alafia River CWM Team:

ISSUE 1 - Coordinated Water Use and Land Use.

There is no clear linkage between the planning and implementation programs of the District and the land use planning decisions of local governments (SWFWMD, 1995). The District is the agency charged with primary responsibility for water management decisions within its region and is a centralized source for water related research and information. Local governments exercise primary authority over land use through long-range (20-year) Local Government Comprehensive Plans. Existing statutes relating to land and water planning and management create two separate tracks with minimal connection and no requirements for consistency between them. Integration between land and water use planning and management processes are essential to either being effective in accomplishing its objectives. This issue was the subject of the Governor's Task Force on Land and Water Planning.

Strategy:

Work to have water supply as a consistency requirement for local government comprehensive plans and improve coordination between land and water planners.

Actions:

1. Use the District's Needs and Sources report as the source document for water supply availability. (Responsible entities: SWFWMD, FDEP, Tampa Bay Water, Hillsborough County, Polk County, local governments)

2. Ensure District lobbyists make consistency a part of our 1999 legislative agenda. (Responsible entities: SWFWMD)

3. Develop a linkage mechanism between local governments.

4. Increase District involvement with the Regional Planning Council and local government planning departments. (Responsible entities: SWFWMD, FDEP, Tampa Bay Water, Hillsborough County, Polk County, local governments).

5. Develop an annual report summarizing the status of water supply, water resources, and new regulations for distribution to local land use planners and others. (Responsible entities: SWFWMD)

6. Develop a Memorandum of Understanding between the District and local governments which provides that local governments will give advance notice to the District when DRIs and large Comprehensive Plan amendments are proposed. (Responsible entities: SWFWMD, Hillsborough County, Polk County, local governments)

7. Coordinate five-year planning documents, such as Comprehensive Plan Updates and Basin Plans, on the same time frame. (Responsible entities: SWFWMD, FDEP, Tampa Bay Water, Hillsborough County, Polk County, local governments)

Projects:

Project Name: Water Resource and Water Supply Development: Surface Water and Storm Water
Project Description: This is a District funded study to determine the feasibility and availability of surface water and storm water to meet regional water supply needs out to 2020 in the Southern Planning area. The project consists of evaluating potential surface water and storm water supplies by analyzing yields form the major riverine systems in the planning area. A total of 10 rivers were evaluated. Potential yields were calculated by diverting 10 percent of daily flow, using the 85th percentile (P85) for a minimum flow (as a diversion cutoff), and a diversion capacity of twice the median flow of the river. Quantities were calculated using the historic flow record from 1965-98 when available at downstream gaging stations. A long list of 63 projects (both surface water and storm water) were first developed and later narrowed down to the most likely to proceed list of about 16 projects. The most likely projects were selected on their ability to provide significant quantities of water to meet regional needs. A series of technical memorandums have been drafted by CH2M HILL, the consultant, which describes each phase of the project. The final technical memorandum, TM No. 4, is currently being revised per District staff comments with a final report expected by 11/30/00. At that time, the project will be closed-out.
Location: Watershed
Participants: SWFWMD

Implementation Schedule: 6/8/1999-11/30/2000
How Financed: SWFWMD

Project Name: Natural Treatment of Storm and Waste Water
Project Description: The requested funding is to support the third year of a New Water Sources Initiative (NWSI) project in cooperation with the Florida Institute of Phosphate Research (FIPR) and will be used for ongoing data collection and analysis. In addition, a final project report will be prepared during the third year of the project. This project began in FY 1999 and is to enhance the water treatment aspects of NWSI project F023. The projects are being conducted at Florida Power Corporation's Hines Energy Complex, which is located in the Southern Water Use Caution Area (SWUCA) on previously mined phosphate land situated southwest of the city of Bartow in Polk County. The purpose of NWSI project F023 is to construct a one million gallons per day (mgd) aquifer recharge/recovery well. Water used for injection in the well will be obtained from an onsite cooling pond. The purpose of NWSI project F027 is to enhance the water quality treatment phase of NWSI project F023. The project will investigate the feasibility of using wetlands on waste clay settling areas to treat secondary treated wastewater and stormwater to drinking water standards. Further water treatment will be achieved by use of sand tailing basins to provide filtration. Following treatment to drinking water standards, the water will be injected into the Upper Floridan aquifer. Water will be withdrawn from the aquifer during periods when there is insufficient water in the cooling pond for use in cooling for power generation. Funding for the first year of the project was for site exploration and design and construction of the wetlands treatment area and sand filtration basins. These activities were initiated in October 1999 and are anticipated to be completed by October 2000. The second year of funding is for data collection and analysis. If these projects are successful, FPC will expand the water quality treatment and recharge well systems to offset the effects of up to 12.5 mgd of future ground water withdrawals.
Location: Watershed
Participants: SWFWMD/FIPR
Implementation Schedule: 9/14/1999-12/31/2002
How Financed: SWFWMD/FIPR

ISSUE 2 - Decline of Confined Aquifer Water Levels Associated with Wellfield Water Withdrawals in the Area of the South Central Hillsborough Regional Wellfield.

Tampa Bay Water and Hillsborough County Water Department have operated the South Central Hillsborough Regional Wellfield since 1985. Prior to the permitting of this facility the District, local residents, and the administrative hearing officer ensured that there was a specified well-mitigation program in place on the permit before significant production of water was initiated. As expected, numerous impacts to private wells occurred when these large wellfield production wells started pumping. Although there

were problems initially, Tampa Bay Water created an internal system to handle the mitigation of these many, many impacted wells. The adverse impacts consisted of lowered ambient Floridan and Intermediate aquifer water levels, which in general caused well pumps and associated equipment to fail prematurely. The mitigation consisted of well pump repairs, well refurbishment, or in many cases complete well replacement. This mitigation program is ongoing and has had additional requirements added during subsequent permit renewals. The current program is now adequate, and the ongoing implementation is being tracked and monitored by District permitting staff.

Strategy:

Continue to implement the existing mitigation program and monitor the performance of the required activities.

Actions:

1. Provide consultation and advice for complainants about the requirements and limitations of the wellfield permit's mitigation condition.

2. Continue to monitor fluctuating confined aquifer water levels within the specified mitigation area.

3. Continue to evaluate the adequacy and scope of the mitigation program with regard to any potential changes or variations of the hydrologic system in the wellfield area.

Strategy:

Evaluate potential affects on the well-mitigation area and the existing permit requirements when the South Central Hillsborough Regional Wellfield is linked with the Tampa Bay Water's regional supply system.

Actions:

1. If total wellfield pumping increases significantly beyond current pumping levels when the pipeline intertie to the regional loop system is completed and operational, then confined aquifers should be monitored for any significant recession in average annual, or "steady-state" water levels in the wellfield area (Responsible agencies: SWFWMD, Tampa Bay Water).

2. Since new well complaints have become less frequent with the established wellfield drawdown, or cone of depression, new increases or peaks in the frequency of new well complaints should be monitored for assessment of

mitigation area boundary adequacy (Responsible agencies: SWFWMD, Tampa Bay Water).

ISSUE 3 - Increased Water Demands will Continue to Stress Already Stressed Water Resources, Exacerbating Lake Level Declines in the Region and Seawater Intrusion into the Floridan Aquifer.

The SWUCA was declared a "water use caution area" (where water resources are or will become critical in the next twenty years) in 1992 by the District Governing Board, encompassing an area of about 5,100 square miles covering the southern half of the District. It includes all of Manatee, Sarasota, Hardee and DeSoto counties and portions of Hillsborough, Charlotte, Polk and Highlands counties. Water resource concerns associated with the SWUCA involve the decline of lake levels along the Highlands Ridge and advancing coastal saltwater intrusion in the Floridan Aquifer. A Water Use Caution Area, also known as a Water Resource Caution Area (WRCA), is defined by State law as an area where water resources are, or are expected to, become critical within the next twenty years. A number of WRCAs exist throughout the State, including several in the Southwest Florida Water Management District (SWFWMD, or the District).

Strategies:

1. Carefully refining the issues to be addressed, including the development and implementation of a resource management program which protects water and related natural resources while maximizing water supply.

2. Identifying regulatory and non-regulatory alternatives for cooperative management.

3. Evaluating and modifying the minimum aquifer level as needed.

4. Forming a work group of affected parties to assure full involvement.

5. Developing the prevention/recovery strategy for the area.

6. Coordinating with other water districts, DEP, the Department of Agriculture and Consumer Services (DACS), Charlotte Harbor NEP and others.

7. Maintaining ongoing communication with the District's Governing and Basin Boards, advisory committees and other appropriate parties.

Actions:

In the short term, the District will:

1. Continue to use existing water use permitting rules for the Eastern Tampa Bay (ETB) and Highland Ridge (HR) Water Use Caution Areas (WUCAs), as summarized in Figure 20 (next page). District-wide rules will continue to be stringently applied in the balance of the SWUCA.

2. Anticipate that demand for ground water will exceed the quantities available in at least portions of the SWUCA, and develop and adopt a "Competing Applications Rule" which will allow the Governing Board to determine which uses should receive permits based on those most in the public interest.

3. Develop a revised SWUCA Rule as part of an overall management strategy. This will include reestablishment of minimum levels, possible use of components from the original SWUCA Rule that were not challenged (e.g., water conserving credits for agriculture, ground water withdrawal credits for use of alternative sources, heightened efficiency standards for all users, etc.) and revisions to some of the SWUCA Rule language to accommodate suggestions of the Judge.

4. Continue forward with water supply planning efforts such as the "District-wide Assessment" and a subsequent "Regional Water Supply Plan" for the SWUCA. Existing water resource development efforts will be enhanced pursuant to Chapter 97-160, Laws of Florida, so as to create effective partnerships with local governments, utilities, agriculture, the regional water supply authority and others to meet present and future water supply needs.

5. Establish an outreach program to re-engage the affected and interested public. The primary objectives will be to inform and involve, disseminating information on water use trends, projected uses and resource management decisions, while gaining effective feedback such as assessment of revised and new rule proposals and input on the intent of comprehensive monitoring programs.

This overall interim strategy is intended to allow water use permit renewals and some new permits in parts of the SWUCA. Most of the associated quantities are expected to be offset by reductions in permitted quantities due to heightened water use efficiency requirements, retirement of some permits and continuing cooperation of user groups in achieving water conservation (e.g., industrial process improvements, public supply per capita reductions and best management practices among agriculture and recreational users cited earlier in this report).

In the longer term, the District will continue and refine the short term approaches, including:

6. Implementation of the revised SWUCA Rule and associated minimum levels as

part of an overall recovery strategy.

7. Use of the Competing Applications Rule as needed.

8. Continuous improvement of the detailed monitoring system necessary to identify trends and refine our understanding of the resource.

9. A commitment to develop alternative water supply sources, including but not limited to, reuse of storm water and wastewater, aquifer storage/recovery, sustainable use of surface water and water conservation.

RESPONSIBLE PARTIES:

SWFWMD, Tampa Bay Water, local governments, Coastal Zone Management Program and the Florida Cooperative Extension Service.

COSTS:

The proposed SWUCA rule (revision of 40D-2 and 40D-8 FAC, April 1994) is not expected to significantly contract economic activity in terms of sales and employment nor significantly prevent it from growing at projected levels through 2015 (Hazen and Sawyer, 1994). Average cost and benefit loss is $158 for water utility customers per household per year for the years 2005 through 2015. SWFWMD personnel costs associated with reports/data processing and reviews are estimated to be approximately $134,000 per year. In addition, approximately four regulatory positions over the life of the project (four years) will cost an estimated $700,000. Cooperative funding may be sought from participating local governments, river basin boards of the SWFWMD, Tampa Bay Water and the Coastal Zone Management Program.

Projects:

Project Name: Partnership Agreement Projects
Project Description: The Northern Tampa Bay New Water Supply and Groundwater Withdrawal Reduction Agreement - Partnership Agreement (Agreement) - provides for the development of new and alternative water supply sources in the Tampa Bay area. Under the Agreement, Tampa Bay Water is required to develop at least 38 million gallons per day (mgd) of new supply by December 31, 2002, and a total of 85 mgd by December 31, 2007. The Agreement also requires specific reduction in pumping from the Central System Wellfields. By December 31, 2002 and December 31, 2007, pumping from the wellfields shall be reduced to 121 mgd (annual average) and 90 mgd (annual average), respectively. The District has pledged $183 million to assist with the development of alternative supply. Additionally, the District Governing Board, in conjunction with the Basin Boards in the three-county area (Hillsborough, Pasco and

Pinellas counties), has also pledged $9 million per year of funding assistance to implement conservation and demand management programs to reduce demand by 10 MGD by 2000 and 17 MGD by 2005. Tampa Bay Water proposes to develop at least 53 mgd (annual average) by December 31, 2002 and a total of 111 mgd (annual average) December 31, 2007. In November 1998, Tampa Bay Water Board of Directors selected a number of projects for development to meet the December 31, 2002 deadline. The selected projects will produce 91 mgd (annual average) by December 2005. By July 2001, Tampa Bay Water Board of Directors will select other projects to provide at least an additional 20 mgd (annual average). The projects that have been selected and under development include the following: Brandon Urban Dispersed Wells; Seawater Desalination @ Big Bend Power Plant; Enhanced Surface Water System; North Central Hillsborough Intertie; and Brandon/South Central Connection. The Enhanced Surface Water System included Intake and Pumping facilities on the Tampa Bypass Canal and Alafia River, Transmission Mains, Surface Water Treatment Plant and a 15 billion storage capacity off-stream reservoir. Construction of the Reservoir will be completed in 2004, and operation will begin in 2005. Funding Agreements are required to be developed and approved by the District for eligible project costs.
Location: Watershed
Participants: SWFWMD/Tampa Bay Water/Hillsborough, Pasco and Pinellas Counties
Implementation Schedule: 5/1/1998-10/1/2007
How Financed: SWFWMD/Tampa Bay Water/Hillsborough, Pasco and Pinellas Counties

Project Name: Hillsborough County South Central ASR Test Well
Project Description: This project is located within the Southern Water Use Caution Area (SWUCA). The county is requesting funding to design, construct, and cycle test a 1.25 MG test well, associated monitor wells, and inter-connecting pipelines to the existing reclaimed water system. This project will demonstrate the viability of Aquifer Storage & Recovery (ASR) to maximize the beneficial use of reclaimed water as a cost effective means of storing excess reclaimed water during wet weather conditions for later recovery and reuse. An ASR feasibility study has been completed showing the Big Bend area to be feasible for ASR implementation. The County has applied for a FDEP Class V, Group 3 permit and is anticipating starting the well construction process immediately following permit issuance in late 2000. Cycle testing and final report preparation are expected to be completed in 2002. If successful, this will be the first of a series of 7 ASR wells to be constructed in South/Central Hillsborough County. The results of the testing at this site will determine the feasibility of expanding the ASR system. Near term construction (2001) of inter-connecting pipelines will enable the County to transfer reclaimed water to and from existing facilities and customers in the Falkenburg, Valrico, and South County reuse service areas. Initially, reclaimed water will be received in the ASR from the Falkenburg and South County AWTPs. In the future, the County may participate in a regional approach to maximize conservation and

receive additional reclaimed water from interconnects with the City of Tampa and Temple Terrace. During the wet season, the well will have a storage capacity of 125 MG at a rate of 1.25 MGD. Through future ASR expansion, the maximum water conservation benefit is expected to increase by approximately 8 MGD at build-out with the ability to store over one billion gallons.
Location: Watershed
Participants: SWFWMD
Implementation Schedule: 10/1/2000-3/1/2003
How Financed:

Project Name: Water Conservation Initiative
Project Description: The Water Conservation Initiative, guided by the Water Conservation Strategic Plan, includes the overall goal of increasing conservation activities at the District and local levels. Staff was directed to work on the Initiative by the Governing Board at their May 2000 meeting, with direction from the Governing Board Planning Committee. The Strategic Plan outlines tasks for accomplishing several goals: (1) provide the necessary resources to raise the awareness of water conservation; (2) identify user groups and develop appropriate conservation education vehicles; (3) engage local governments and user groups in a District-wide conservation information exchange program; (4) Provide local governments with the assistance required to create the necessary links between water use and land use; and (5) create incentives for water conservation implementation. An interdepartmental staff team from the Resource Conservation and Development, Planning, Communications and Community Affairs, Permits Records and Data, and Executive Departments has been assembled to achieve the outlined goals. The establishment of a Water Conservation Task Force, consisting of representative members of user groups, local governments and others, is expected to offer substantial input and provide direction toward the accomplishment of conservation objectives. The time line associated with the Plan is five years, however, specific tasks have been identified over the first year. Listed funds reflect tasks associated with a conservation summit, task force meetings, and a formal survey to benchmark the project's progress. Additional funds approved by the Governing Board include $195,000 for the computer hardware and software for the development of a virtual resource library.
Location: Watershed
Participants: SWFWMD
Implementation Schedule: 5/25/2000-12/31/2005
How Financed: SWFWMD

Project Name: Hillsborough County Ultra-Low-Volume (ULV) Toilet Rebate - Phase VIII
Project Description: Hillsborough County will encourage the early replacement of inefficient toilets with efficient ultra-low-volume toilets through the use of rebates. The county will rebates for an estimated 7,765 toilets at 5,475 residential and commercial

properties, resulting in daily water savings of 180,000. The county will hire a contractor to administer the project. Rebate amounts are a maximum of $125 for the first toilet, $65 for the second, and $40 for the third, for single-family, and a maximum flat rate of $100 for multi-family. Low volume showerheads and faucet aerators will also be offered to participants.
Location: Watershed
Participants: SWFWMD/Hillsborough County
Implementation Schedule: 10/1/2000-5/1/2002
How Financed: Hillsborough County

ISSUE 4 - Tampa Bay Water is Proposing Water Withdrawing from the Alafia River.

Strategy:

Insure that activities which withdraw water from the Alafia River do not cause unacceptable environmental impacts.

Actions:

1. Identify target minimum flows for maintenance of a low salinity habitat in the lower Alafia River.

2. The Tampa Bay Surface Water Improvement and Management (SWIM) Plan addresses the restoration and protection of low-salinity habitats. The long-term survival of these habitats requires adequate supplies of freshwater with appropriate seasonal timing, magnitude, and quality. To the extent that the quantity, quality, or timing of freshwater inflows to these systems are altered as a result of water supply operations, negative impacts to a habitat may occur. As a result, economically and ecologically valuable fish and wildlife populations could be negatively impacted.

3. Set minimum wet weather and dry weather flows for the Alafia River.

Projects:

Project Name: The Alafia River Project Water Use Permit Application No. 2011794.00 was issued in July 1999.
Project Name: Alafia River Project
Location (drainage basin): Alafia River
Participants: Tampa Bay Water, SWFWMD
Implementation Schedule: On-going
How Financed: Tampa Bay Water, SWFWMD

Project Description: The Alafia River Project Water Use Permit will provide additional new water supply quantities for Tampa Bay Water's Interconnected Regional Water Supply System. The allocation of the water use quantities for replacement and rotation purposes is pursuant to the Northern Tampa Bay New Water Supply and Ground Water Withdrawal Reduction Agreement (Partnership Agreement) effective May 27, 1998.

ISSUE 5 - Water Level Declines and Water Quality Degradation Associated with Ground-water Withdrawals.

The water resource concerns associated with the SWUCA involve the decline of lake levels along the Highlands Ridge and advancing saltwater intrusion in coastal regions. Data show the potentiometric surface in the Floridan Aquifer has declined significantly during the past 40 years. Information provided by the United States Geologic Survey (USGS) reveals seasonal declines as great as 50 feet in 1989. Water quality monitoring shows increasing trends for sulfates, total dissolved solids and chlorides across the coastal counties. Many lake levels in the Highlands Ridge area have also declined significantly, in some cases as much as 20 feet.

Strategy:

Carefully refine the issues to be addressed, including the development and implementation of a resource management program which protects water and related natural resources while maximizing water supply; identify regulatory and non-regulatory alternatives for cooperative management; evaluate and modifying the minimum aquifer level as needed; form a work group of affected parties to assure full involvement; develop the prevention / recovery strategy for the area; coordinate with other water districts, DEP, the Department of Agriculture and Consumer Services (DACS), Charlotte Harbor NEP and others; and maintain ongoing communication with the District's Governing and Basin boards, advisory committees and other appropriate parties.

Actions:

In the short term, the District will:

1. Continue to use existing water use permitting rules for the Water Caution Areas.

2. Develop and adopt a "Competing Applications Rule" based on the public interest.

3. Develop a revised SWUCA Rule as part of an overall management strategy.

4. Continue forward with water supply planning efforts such as the "District-wide assessment" and a subsequent "Regional Water Supply Plan" for the SWUCA.

5. Establish an outreach program to re-engage the affected and interested public.

In the longer term:

6. Continue and refine the above approaches, including: implementation of the revised SWUCA Rule and associated minimum levels.

7. Use of the Competing Applications Rule as needed.

8. Continuous improvement of the detailed monitoring system.

9. A commitment to develop alternative water supply sources.

Projects:

Project Name: FL Power Corp. - Hines Energy Complex Recharge/Recovery Proj.
Project Description: This contract is a cooperative funding agreement between the Florida Power Corporation and the District. The project objective is to design, construct and test a recharge/recovery well system. An on-site cooling pond will be used as the source of water to be injected in the well. Water in the cooling pond is derived from the on-site capture of storm water and reclaimed waste water from the City of Bartow. Prior to injection, the water will be treated to potable standards, using a wetlands treatment , a wetlands water quality treatment system, and a sand filtration system. The total cost of the project will be $525,000. The District agrees to fund fifty percent of the project costs up to a maximum cumulative total of $262,500 and shall have no obligation to pay any costs beyond this maximum amount. The contract period shall be effective upon execution by all parties and shall remain in effect until December 31, 2001.
Location: Watershed
Participants: SWFWMD/Florida Power Corporation
Implementation Schedule: 11/18/1997-12/31/2001
How Financed: SWFWMD/Florida Power Corporation

ISSUE 6 - Improved Coordination of Land and Water Use Planning.

There is no clear linkage between the planning and implementation programs of the District and the land use planning decisions of local governments (SWFWMD, 1995). The District is the agency charged with primary responsibility for water management decisions within its region and is a centralized source for water related research and information. Local governments exercise primary authority over land use through long-range (20-year) local government comprehensive plans. Existing statutes relating to land and water planning and management create two separate tracks with minimal connection and no requirements for consistency between them. Integration between land and water use planning and management processes are essential to either being

effective in accomplishing its objectives. This issue was the subject of the Governor's Task Force on Land and Water Planning.

Strategy:

Work to have water supply as a consistency requirement for local government comprehensive plans. Improve coordination between land and water planners.

Actions:

1. Use the District's Needs and Sources report as the source document for water supply availability. Ensure District lobbyists make consistency a part of our 2001 legislative agenda. Develop a linkage mechanism between local governments.

2. Increase District involvement with the Regional Planning Council and local government planning departments. Develop an annual report summarizing the status of water supply, water resources, and new regulations for distribution to local land use planners and others. Develop a Memorandum of Understanding between the District and local governments which provides that local governments will give advance notice to the District when DRIs and large Comprehensive Plan amendments are proposed. Coordinate five-year planning documents, such as Comprehensive Plan Updates and Basin Plans, on the same time frame.

ISSUE 7 - Agricultural Irrigation Runoff to Streams.

Previous studies have shown that certain streams in the Alafia River basin receive flow from agricultural irrigation. Stream flow records in the Alafia River should be evaluated to determine if excess agricultural irrigation waters continue to supplement dry season flows in the river and its tributaries. Periodic flow measurements should be done on unmonitored tributaries that have been previously studied. Flow measurements at all sites should be compared to water chemistry data to evaluate to what extent that deep ground waters from irrigation are entering the streams. In areas where flow supplementation is occurring, best management practices identified in the District's agricultural exemption program should be implemented. For those agricultural operations which may be exempt, implementation of these programs should be encouraged.

Strategy:

Re-evaluate the extent that agricultural irrigation waters are flowing to streams in the Alafia River watershed. If flow supplementation is occurring, identify problem areas and implement best management practices to minimize irrigation runoff.

Actions:

1. A series of stream flow measurements should be made on tributaries and the main stem of the Alafia River in the dry season to determine if base flow is being supplemented by agricultural irrigation water. Water chemistry measurements should also be made to determine if the mineral composition of the water is characteristic of surface or ground water.

2. A geographic analysis should be done to identify sub-basins where land use may be resulting in flow supplementation.

3. In areas where flow supplementation is occurring, best management practices identified in the District's agricultural exemption program should be implemented where applicable. Implementation of these programs should be encouraged for those agricultural operations which may be exempt.

ISSUE 8 - Review Stream Flow Management Criteria for Phosphate Mining Reclamation Plans.

Approximately 171 square miles in the eastern portions of the Alafia River watershed are mined or will be mined for phosphate ore. This area includes only acreage of lands owned or controlled by mining companies proposed for future mining with a development of regional impact approved. Additional lands are owned or controlled by mining companies. Existing state reclamation criteria emphasize maintenance of pre-mining flooding criteria, but make no mention of maintaining base flow or average rates of runoff in the affected streams. In newly proposed mining in other watersheds that is being permitted using the net ecosystem benefit process, the industry has been willing to consider improved methods and practices to minimize impacts to the resource. Although the mines in the Alafia River watershed have already gone through initial permitting, resource managers should interact with the phosphate industry to identify improved analyses that can be conducted to determine if stream flow will be significantly altered in the mined sub-basins.

Strategies:

1. The sufficiency of existing regulations for phosphate mine reclamation should be reviewed to determine if they protect important stream flow characteristics such as base flow and average basin runoff.

2. If necessary, develop improved technical methods to evaluate the effect of mine reclamation on stream flow.

3. Reclamation plans should be designed so that historic flow regimes in tributary sub-basins are maintained to the greatest extent practical.

4. Using such analyses, reclamation plans should be designed so that the entire flow regime of the affected streams is altered as little as possible.

Actions:

1. Determine technical tools that can be used to evaluate the impact of phosphate mining and reclamation on streams in the Alafia River basin.

2. Determine if the industry is willing to pursue improved analyses to achieve a net ecosystem benefit that will exceed current state permitting criteria.

3. Employ improved hydrologic analyses to design reclamation plans that protect the entire flow regime of tributaries in sub-basins to be mined.

ISSUE 9 - Minimum Flows for the Alafia River.

The District is scheduled to establish minimum flows for the Alafia River in the Fall of 2001. Minimum flows are defined in the Florida Administrative Code as "the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area." In evaluating minimum flows, the District will evaluate the needs of natural communities associated with the Alafia River and reductions in the flow regime of the river that will not cause significant harm to the resources of the river.

Strategy:

Adopt minimum flows for the Alafia River to establish limits to withdrawals that will not cause significant harm to the water resources or ecology of the area.

Actions:

1. Collect and evaluate hydrologic and ecological information necessary to establish minimum flows for the Alafia River.

2. Adopt minimum flows for the Alafia River.

Projects:

Project Name: Minimum Flows / Estuarine
Project Description: Chapter 373.042 requires that a minimum flow for a watercourse be established that shall be the limit at which further withdrawals would be significantly

harmful to the water resources or ecology of the area. Minimum flows may involve streamflow to either freshwater or estuarine resources. An understanding of the physical, hydrologic, and ecological characteristics of these resources is necessary to establish technically defensible minimum flows. While much of the necessary data can be collected and analyzed by in-house staff, manpower and time limitations and the specialized expertise required for some analyses dictates that some work must be consulted out. Therefore, $100,000 is budgeted for consultant services to conduct hydrologic and other technical analyses to support the District's establishment of minimum flows. Funds will be combined with $30,000 from Project P248 to fund a consultant contract with a not to exceed limit of $130,000

Location: Watershed
Participants: SWFWMD
Implementation Schedule: Fall of 2001
How Financed:

CHAPTER IV - FLOOD PROTECTION

Approaches to flood protection/flood management must recognize flooding as a natural occurrence in the hydrologic cycle. The natural systems of the Alafia River's watershed continue to be formed by their interaction with this process. Flood-prone lands serve several valuable functions. They provide temporary natural storage of runoff from uplands and overflow from water bodies. This helps regulate the timing, velocities, and levels of flood discharges while recharging groundwater resources. They also help maintain water quality and provide habitat for fish and wildlife. Flood-prone lands include not only wetlands but also the less frequently flooded lands which make up the floodplain, areas of the watershed subject to over bank flooding at least once every 100 years. Both are important in flood mitigation providing storage for these necessary periodic inundations. An average 5-acre stand of cypress can store 6.3 acre-feet of water (274428 cf or 2,052,721 gal.).

One of the primary concerns in watershed management is to understand the functions of the floodplain and to provide safeguards, not only from damages when flooding occurs, but also for the natural systems and habitats. Effective management plans must recognize the importance of lessening the damage potential to life and property by the restoration of the natural resources and function of the floodplains. The District's watershed management goal for flood protection is "To minimize the potential for damage from floods by protecting and restoring the natural water storage and conveyance functions of the flood prone areas. The District shall give preference wherever possible to non-structural surface water management methods."

Flooding in the Alafia watershed can result from excessive runoff from large storm events, and from tidal surge affects along coastal areas during hurricanes and tropical storms. It is interesting to note that storm events that produce flooding in one part of the watershed may not produce flooding in other areas within the basin. Thus flooding is understood to be a function of rainfall pattern and intensity, tailwater levels including tidal surges, and the attributes and capacity of the conveyance system.

The Alafia River becomes a broad estuary at its mouth, and high tide levels can extend far upstream. The lower portion of the watershed includes a considerable amount of urban development. Heavy rainfall accompanying hurricanes in the lower portions of the basin can exacerbate tidal flooding, especially in areas where secondary drainage systems are poorly developed. In contrast, floodplains in the upper reaches of the river tend to be narrower with well defined, only slightly meandering channels. These areas experience flooding as a result of flows that exceed the capacity of the main portion of the channel, and flood over the channel banks, or because of restrictions placed within the channel, such as roads and culvert crossings.

District funded flood protection efforts within the Alafia River watershed include the District's land acquisition, cooperative funding, and aquatic weed control programs; and the District's operation and maintenance of regional flood control structures. In addition, the District works with local governments and other entities to integrate water resource planning with land use planning. The District also supports information development and distribution through activities such as the District's Geographic Information System and the preparation of aerial topographic maps.

Past storm events have illustrated the system's response to major rainfall events, and the area's susceptibility to flood damage when preventative measures are not pursued. Many storms events within the Alafia River watershed have produced severe flooding and associated structural damage. A brief summary of seven such storm events is presented below to provide a historical perspective. In some of these cases, tidal surges caused much of the damage near the coast. For events when river flows were also high, a combination of a tidal surge stacking water at the mouth, and high river flows exiting the system combined to cause flooding.

Overview of Historic Storm Events:

September 25, 1848

This hurricane struck the vicinity of Tampa Bay. At Fort Brooke, the military base in Tampa, the tides were estimated at 14 feet. The high winds and tides destroyed all the wharves and most of the buildings at the post. A second hurricane on October 12 struck the same area and created tides of 9 feet.

October 21 - 31, 1921

This storm began in the Western Caribbean Sea and made landfall north of the City of Tarpon Springs. Flooding conditions were protracted due to the slow movement of the storm. Substantial damage was sustained within Hillsborough County as a result of the 9.6 foot tidal surge and 75 mph winds.

September 4, 1933

This hurricane started in the Atlantic Ocean and crossed central Florida in a northwesterly direction causing heavy damage to the citrus and transportation industries. In Tampa, the TECO dam failed releasing stored water which destroyed bridges and overflowed the banks of the Hillsborough River. This 50-year event kept the area flooded for 5 weeks. At Lithia, the flood stage reached an elevation of 35.5 feet above mean sea level, (M.S.L.), with a discharge of 45,900 cfs making it the largest flood event on record.

September 1 - 7, 1950

This was a compact, but severe, hurricane that originated in the western Caribbean Sea, passed northward over Aruba and the Gulf of Mexico, then

moved north and parallel to the Florida coastline. Intense rainfall accompanied surges estimated between 6 and 8 feet along the central gulf coast. These were the highest tides recorded since the 1921 event.

September 10 - 11, 1960

Precipitation from Hurricane Donna totaling 13.96 inches fell within a two day period over an area that was already saturated. The area had received ten inches of rainfall in the three weeks prior to the hurricane. This prior rainfall had already reduced the amount of storage available in ponds, depressional areas and in the soil. As a result, the area experienced massive flooding from the additional hurricane precipitation. Data from this event was used to check theoretical profile computations. The peak discharge at the gaging station at Lithia was 20,300 cfs. The river reached a stage of 30.98 feet above M.S.L. Total damage was estimated at more than 1 million dollars. Additional information can be found in *Flood Profiles of the Alafia River, West-Central Florida*, prepared by the USGS (WRI 77-74) in cooperation with the Southwest Florida Water Management District.

June 19, 1972

Hurricane Agnes formed on the northeastern tip of the Yucatan Peninsula. Although the center of the storm passed about 150 miles west of the Florida peninsula, it still produced a high, damaging tidal surge due to its massive size. Tides at Tampa were approximately 5.6 feet. The high tide, wave action, and an accompanying tornado caused damage to homes, seawalls, and roads.

September, 1988

A stalled cold front at the end of the rainy season (Labor Day) created flood conditions throughout the watershed. Within the Delaney Creek watershed, and within portions of the Alafia River watershed, this event resulted in monthly mean flows for September 1988 that exceeded the monthly mean flows for the months of September 1997 through April 1998 during the El Niño event.

December, 1997

From the month of September1997 through the month of April 1998, the El Niño phenomenon created several cyclonic waves that produced 33.25 inches of rainfall in the Alafia River Watershed. Some of these rainfall events caused significant flood damage to homes in developed areas within the watershed. In some areas, flood levels were approximately 3 to 4 feet above the predicted 100-year flood levels.

SECTION 1. LITERATURE REVIEW

A number of studies are available detailing flood elevations in the Alafia River Basin**.**

These offer information such as the size and location of the watershed area, flood profiles, and river flow rates and levels for various recurrence intervals storm events.

1-1 RIVERINE SYSTEM STUDIES

1-1.1 Archie Creek/Coastal Areas and Buckhorn Creek Watersheds: Stormwater Management Master Plan, Singhofen & Associates, Inc. (1988)

Buckhorn Creek is one of the larger tributaries to the Alafia River. The Buckhorn Creek Watershed lies north of the Alafia River, east of Providence Road and west of State Road 640 (Lithia-Pinecrest Road). The primary objective of this study is to identify existing flooding problems and present a "Preferred Stormwater Management Master Plan" to alleviate the existing problems within the watershed as well as minimize future flooding from new development. Flood elevations were developed for the 2.33 (a.k.a. mean annual), 5, 10, 25, and 100 year - 24 hour storm events. The 5,023 acre watershed was modeled using Soil Conservation Service (SCS) methodology to generate peak runoff rates, and the Explicit Channel Simulation Model ("EXPLC") to determine the peak water surface elevations.

1-1.2 Floodplain Information on Buckhorn Creek, SWFWMD, (1984)

The confluence of Buckhorn Creek with the Alafia River is located approximately 6.6 river miles upstream of the U.S. Highway 41 bridge crossing over the Alafia River. This report includes flood elevations for the 2.33, 10, 25, 50, 100, and 500 year rainfall events along Buckhorn Creek from its confluence with the Alafia River to the Forest Bridge Circle road crossing. The flood frequency elevations and profiles are based on the step-backwater method.

1-1.3 Pleasant Grove Floodway, SWFWMD, (1977)

The Pleasant Grove Reservoir is located in southeast Hillsborough County, south of State Road 60 and east of Turkey Creek Road. It serves multiple purposes in flood control, groundwater recharge, and recreation. The reservoir is built on the Little Alafia River which flows into the main stream of the Alafia River. The purpose of this study is to define the water-surface profile (i.e. water-surface elevations at the corresponding cross sections), along the Little Alafia River, between the Pleasant Grove Reservoir and the Alafia River. The water-surface profile in the channel was computed using the standard step method for gradually-varied flow analysis. The Pleasant Grove Reservoir has been renamed the Edward Medard Park and Reservoir.

1-1.4 Flood Frequency Elevations on Edward Medard Park and Reservoir and Downstream to Alafia River, SWFWMD, (1978)

The results of this study include flood frequency elevations on Edward Medard Park and Reservoir and on the downstream channel to its confluence with the Alafia River. Water surface elevations are computed for the 2.33, 10, 25, 50, 100, and 500 year rainfall events. The study also defines flood profiles in the downstream channel in case of catastrophic dike failure at the reservoir, and it also defines the floodway, or area flooded in the downstream channel when the principal spillway is discharging at design capacity.

1-1.5 Floodplain Information on the Alafia Tributaries: Bell Creek - Fishhawk Creek and the South Prong Alafia, SWFWMD, (1979)

This study defines the flood stages on Bell Creek, Fishhawk Creek and the South Prong Alafia River for the 2.33, 10, 25, 50, 100, and 500 year rainfall events. The USGS E-431 step-backwater method was used to generate the flood stage information.

1-1.6 Alafia River Corridor: Resource Evaluation (Save Our Rivers, Preservation 2000, Water Management Lands Trust Fund), SWFWMD, (1993)

This report is an evaluation to determine whether the subject lands qualify for acquisition under the SOR program or Preservation 2000. The study includes a review of the water management benefits that would be attained if the subject parcels were acquired, including information relating to surface water characteristics, flood prone areas, water supply capability, groundwater and environmental conditions, local government planning, and land use regulations.

1-1.7 Hydro-biologic Assessment of the Alafia and Little Manatee River Basins, Dames and Moore, (June 1975)

The investigation is an extensive and comprehensive assessment of the region's hydro-biologic relationships. It includes descriptions of baseline ground-water/surface-water conditions and biologic communities; an evaluation of the surface water dynamics; surface water and groundwater quality, and capacities of ground-water systems for withdrawal; and recommendations for water resource management.

1-1.8 Alafia River Watershed Management Program: Poley Creek Watershed Evaluation (K297) - Final Report, Keith and Schnars (December 2000)

In response to a cooperative funding request from Polk County, the District's Peace River Basin Board approved funding for the Alafia River Watershed Management Program - Poley Creek Drainage Improvements. This project is part of a multi-year funded, multi-phased program to evaluate and implement best management practices (BMPs) in the Alafia River Watershed.

The Poley Creek Watershed is located within Polk County and the City of Lakeland. Poley Creek extends from just east of Harden Boulevard, to the southwest where it discharges to the North Prong of the Alafia River. The main tributary of Poley Creek, Lake Drain extends from Scott Lake to Poley Creek south of Ewell Road. This watershed has experienced rapid growth, and Polk County desires to gain a better understanding of the watershed and its capacity.

The Watershed Management Program includes three major elements: Watershed Evaluation, Watershed Management Plan, and Implementation of Best Management Practices. The Watershed Evaluation has been completed, and the Watershed Management Plan for Lake Drain has received cooperative funding for FY 2001. It is anticipated that the Watershed Management Plan for the remainder of the Poley Creek system will be developed in future fiscal years.

The Watershed Management Plan for Lake Drain will build on the information developed in the Alafia River Watershed Management Program: Poley Creek Watershed Evaluation to conduct a floodplain analysis, establish Levels of Service (LOS), identify system deficiencies, and provide an alternative analysis. The plan will also address the status of water quality within the watershed and conveyance system, and will include an overview of the status of wetland systems within the watershed, particularly in the vicinity of the intermediate conveyance system. The alternative analysis will include the development of a BMP Implementation Plan for Lake Drain which will include prioritized recommendations with associated cost estimates for implementation, and a conceptual permit for the selected BMPs.

1-1.9 Delaney Creek Stormwater Management Master Plan, Ghioto, Singhofen & Associates, Inc. (April 1986)

The Delaney Creek watershed is located in Hillsborough County, primarily south of State Road 60 and north of the Alafia River. The master plan report includes floodplain information for the 5, 10, 25, 50 and 100 year storm events. Based on this modeling information, it was determined that flooding within the watershed would need to be addressed through both capital improvement projects and special regulatory requirements. The preferred plan described in the report includes capital improvements to address flood problems that existed at the time of the report, and proposed basin specific regulatory criteria. The basin specific criteria, which was adopted as part of the District's surface water regulations, was intended to provide adequate flood protection for new development without increasing flood potential in existing developed areas. The District still uses these basin specific criteria for projects proposed within the Delaney Creek watershed.

1-2 MINIMUM FLOWS AND LEVELS

The District, pursuant to Section 373.042 (2) of Florida Statutes, publishes its approved

Priority List and Schedule for the Establishment of Minimum Flows and Levels, and updates this information annually. The following surface watercourses, aquifers, and surface waters within the District were approved by the Governing Board on September 26, 2000, and by the Florida Department of Environmental Protection on December 15, 2000.

The Priority List is based on the importance of waters to the state or region, the existence of or potential for significant harm to the water resources or ecology of the state or region and includes those waters which are experiencing or may reasonably be expected to experience adverse impacts. It is the District's intention to voluntarily undertake independent scientific peer review for all waterbodies on the Priority List.

MFL Priority List and Schedule for Completion

2001
Hillsborough County Lakes (Calm, Hobbs, Starvation, Church/Echo, Crenshaw, Cypress, Fairy, Halfmoon, Helen, Ellen, Barbara, Round, Saddleback, Raleigh and Rogers)[(1)]
Pasco County Lake (Big Fish) [(1)]
Southern Water Use Caution Area (SWUCA) (Floridan Aquifer)
Upper Peace River
Tampa Bypass Canal
Sulphur Springs
Alafia River (includes Lithia and Buckhorn springs)
Polk County Lakes (Eagle, McLeod, Wales, and Clinch)
Highlands County Lakes (Lotela, Letta, and Jackson)

2002
Pasco County Lakes (Bird, Moon, Linda, Pasadena, Padgett, Parker a.k.a. Ann, Green, Bell, Clear and Hancock)
Hernando County Lakes (Hunters, Lindsey, Mountain, Neff, Spring and Weekiwachee Prairie)
Hillsborough County Lakes (Strawberry, Reinheimer, Wimauma, Platt, Mound, Allen, Harvey, Charles, Jackson, Garden, Taylor and Dan)
Middle Peace River

2003
Citrus County Lakes (Tsala Apopka and Marion)
Sumter County Lakes (Panasofkee, Big Gant, Deaton, Miona and Okahumpka)
Polk County Lake (Crooked)
Highlands County Lake (Placid)
Lower Peace River Estuary System [(2)]

2004-2005
Intermediate Aquifer (SWUCA) (where deemed technically feasible)
Upper Hillsborough River System
Weekiwachee River System
Manatee River System

2006 - 2010 [3]
Braden River System
Little Manatee River System
Middle Withlacoochee River System
Upper Withlacoochee River System (Green Swamp)
Lower Withlacoochee River System (Lake Rousseau / Rainbow Springs)
Myakka River System
Highlands / Polk Surficial Aquifer
Anclote River System
Brooker Creek
Pithlachascotee River System
Myakkahatchee Creek (Big Slough)

2011 - 2015 [3]
Crystal River System
Homosassa River System
Chassahowitzka River System

[1] Establishment to occur in the first quarter of 2001.
[2] A "River System" refers to the unique, watershed-based aspect of flowing watercourses and may include analysis of springs, tributaries, lakes, wetlands and aquifers, as appropriate.
[3] Lakes during this period will be selected at a later date based on future priorities.

Prior to the MFL program, lake flood frequency elevations were developed in conjunction with the District's Lake Levels Program. This program established sets of water level guidelines for lakes within the District, and the levels for many lakes within the Alafia River watershed were adopted under that program.

Another similar report, entitled Flood-Stage Frequency Relationships for Selected Lakes (1992), included all flood frequency elevations developed during the course of lake levels studies. These reports still provide useful information; however, when the MFL program is fully implemented, it is anticipated that a new report will be developed that will replace the Lake Levels Program reports.

1-3 COUNTY STUDIES

1-3.1 The Alafia River Study, Hillsborough County City-County Planning Commission, (May, 1988)

The study, which includes a detailed description of the watershed, is focused on identifying the consequences development has had on river-related natural resources. It also presents goals, objectives, and policies to achieve an acceptable and manageable level of future development. It breaks down the watershed into four specific areas or sectors: the Western Sector from the mouth at Tampa Bay extending 10 miles eastward to John Moore Road, the Central Sector from John Moore Road to the confluence of the North and South Prongs, and the remaining two sectors.

1-3.2 Report to the Board of County Commissioners, Hillsborough County, Florida, Attachment 2, (April 22, 1998)

In this report, the Public Works Department's Community Services Team examines the specific problems related to the heavy rainfall amounts of September, 1997 through March, 1998 (El Niño). Included are maps of the geographic locations of flooding reports received during the September and December events and the January through March event, and the locations of proposed projects intended to address these concerns. The report also includes project descriptions and estimated costs.

1-4 FLOODPLAIN STUDIES

1-4.1 Flood Insurance Study; Hillsborough County, Florida, Unincorporated Areas, FEMA, Revised: August 3, 1992

This study investigates flood hazards in unincorporated Hillsborough County and is one of the basic sets of criteria for the Federal Insurance Program administered by the Federal Insurance Administration. It contains discharge summaries, tidal surge elevations, floodway data, flood insurance zone data, and flood profiles for the Alafia River and its major tributaries.

1-4.2 Flood Profiles of the Alafia River, West-Central Florida, Computed By Step-Backwater Method, USGS, (March 1978)

This report presents theoretical flood profiles for the Alafia River, North Prong Alafia River, and South Prong Alafia River, and describes how theoretical flood peak discharges and elevations were determined and flood profiles constructed. Flood profiles were determined for floods having recurrence intervals of 2.33, 5, 10, 25, 50, 100 and 200 years. Profiles are presented for 19.2 miles of the Alafia, 9.1 miles of the North Prong, and 9.8 miles of the South Prong.

Cross sections were selected for 151 sites. The cross section geometry was determined from aerial photographic maps with contour intervals of 1 foot. The channel-bottom elevations were determined from sounding the streambed.

1-5 WATERSHED MANAGEMENT PLANS

1-5.1 Alafia River Watershed Management Plan, Hillsborough County (anticipated completion date 2002)

Hillsborough County has been proactive in its approached to addressing flooding within its jurisdictional limits. The Hillsborough County Commission budgeted funding for the development of Watershed Management Plans for all of the major intermediate and regional conveyance systems within Hillsborough County. The Hillsborough County Water Resources Management Master Planning Team has developed a schedule for the completion of the Surface Water Management Master Plans. The Alafia River Surface Water Management Master Plan is scheduled to be completed in Fiscal Year 2002.

The Surface Water Management Plans include an evaluation of the existing conditions within the conveyance system for storm events including the 2.33, 5, 10, 25, 50, and 100 year - 24 hour storm events. These plans also include proposed implementation projects and cost estimates. Hillsborough County has dedicated $10,000,000 for the development of these plans.

1-5.2 Hillsborough County - Bullfrog Creek/Wolf Branch Watershed Management Plan - Final Report (October 2000)

The Bullfrog Creek/Wolf Branch watershed is located within Hillsborough County between the Alafia River to the north, and the Little Manatee to the south. Bullfrog Creek drains the northern and eastern portions of the watershed and discharges into Tampa Bay, just south of the Alafia River. Wolf Branch drains the southwest portions of the watershed and discharges into Tampa Bay approximately 6 miles south of the Bullfrog Creek discharge point.

The Bullfrog Creek/Wolf Branch WMP is organized into seven elements, including Background, Flood Control, Water Quality and Natural Systems Conditions, Pollutant Loading, Alternatives Analysis, Proposed Level of Service, and Recommendations.

Chapter 4 of the report, entitled “Hydraulic/Hydrologic Model Methodology describes the modeling methods used to evaluate flood protection. The model methods used incorporate the Soil Conservation Service (SCS) methodology and the Storm Water Manager Model (SWMM), as developed by the United States Environmental Protection Agency (USEPA). Hillsborough County has modified the RUNOFF Block of the SWMM

for hydrologic modeling and the EXTRAN Block for hydraulic modeling.

The evaluation of the system included modeling for the 2.33, 5, 10, 25, 50 and 100 year - 24 hour events, from which existing and proposed flood protection levels of service were generated. The Final Report includes model input and output data, flood elevations and profiles, recommendations for system improvements, and associated cost estimates.

1-5.3 Hillsborough County - Delaney Creek Area Watershed Management Plan

The WMP includes recommendations for construction projects that will increase the flood protection LOS, and water quality within the Delaney Creek system. Recommendations are also provided regarding preferred maintenance methods and the use of BMPs to reduce pollutant loadings. The WMP includes surface water modeling using the County's modified SWIM model.

1-6 DAM BREAK ANALYSES

1-6.1 Edward Medard Park and Reservoir - Dam Break Analysis

The District is in the process of contracting with a consultant to perform a dam break analysis for the reservoir. The analysis, which is scheduled to be completed in 2001, will assume a "sunny day" condition at the time of the break. The modeling will be used to project the resulting impacts to downstream areas for use in the development of an Emergency Action Plan. In the future, the District plans to combine the dam break analysis with storm event scenarios, possibly utilizing the Hillsborough County Alafia River Surface Water Management Master Plan, to project the effects of a dam break during high flow conditions.

1-6.2 Lake Grady Dam - Dam Break Analysis

As a part of the ERP permitting review process, the consultant for this project, BCI, Inc., produced an evaluation of flood flows and levels downstream of the Lake Grady Dam in the event of a dam failure. A "worst case" scenario was modeled using assumptions of a full reservoir, and an instantaneous break within the dam face. This information was used to identify areas downstream that could be flooded in the event of a dam break, for use in the development of an emergency action plan and notification procedure.

1-6.3 Tampa Bay Regional Reservoir - Dam Break Analysis

An embankment failure analysis of the Tampa Bay Regional Reservoir is being

performed by HDR Engineering, Inc. on behalf of Tampa Bay Water. Since the reservoir is off-stream, two fair-weather breach scenarios at two separate locations along the reservoir embankments will be analyzed assuming a piping failure. One breach will be simulated at the northwest corner of the reservoir, in which Fish Hawk Creek would be the immediate receiving water. Another breach will be simulated at the southeast corner. In this case, Chito branch would convey breach outflow to the South Prong of the Alafia River.

Modeling will assume a breach formation time of one-hour and peak outflows will be calibrated to an upper envelope outflow curve of historic dam failures. The model will be calibrated to USGS gage data and USGS high water marks obtained from Hurricane Donna and as presented in the1978 USGS report titled “Flood Profiles of the Alafia River, West-Central Florida, Computed by Step-Backwater Method”. Flood wave information will include peak stage, wave arrival time and velocities throughout the South and North Prongs of the Alafia River, the main stem of the Alafia River and Fish Hawk Creek.

SECTION 2. AVAILABLE DATA

2-1 FLOOD PROTECTION WITHIN THE WATERSHED

2-1.1 The Edward Medard Park and Reservoir

The Medard Park and reservoir are located in southeast Hillsborough County, Florida, south of State Road 60 and east of Turkey Creek Road. It serves the multiple purposes of flood control, groundwater recharge, and recreation. The reservoir outlet works consist of a principal discharge structure and an emergency spillway which is located approximately 4000 feet north of the main structure. The principal discharge structure is a fixed crest drop inlet spillway with lower control gates for environmental regulation and drainage. The weir is set at elevation 60' and will serve as the principal discharge point up to elevation 66.2' where the emergency spillway will be crested.

The reservoir discharges into the Little Alafia River which joins the Alafia River about two miles downstream. The first 3000 feet of the stream has been channelized but the remainder is natural. Land adjacent to the downstream channel is mostly pasture and woodlands with some houses and lawns. Homes within this area may experience some flooding problems during the periods of maximum discharge from the primary structure.

2-1.2 Lake Grady Dam

Lake Grady Dam is located approximately two miles upstream of the Alafia River on Bell Creek. It was constructed in the late 1960's, as an in-stream earthen embankment, by private development concerns in an attempt to create lakefront property. It is now

owned and maintained by a division of the homeowner's association, the Lake Grady Road and Bridge District of Hillsborough County, Florida.

Over the decades, the dam deteriorated and became unstable. Due to structural problems, the lake was drained in 1983. The dam was refurbished, and the outfall structure was changed to a concrete weir structure in 1986. However, in 1987, the structure was again experiencing serious seepage problems, including material loss. To avoid a dam failure, the District required the structure gate to be opened in 1988 to drain the lake. In addition, Hillsborough County closed that portion of Shadow Run Boulevard located on top of the dam to protect public health and safety.

The gate remained open until the dam and outfall system were modified in the late 1990's, and the road has been removed. The dam and outfall structure modifications were designed by Bromwell and Carrier, Inc., (BCI). The improvements included the installation of a bentonite slurry wall within the dam; the installation of two additional box culverts, bringing the total number of box culverts exiting the outfall system into Bell Creek to four; and modifications to the concrete weir outfall structure. These modifications are intended to protect the dam from damage due to seepage, and to allow the outfall structure to adequately control the discharge resulting from a 500 year - 24 hour storm event without dam overtopping.

In 2000, after the dam had been put back into service, and the reservoir had been allowed to fill, a sink hole opened in the southern end of the reservoir. Water quality problems were experienced in area wells, and emergency measures had to be implemented to provide drinking water to area residents. The lake level was reduced to allow the sink hole to be located. It was determined that the sink hole was the avenue by which the reservoir's lesser quality water was entering the area water supply. The sink hole was plugged, and the water quality in the affected wells recovered to meet drinking water standards.

2-1.3 Tampa Bay Regional Reservoir

Located near the Picnic area in southeastern Hillsborough County, the proposed Tampa Bay Regional Reservoir is one of TBW's Master Water Plan projects located within the Alafia River CWM boundary. The reservoir is an element of the Enhanced Surface Water System proposed by TBW that will link water withdrawals from the Alafia River, Hillsborough River and Tampa By-Pass Canal through the South-Central Hillsborough Intertie pipe system to the Tampa Bay Regional Water Treatment Plant. The reservoir will provide storage for water diverted from the surface water sources during periods of high flow, for use as potable water. The reservoir will be constructed as an earthen embankment with an average height of 45 feet, an average water depth of 40 feet, and a storage capacity of approximately 15 billion gallons, (48,000 acre-feet). Since this will not be an in-stream reservoir, water can only enter by pumping, or as direct rainfall into the reservoir.

2-1.4 The Mouth of the Alafia River

The mouth of the Alafia River is an area of mangroves, natural vegetation, and tidal marsh which serve to dissipate wave energy. Concrete and metal seawalls/bulkheads line portions of the Alafia shoreline. These types of features are expected to remain intact through a 100-year event, and be effective wave dissipaters if of sufficient height.

2-1.5 Flow Measuring Stations Within the Watershed

The United States Geological Survey (USGS) and District maintain several stage and flow measuring gages within the watershed. Periods of record and frequency of measurement vary among the stations. Elsewhere within the watershed, the District measures stages on lakes with adopted levels and structures. The following Figures provide the names and locations of the gaging stations (GS) along with peak discharge rates for various frequency events at specific gage stations and other specified locations within the riverine system.

Table 4-1. Gaging Stations within the Alafia, Delaney Creek and Bullfrog Creek Basins.

USGS Gage Station Number	Location of Stream or Lake	S-T-R	Latitude/ Longitude	Period of Record (years)	Maximum Dis-charge or Stage	Minimum Dis-charge or Stage*
02301000	N. Prong	10-30-22	27°52'00"N 82°06'00"W	51	9570 cfs 54.56 ft.	3.9 cfs
02301300	S. Prong near Lithia	9-29-22	27°48'00"N 82°07'04"W	33	2600 cfs 57.93 ft.	1.2 cfs

02301500	Alafia	16-30-21	27°52'30"N 82°13'00"W	69	45,900 cfs 38.36 ft.	4.1 cfs
02301600	Lithia Sprgs.	17-30-21	27°52'00"N 82°13'50"W	54	79 cfs	6.2 cfs
02301638	Alafia at Bell Shoals	23-30-20	27°51'30"N 82°16'26"W	3	11.4 ft.	-0.76 ft.
02300900	Scott Lake	17-29-24	27°57'44"N 81°56'00"W	48	169.19 ft.	159.29 ft.
02300700	Bullfrog Creek	12-31-19	27°47'30"N 82°21'08"W	41	5200 cfs 30.64 ft.	0 cfs
02301750	Delaney Creek	25-29-19	27°53'32"N 82°21'08"W	17	633 cfs 20.71 ft.	0 cfs
N/A	Medard Reservoir	36-29-21	27°55'00"N 82°10'08"W	33	63.52 ft.	43.45 ft.

* daily mean discharge
Stages have been converted to NGVD of 1929.
Sources: USGS Water Resources Data Florida water Year 2000, USGS, April, 1999; SWFWMD database.

Table 4-2. Summary of FEMA Peak Discharge Rates at Selected Locations.

Flooding Location	Drainage area (sq. mi.)	Peak Discharge Rate (cfs)			
		10-year	50-year	100-year	500-year
Alafia River at Lithia GS	335	8,740	16,600	20,900	33,800
N. Prong/Alafia at Keysville GS	135	4,140	7,320	9,890	13,500
S. Prong/Alafia near Lithia GS	107	4,180	7,852	9,800	15,200

Buckhorn Creek at cnfl. w/Alafia	7.8	777	1,374	1,661	2,411
Buckhorn Creek at Kings Ave.	5.6	366	669	823	1287
Tribu. Canal at cnfl. w/ Buckhorn Crk.	1.5	167	309	381	594
Rice Creek at cnfl. w/Alafia	5	686	1,200	1,430	2,140
Delaney Creek at mouth	10.69	1,390	2,350	2,850	4,210
Bullfrog Creek at mouth	40	3,570	6,110	7,420	11,100

Source: Flood Insurance Study; Hillsborough County, Florida, Unincorporated Areas, FEMA, Revised: August 3, 1992.

2-1.6 Land Use Within FEMA's 100-Year Floodplain

The District's GIS system contains current and future land use designations, based on 1995 data and the Comprehensive Plans for each of the counties within the watershed, and delineations of Federal Emergency Management Agency's (FEMA) 100-year floodplain boundaries. An overlay of land use information with the floodplain boundaries will provide an indication of current, and potential future development within the 100-year floodplain. It should be noted that the floodplain boundaries currently described by the FEMA information may change in the future, as a result of more detailed information and studies, or as a result of anthropogenic impacts to flow rates and levels within the basin.

SECTION 3. REGULATORY AUTHORITY AND SPECIAL RULES

3-1 STATE/DISTRICT REGULATIONS

State Water Policy (Chapter 62-40, Florida Administrative Code), and the State Comprehensive Plan (Chapter 187, F.S.) provide that nonstructural solutions to flood control shall take precedence over structural solutions. This approach implies retention of natural areas for flood attenuation. It, also, provides for funding of stormwater

master plans, encourages development away from floodplains through local

government planning assistance, land acquisition, and maintenance.

The Local Government Comprehensive Planning and Land Development Regulation Act (LGCPLDRA) requires local governments to prepare and adopt comprehensive plans that address specific public services. It requires these governments to protect potable water wellfields and environmentally sensitive lands, regulate flood-prone areas, and provide drainage and stormwater management.

Chapter 40D-4's Basis of Review specifies that post-development peak discharge rates for new development not exceed pre-development peak discharge rates for the 25 year - 24 hour event. In closed watersheds, i.e., those that do not have a surface outfall up to and including the 100 year - 24 hour event, post-development discharge volumes must not exceed pre-development discharge volumes for the 100 year event.

In addition to regulating discharge, the District also restricts floodplain encroachment. District regulations require compensating storage be provided for fill placed within the 100-year floodplain. Rules also stipulate that activities affecting floodplains and floodways will not cause adverse impacts, i.e., increased flooding.

3-2 COUNTY REGULATIONS

The Alafia watershed is within the jurisdiction of two counties, and both have standards governing the release of runoff. Hillsborough County requires that post-development peak discharge rates for the 25 year - 24 hour event not exceed pre-development discharge rates for the 10 year - 24 hour event for new developments. This regulation applies, county-wide, to all open watersheds including the Alafia River basin. Polk County specifies that federal, state, and local regulations shall be met. In certain areas, development reviewers may recommend that post-development volumes as well as peak discharge rates not exceed pre-development volumes and rates for the 25 year, or the 100 year - 24 hour event; however, these recommendations are not binding on the developer.

3-3 CITY REGULATIONS

Similarly, cities, wholly or partially within the watershed, have standards governing the release of runoff. Plant City specifies that future development will maintain pre-development runoff rates as required by SWFWMD.

3-4 ARMY CORPS OF ENGINEERS (ACOE) REGULATIONS

Typically the ACOE regulates dredge and fill within what is considered CORP projects. That includes most if not all navigable waterways. In addition, the ACOE has jurisdiction over certain wetlands, and they regulate the construction of dams and levees within “Waters of the U.S.”

3-5 FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP) REGULATIONS

The FDEP is responsible for the regulation of surface water impacts associated with mining, for all mining activities other than borrow pits. This includes all phosphate mining activities. To avoid any conflict of interest, FDEP also serves as a permitting agency for projects implemented by the District.

Phosphate mining affects a large portion of the upper reaches of the Alafia. FDEP regulations require that areas affected by phosphate mining and related activities must be reclaimed in a fashion that restores hydrologic functions that are significantly similar to the pre-disturbance condition. This is evaluated through the comparison of surface water modeling for both the pre and post disturbance conditions. Further information regarding FDEP reclamation requirements can be obtained from the FDEP - Bureau of Mine Reclamation.

SECTION 4. GOVERNMENT AND OTHER WATERSHED ACTIVITIES

In addition to administering water quantity and floodplain regulations, governmental entities also aid in flood protection through other activities such as data collection, which includes cataloging flooding complaints. Other activities that affect flood protection include land acquisition programs, land use regulation, and emergency management.

4-1 FLOOD COMPLAINTS/RECORDS

Both counties which comprise the Alafia River watershed have a system for tracking flooding complaints. Hillsborough County keeps a record of yard, street and home flooding, indexed by section, township and range. The record also includes actions taken or proposed with regard to the reported flooding.

In their *Report to the Board of County Commissioners, Hillsborough County, Florida, Attachment 2,* (April 22, 1998), the Hillsborough County Public Works Department's Community Services Team examined specific problems related to the El Niño event that deposited heavy rainfall amounts from September, 1997 through March, 1998. The team mapped the geographical location of flooding reports and complaints received by the County during this period, and identified project locations and cost estimates for proposed flood protection improvements.

The District also records flood complaint information by section, township and range, and the specific location of the flooding occurrence is plotted on the District's GIS system. Complaints are assessed to determine if there is a violation of District rules, and if so, actions are taken to correct the situation. Flooding complaints that are not related to a violation of District rules are recorded in the GIS system, and are usually

referred to the appropriate County Department for further investigation. Local municipalities, the FDOT, and long time residents are also good sources of flooding information.

4-2 LAND ACQUISITION PROGRAMS

Several agencies have land-buying programs that operate or may operate within the watershed. These programs include the Department of Environmental Protection's Conservation and Recreational Lands (CARL) program, the District's Save Our Rivers (SOR) program and Hillsborough County's Environmental Lands Acquisition and Preservation Program (ELAPP). Polk County also instituted a land acquisition program at the end of 1994.

Usually, these programs emphasize preservation of natural systems and the enhancement/preservation of water quality. However, since the lands purchased often include flood-prone wetland areas, acquisition also serves to prevent development in these natural flood storage areas.

4-3 LAND USE REGULATION

Each of the counties and municipalities in the watershed regulates land use within their boundaries in accordance with a State-approved comprehensive plan. These plans specify the type and amount of development allowed in any given area. As a result, the plans influence where and to what extent development will be allowed in floodplains. To participate in the National Flood Insurance Program, FEMA requires local governments to adopt floodplain management ordinances meeting FEMA's specifications. All counties and municipalities within the Alafia River watershed participate in this program.

4-4 EMERGENCY MANAGEMENT

Flooding requires actions such as evacuation planning and implementation, operation of evacuation shelters and delivery of food and water, rescue operations, medical mobilization, flood control system operations, damage control and assessment, flood insurance compensation, delivery of federal aid, and repairs or replacement of damaged/destroyed infrastructure and buildings. Properly targeted building codes and land use regulations can help to minimize the need for these activities.

Many agencies and organizations are involved in emergency management and flood protection. On the Federal level they include the Federal Emergency Management Agency (FEMA), the Army Corp of Engineers (USACOE), and the National Weather Service, (NWS). State agencies are the Florida Department of Consumer Affairs (DCA) - Division of Emergency Management, the Southwest Florida Water Management District (SWFWMD) and their counterparts throughout the state, and various Regional Planning Councils. Others involved parties include local governments and the Red

Cross.

There are three general situations that drive agency activities and responses; pre-disaster, disaster event, and post-disaster. Coordination with federal and state agencies prior to, during and after disaster events, and also during non-disaster periods, is an important component of the District's Flood Protection Area of Responsibility (AOR). These coordination efforts may depend on the specific program requirements of the Federal and State agencies.

Depending on the specific circumstances, some flood protection efforts and projects can be acted upon with an immediate response (short-term projects), while other projects may require standard design and permitting (mid-term), or extensive data collection, evaluation, and a lengthy implementation program (long-term). Immediate emergency measures usually target a specific condition that is putting public health and safety or property in imminent danger. The primary focus of the mid and long-term programs is on hazard mitigation to break the cycle of recurring damages.

SECTION 5. FLOOD PROTECTION ISSUES

As previously stated, the District's water management goal for flood protection is, "To minimize the potential for damage from floods by protecting and restoring the natural water storage, and conveyance functions of the flood prone areas. The District shall give preference wherever possible to non-structural surface water management methods." Water level fluctuation and periodic flooding of dry land occurs as a response to the dynamics of the hydrologic cycle. Flood protection is a complicated issue, and as a result, a holistic approach is necessary. Natural system preservation, water supply, water quality, and flood protection considerations must be integrated in order to construct a comprehensive watershed management system. Therefore, more detailed information and sophisticated computer models are required to allow policy makers to make good management decisions. The purpose of this section is to identify the flooding related issues within the Alafia watershed, and to propose strategies that can be developed and effectively implemented to address these issues.

5-1 ACTION PLAN: FLOOD PROTECTION

Below are flood protection issues, goals and actions identified by the Alafia Watershed Land and Water Linkage Task Force that fall under the water management responsibilities of the District:

<u>Task Force Issues</u>:

- Building too close to floodplains and in wetlands restricts floodway flows.
- Alterations to floodplains that avoid agency scrutiny and approvals, or in a

subsequent phase long after initial approvals.

Task Force Goals:

- To create more natural wetlands to replace ones that no longer exist due to developments.
- To better monitor Alafia River basin development.
- To preclude development in areas that are providing natural flood storage capacity on a regional basis that covers the entire Alafia River basin.
- To include proper maintenance of ditches, culverts and retention ponds in the management of existing and future drainage system improvements.
- To determine causes of flooding within the Alafia River basin through completion of studies by the SWFWMD, state, and Hillsborough County.
- To identify and address causes of unnatural flooding on the Alafia River and maintain regular flooding at pre-development "normal" flood levels (13.5 feet).
- To reassess stormwater design standards employed by Hillsborough County and SWFWMD and inform the public as to the implications of changing these standards relative to both flood control and the cost of development.
- To employ best management practices in urban and rural areas to improve water quality and reduce runoff.

Task Force Actions:

- Proper analysis of growth as well as corrective action for problem flooding areas.
- To stop flooding of the road, yards and under the houses.
- Natural reservoirs - rivers, culverts, ditches, street flooding.
- To control water runoff in their own developments. More natural wetlands.

Below are flood protection issues, goals and actions identified by the Alafia River CWM Team:

ISSUE 1 - Data Collection.

Topographic information is needed for the development of input data for hydrologic and

hydraulic modeling, and flood plain mapping. There area sections within the Alafia River watershed that have not been mapped, or have outdated mapping information. Other data collection efforts for modeling and calibration purposes should include acquiring hourly rainfall data and spatial distributions, along with flow rates and levels.

Actions:

1. Identify areas where rainfall and flow data are needed.

2. Install monitoring equipment.

3. Collect, process and appropriately distribute collected data.

4. Propose a project to identify areas where gage information is needed to confirm the modeling being developed by Hillsborough County for all of their watersheds, and install the monitoring equipment. This project would also involve the monitoring and maintenance of the monitoring equipment, the collection and reporting of the data, and the distribution of the collected data.

Strategy:

Perform aerial topographic mapping.

Actions:

1. Identify areas that have not been mapped, or that have outdated aerial topographic mapping information.

2. Perform aerial mapping with contour information (paper and digital formats) for the areas identified in Action #1.

2. Propose a project or projects to identify areas within Hillsborough and Polk Counties where topographic aerial mapping is either not available, or is outdated, and perform the aerial mapping. Costs are estimated to range from $7,000 to $9,000 per square mile, depending on the amount of urbanization within the area.

Projects:

Project Name: Hillsborough County & Tampa - One Foot Contour Aerial Mapping
Project Description: This project, which is part of the on-going cooperative effort between the Board and Hillsborough County, serves as part of the Stormwater Management Program. The 1 foot contour mapping from aerial photography project will help to determine the effects of developments in the area upon the natural drainage of

the area. Also, the 1929 Vertical Datum is being updated to NAVD88, changing elevations by approximately 1 foot. New survey marks will be set and new contours will assure accuracy. The measurable benefits include adding contours to the County's contour map, updating GIS System Base Map, warning citizenry of flooding dangers, assisting SWFWMD in floodplain identification and assisting Emergency Operations Centers in shelter locations in emergency planning. Other benefits would be information to decide shelter locations and water run-off patterns, which could be used to minimize water pollution which helps with the water quality priority. The project consists of acquiring aerial photography and utilizing this photography to accomplish contour mapping. Hillsborough County is proposing to acquire digital orthophotography on a yearly basis beginning in 2002. Orthophotography and DTM's (Digital Terrain Models) will be utilized.
Location (drainage basin): Alafia, NW Hillsborough, Hillsborough,
Implementation Schedule: On-going
How Financed: SWFWMD, Hillsborough County, City of Tampa

ISSUE 2 - Data Management.

Data management includes the collection, maintenance, update/revision and retrieving of the data required to understand the systems that influence the water resources in the watershed. The data can be used by a variety of methods to produce information that defines the floodprone areas. The watershed characteristics are constantly changing. Therefore, the data used must be updated to represent the current state of the watershed.

The ability of the District, private consultants, Federal, State, or Local Governments to complete accurate Flood Prone Area Analyses is dependent upon the quality of the data available. Limitations on the collection of quality data include the cost of data acquisition, physical constraints and lack of knowledge of what data are needed during the data collection phase of a project.

Strategy:

Enhance flood protection data management.

Actions:

1. Develop a data management system with appropriate data standards to provide the information required to define the floodprone areas.

2. Provide the requirements necessary, in an ARC/INFO based GIS format, to allow the transfer and formulation of input and output data from numerical models to a GIS. This will support further data development for other predictive models (i.e., water quantity, water quality, groundwater, natural systems). It will also provide

access to the data and modeling results for regulation within the watershed.

3. Encourage the development of data transfer tools by the developers of stormwater management software. The goal is to have software with the capability to transfer the input data and output results to SWFWMD data standards or to translate the information to data formats used by other stormwater management software and GIS.

4. Use of data management tools to update the database through the regulatory process by requiring permit (ERP) submittals to include the data in the District's data standards.

Projects:

Project Name: FEMA Coordination Project.
Project Description: This project was initiated by the Engineering Section of the Resource Management Department. The goal of this project is to ensure that data collected by or produced for the District is published in a manner consistent with the FEMA data format. It is anticipated that there will be no direct costs associated with establishing FEMA's format. A process for converting existing data into the format will be determined. Costs and a time line for the conversion of existing data have not been determined.

Project Name: Conversion of Hillsborough County Watershed Management Plans.
Project Description: Hillsborough County has undertaken an aggressive schedule for completing watershed management plans for the entire county. These watershed plans contain valuable information including the delineation of floodprone areas. This information will need to be converted into the District's standard data format.

Project Name: Memorandum of Understanding (MOU).
Project Description: A document is being prepared that will explain the role of local government's and the District's responsibility in terms of flood protection. This document will include a description of the local, intermediate, and regional systems within the local governments' boundaries. It will also detail the efforts required to update the existing floodplain information. Cost associated with updating the floodplain information will be estimated in the MOU.

ISSUE 3 - Ownership, Responsibility, Maintenance, and Operation of Flood Management Systems.

Flood management systems function to convey and store surface water. The existing system is a melange of natural and manmade systems that are under both public and private ownership. The District, State established authorities, Federal, State and Municipal governments, as well as private citizens and home owners associations are

responsible for the operation and maintenance (O&M) of these systems.

Strategy:

Determine ownership and responsibility for flood management systems.

Actions:

1. Determine who owns and is responsible for maintenance of various strategic or significant flood management systems within the watershed, in conjunction with the development of regional models described in Issue 6.

2. Determine if O&M plans exist for significant flood management systems, and if necessary, develop O&M plans and schedules. This includes developing strategies for maintaining and operating the systems, obtaining easements or ingress and egress agreements with property owners, and naming the governmental entities or other parties responsible for the completion and implementation of the O&M plans and schedules.

3. Develop a notification procedure for notifying affected parties when structure operations or schedules are changed.

4. Develop a GIS coverage that will show the location and pertinent information for all flood management structures. The GIS layer could be developed in stages, with the structures maintained and operated by governmental entities being developed first. Structures owned and operated by private entities could then be added. Eventually, the addition of new structures could be incorporated into the permitting and As-Built certification process.

Projects:

Project Name: Flood Education Program
Project Description: Program educates the public, local governments and others on the District's role and responsibility in flood protection. This is accomplished through the distribution of informational brochures to interested persons and to local government building/planning/zoning departments for distribution to their customers.
Location (drainage basin): All
Implementation Schedule: On-going
How Financed: SWFWMD

ISSUE 4 - Flood Prone Area Analysis.

The methods used in floodprone area analysis vary from statistical analysis of measured physical data during historical flooding conditions, to the use of mathematical

algorithms in computer programs (models). Models project a simulated response by the watershed, based upon an input selection of physical data, and assumptions of the watershed characteristics. The amount and quality of data used for input determines the level of detail provided for the analysis. The goals of the analysis will establish the detail required to provide reasonable projections of the water surface elevations, conveyance capacity, and floodprone areas within the watershed. The modeling process requires verification and calibration of the data used in the computer program. The projected results should be within the realm of physical possibilities and represent the physical conditions that would occur during a flood event. During the modeling process additional data may be needed to accurately represent the response of the physical system. The simulation results should represent the response of the watershed to the hydrologic cycle when a sufficient level of detail is applied in the method used to model the watershed.

Strategy:

Establish methods and level of detail required for floodprone area analysis.

Action:

District standards were published in December 1998. These standards include a minimum level of detail required in reporting the results of a floodprone area analysis and a format (electronic and paper form) established for the reported findings.

Strategy:

Conduct required additional floodprone area analysis. Flooding characteristics of the watershed can be used to decide what constitutes current and future water quantity concerns, and necessary actions. One of the primary issues concerning flood protection in the Alafia River watershed involves generation of flood estimates in those areas of the watershed with little or no available data. Tributaries to the Alafia River, lakes in the watershed and headwaters areas that have not already been studied should be targets of future data collection and analysis.

Action:

District staff has completed a preliminary assessment of existing floodprone area analysis. This assessment will be used to prioritize subwatersheds in which a floodprone area analysis needs to be completed. The CWM team will coordinate with local governments during this prioritization. Portions of this work can be completed through the cooperative funding process or through basin initiatives. Total cost for completing floodprone area analysis within the Hillsborough River watershed has been assessed at $7,986,000.

Projects:

Project Name: Hillsborough County is currently executing an accelerated stormwater management master plan schedule. These master plans will include floodprone area analysis data that can easily be converted to the District Format. Master plans that will be completed by Hillsborough County include Delaney Creek (completed in FY 2000), Bullfrog Creek (completed in FY 2000), and the Alafia River (completion scheduled for FY 2002). The County is working cooperatively with FEMA on the review of the Master Plan modeling, and will submit this information to FEMA for FIRM map amendments.

ISSUE 5 - Infrastructure Management Policies, Regulation, and Programs.

Development in a basin, whether in or out of the floodprone areas, increases runoff generated from a given rainfall event. Current regulations prevent post-development peak discharge rates in excess of pre-development peak discharge rates. However, areas with this requirement have still experienced increased flooding as the result of development (Cunningham and Schmidt, 1993). This flooding can result from an increased volume of runoff released from systems designed to only regulate peak flow rates. Stormwater management systems also alter the timing and duration of surface water flow. Increased quantities of runoff combined with alterations to the duration and timing of the discharge can increased peak stages, particularly for events with durations longer than 24 hours, and watersheds with long travel times.

In addition, land alterations, which limit or destroy the function of the floodprone areas, may have been allowed because of a lack of sufficient information needed to properly identify the floodprone areas. Storage of flood waters occurs on most properties in Florida, especially where jurisdictional wetlands exists. Regulations, enforced by the District and county governments, require that the storage in these areas be included in the existing condition analysis (pre-development) for proposed projects. The 100-year storm event should be analyzed to establish the existing condition floodplain on the site. If the function of the floodplain is altered on the developed site (post-development), the permitted stormwater management system should be required to provide the same floodplain function as the pre-developed site. Analysis of various duration rainfall events for a specific return period can identify which event results in the greatest amount of flooding. FDOT regulations require a similar analysis, known as the "critical event" analysis (FDOT, 1987). Regulations could be modified to require detention or quicker release of increased runoff volumes so as not to coincide with peak flows in the receiving water.

Regulations could also be modified to encourage the use of Low Impact Development techniques. Hillsborough County Watershed Management Planning efforts have highlighted the effect of impervious area and total runoff on flood protection and pollutant loading. The use of techniques to reduce the amount of runoff should be encouraged.

Strategy:

Reduce the impact of new land development in terms of flood protection.

Actions:

1. For Environmental Resource Permit applications, require modeling of current tailwater conditions and impacts of upstream volumes and timing on proposed stormwater management systems and the proposed systems receiving water.

2. Promote rule revisions as necessary to require "critical event" analysis.

3. Promote the reuse of stormwater for nonpotable water uses as part of the stormwater management system design to increase storage in floodprone areas.

4. Promote rule revisions to encourage the use of Low Impact Development techniques.

Strategy:

Strengthen regulations and enforcement.

Actions:

1. Ensure that regulations are enforced. That is, compensation for development in floodprone areas is achieved. The areas used for floodprone area mitigation must be readily available to the rising flood waters, and accessible in a fashion that ensures there will not be an increase in the level of flood waters either upstream or downstream of the site.

2. During permitting, consider cumulative impacts of increased runoff volume in the watershed.

Strategy:

Develop, adopt and implement watershed specific regulations.

Actions:

1. Complete floodprone area analysis for basins that are under development pressure.

2. Explore modified regulatory criteria in each of the subbasins within the

watershed.

Strategy:

Develop/implement programs to measure the effectiveness of regulatory goals and performance criteria.

Actions:

1. Develop a method to collect data and test the watershed's response to the hydrologic cycle.

2. Set up a test to measure watershed management goals for flood management.

3. As a condition of Environmental Resource Permits require site owners to continuously monitor surface water elevations at the outfall points and storage areas of permitted sites.

Strategy:

Link water management and land planning.

Actions:

1. Encourage local governments to establish levels of service for current (present) and targeted (build-out) conditions for the watershed's stormwater management infrastructure facilities for flood protection using methods developed by the Stormwater Level of Service (LOS) Conventions Committee (FDEP & WMDs 1994).

2. Assist local governments in using LOS criteria in their comprehensive plans to measure the watershed's current flood management capacity.

3. Cooperate with FDOT and local governments on the design of roads. The roads should be designed to meet flood management LOS criteria. Signage programs, including flood elevation levels, could be developed to warn drivers of flooding conditions.

4. Promote legislation to require that deeds or other appropriate documents for real estate parcels indicate whether the property is located within a floodprone area.

5. Determine and establish appropriate setbacks from riparian systems for all structures, (i.e., a setback landward of the 100-year floodplain, or some specified distance from the 10-year floodplain or wetland boundaries).

6. Encourage local governments to change land use plans to limit densities in floodprone areas.

7. Encourage current open land uses (i.e., agricultural, recreational corridors) within floodprone areas to remain, rather than allowing land uses that would involve alterations to the floodplain.

8. Encourage conservation easements, greenways, and the efficient use of the storage available in required stormwater management systems and mitigation areas within and adjacent to existing floodprone areas.

9. Work with local governments to allow clustering of development outside the floodprone areas.

10. Encourage local governments to purchase flood prone property, or the associated development rights.

11. Encourage the use of flood protection methods that do not include blocking off natural stream systems to provide storage. Preferred methods could include diversion systems that allow normal flows and biota movement in the natural conveyance system while providing off-line attenuation.

12. Encourage the use of non-structural flood protection measures.

ISSUE 6 - Planning and Development of Future Flood Management Systems.

Flood protection should be part of stormwater management planning efforts. Some flooding problems in developed areas can be addressed without expensive remedies. For example, maintenance efforts keep existing ditches clean and existing detention facilities structurally sound. Acquiring lands to protect floodplain from alteration can help reduce potential flood damage. Stormwater management master planning should address existing flooding problems with a focus on solutions that minimize environmental impacts, improve water quality and contribute to the water supply.

Strategy:

Plan for future flood protection efforts.

Actions:

1. Encourage municipal and county governments to examine entire subwatersheds using a floodprone area analysis whether within permit applications or for separate studies.

2. Encourage municipal and county governments to inventory existing drainage systems. (Hillsborough County and Polk County are currently performing drainage system inventories)

3. Incorporate other planning elements in the Stormwater Management Plan, i.e., transportation, major developments with regional significance, greenway/wildlife corridors, recreation/parks, agricultural development, water supply, and environmental management.

Projects:

Project Name: Alafia River Watershed Management Program: Poley Creek Watershed Evaluation - Lake Drain
Project Description: This is a cooperative funding project undertaken by the District and Polk County. The project is built upon information obtained in the first phase of the project, the Poley Creek Watershed Evaluation, and includes the develop an overall Management Plan for the Lake Drain portion of the watershed. The Management Plan will address flood protection, water quality enhancement, and natural system preservation. The primary focus of the project will be the development and evaluation of alternative designs that provide flood protection for large rainfall events within the basin. It is anticipated that watershed management plans for the remainder of the Poley Creek system will be proposed for cooperative funding in future fiscal years.

Project Name: Lake Gornto and Lake Chapman Outfall
Project Description: The Lake Gornto/Lake Chapman Outfall project is located in the Delaney Creek watershed and addresses issues of flood protection and water quality. The project is located in the NW corner of the intersection of State Road 60 and Lakewood Dr. in Brandon. These two lakes, together with Tenmile Lake, are surrounded by residential land uses along Camp Florida Rd. (N), Lakewood Dr. (E), State Road 60 (S), and Gornto Lake Rd. (W), that use septic systems for wastewater treatment. Homes have been flooded on Lake Gornto and Lake Chapman. During flooded conditions, septic tanks do not properly function and can contaminate the flood waters. The project is to evaluate and implement the flood protection methods to address the flood damage and contamination of flood waters.

ISSUE 7 - Revenues and Funding Sources.

Revenues and funding sources are available for surface water management at the federal, state, regional, county and city government levels. Cooperative funding programs are available to help cost share on projects of special concern and for watersheds that extend beyond jurisdictional boundaries. Municipal Governments fund stormwater management projects through a variety of funding mechanisms. A consistent source of funding is provided by some entities, while others fund inconsistently. Master plans address funding for problem areas without consideration

of possible future funding from other entities who propose development or alterations within the watershed.

New development or land alteration projects require stormwater management systems. These systems function as facilities for municipal governments but are not necessarily funded, owned, or operated by the municipal government. Major conveyance systems and storage areas are funded by a variety of sources within a watershed. No real overall mechanisms exist to "govern" the stormwater management infrastructure within a watershed.

Strategy:

Seek consistent source(s) of funding for flood management systems.

Actions:

1. Consider alternatives to general revenue sources for funding of stormwater projects.

2. Encourage establishment of stormwater management utility fees.

3. Encourage establishment of special assessment districts.

4. Enhance the availability of funding from the District for county and local governments.

5. Encourage cooperative projects or piggyback scenarios where many agencies contribute to a project developed through a watershed wide study. Possibly provide credits for developers, roadway improvements (FDOT, counties, cities) who tie into regional projects that provide efficient stormwater quality and quantity storage, wetland mitigation and protection of the floodplain and its function. Provide mechanisms for maintenance and operation funding.

ISSUE 8 - Flood Management Awareness.

Public education programs are needed to foster public understanding of the issues affecting flood protection, and support for stormwater management projects and floodplain protection programs.

Strategy:

Develop and implement public education programs.

Actions:

1. Clarify the District's role and responsibilities in flood protection.

2. Clarify FEMA's role and responsibilities in flood protection.

3. Promote cooperation between the responsible jurisdictions on flood protection issues.

4. Educate public, elected officials, developers and builders that developments may be designed to flood relatively frequently (based on a probability of occurrence of a storm event and the level of service provided).

5. Educate the public on the hydrologic cycle and its interaction with the water resource and the impacts on water use. Emphasis that flooding may become an integral part of the water supply methodologies.

6. Educate the public, elected officials, builders, developers and agriculture that restricting development in the floodplain may result in significant monetary savings and enhance natural systems in the future.

7. Provide educational talks to technical groups.

8. Monitor flooding complaints, and determine if educational efforts are needed to assist affected citizens in understanding the design function of storage and conveyance elements in their specific area.

Projects:

Project Name: Flood Education Program
Project Description: Program educates the public, local governments and others on the District's role and responsibility in flood protection. This is accomplished through the distribution of informational brochures to interested persons and to local government building/planning/zoning departments for distribution to their customers.
Location (drainage basin): All
Implementation Schedule: On-going
How Financed: SWFWMD

Project Name: Supervisory Control and Data Acquisition (SCADA) Data on the Internet
Project Description: Project will make SCADA rainfall, streamflow, lake level, groundwater levels and structure status available to the public through the District's Internet homepage.
Location (drainage basin): All
Implementation Schedule: FY 2000
How Financed: SWFWMD

CHAPTER V - WATER QUALITY

SECTION 1. SURFACE WATER QUALITY

The Alafia River, as well as the lakes and other aquatic resources in the watershed provide high-quality recreational opportunities for area residents and tourists alike. Maintaining good water quality and providing conditions which promote the biological health of these aquatic resources will ensure the maximum benefit from the resource now and in the future.

Some of the common water quality problems in surface waters include:

- Nutrients, primarily nitrogen and phosphorus, when in high concentrations can cause an over-abundance of nuisance aquatic weeds, and blooms of algae in quiescent waters. An overabundance of aquatic weeds can impede navigation, and reduces the capacity of a stream course to provide drainage in times of flood. Algae blooms can depress oxygen concentrations, and may cause taste and odor problems in drinking water. Some blue-green algae can create toxins which are harmful.

- Total suspended solids (TSS), may include sources of pollution with high biological or chemical oxygen demand, which can reduce the availability of oxygen in the water for aquatic life. Heavy metals and pesticides are often associated with TSS. They also reduce the clarity of water and may interfere with the feeding efficiency of filter-feeding aquatic insects and shellfish.

- Metals, including mercury, lead, and copper, can reach levels that are toxic to many aquatic insects and other aquatic life. In some cases, metals such as mercury may accumulate in the flesh of fish, posing a threat to human health if consumed regularly.

- Pesticides, including insecticides, herbicides and fungicides, are primarily agricultural in origin. Though often undetectable in the overlying waters, pesticides and their decay products may accumulate in sediments to concentrations that are harmful to aquatic life.

- Microbial Pathogens, include bacteria, viruses, and protozoa which can cause gastro-intestinal disease when in potable water supplies, or when ingested by recreational users of lakes and streams. They can also cause skin rashes as well as eye and ear infections. Microorganisms are not usually tested for by most water sampling agencies, except at public bathing beaches and for potable water supplies.

The Alafia River consists of two main prongs (North and South) the Lower Alafia River,

and several subbasins within the Alafia River watershed (Table 5-1). The North Prong originates in the Pierce-Pebbledale area of Polk county including Thirtymile Creek, Poley Creek, English Creek, Horton Creek, Hamilton Creek, Howell Creek, Sloman Branch, Bird Branch, and Spring Brook and Lake Drain. The South Prong originates at Hookers Praire in Polk county northeast of Brewster including Mizelle Creek, Harrah Creeks and North, West, Chito, Owens, Halls, McMullen, Pollard, Boggy, Gully, Lake Branches and various mined areas.

Downstream of where the North and South Prong join near Aldermans Park on Plant City - Picnic Rd. the Lower Alafia River portion begins. The lower portion flows westerly in a well-defined channel to the Gulf of Mexico at Hillsborough Bay near Gibsonton. The Lower Alafia River tributaries include McDonald, McCollough, and Pellham Branches and Turkey, Fishhawk, Little Fishhawk, Bell, Boggy and Buckhorn, Rice, Breezey, Delaney, Archie, Bullfrog, Little Bullfrog, Cypress, Wolfe Branch, Wolfe, North Branch Bullfrog, and South Branch Bullfrog Creeks.

Table 5-1. Basins within the Alafia River Watershed.

North Prong	South Prong	Lower Alafia River
Thirtymile Creek	Hookers Prairie	McDonald Branch
Poley Creek	Mizelle Creek	McCollough Branch
English Creek	Harrah Creek	Turkey Creek
Horton Creek	North Branch	Little Fishhawk Creek
Hamilton Creek	West Branch	Fishhawk Creek
Howell Creek	Chito Branch	Bell Creek
Sloman Branch	Owens Branch	Boggy Creek
Bird Branch	Halls Branch	Pelleham Branch
Spring Brook	McMullen Branch	Buckhorn Creek
Lake Drain	Pollard Branch	Rice Creek
	Boggy Branch	Breezey Creek
	Gully Branch	Delaney Creek
	Lake Branch	Archie Creek
		Bullfrog Creek
		Little Bullfrog Creek

	Wolfe Branch Creek
	Wolfe Creek
	N. Branch Bullfrog Creek
	S. Branch Bullfrog Creek
	Cypress Creek

Both North and South Prongs have a poorly defined channel and flow in a general northwesterly course though areas of marsh and swamp. Much of the South Prong's headwaters have been severely impacted by phosphate mining. These activities have degraded the water quality of the South Prong yet the filtering ability of the extensive marsh and swamp system within the prong seems to minimize water quality degradation to the Alafia River itself.

Surface water quality of the Alafia River has been most recently reviewed by Hand et al. (1994 and 1996), Zarbok et al. (1994) and Stoker et al. (1996); additional unpublished water quality data are available from local governments (especially the Hillsborough County Environmental Protection Commission, HCEPC). Water quality data associated with mining activities within the North and South Prongs were presented by Wright (1980). Pollutant sources to the Alafia River include point source and non-point source discharges, runoff from mined and barren lands, urban stormwater runoff, clay settling pond spills and occasional acid spills and agricultural runoff.

The Florida Water Quality Assessment 1994 and 1996 305(b) reports and associated Technical Appendices rate the water quality of surface waters in Florida including the Alafia River. Water quality information from the 305(b) reports for many of the river sections are presented in Table 5-2. The river section ratings were calculated by calculating the Water Quality Index (WQI). The WQI was based on the quality of water as measured by turbidity, total suspended solids, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total organic carbon, total nitrogen, total phosphorus, total coliform, fecal coliform, and macro invertebrate diversity index. The WQI was calculated and ratings of good, threatened, fair, poor and unknown resulted.

Table 5-2. Surface Water Quality Data. Current status = 1990-1995: Historic status = 1980-1989

River Section	Status/Max.# obs./yrs.	Rating	River Section	Status/Max.# obs./yrs.	Rating

South Prong Mouth (upstream of North/South intercept)	Current / 130 /	Good	Poley Creek	Current / 10 / 93-	Fair
	Historic / 46 / 80-	Good	English	Current / 8 / 93-	Fair
	Historic / 222 /	Good	Thirtymile	Current / 12 / 93-	Poor
South Prong (@ Jameson Rd)	Current / 10 / 93-95	Good	North Prong (@SR37 Mulberry)	Current / 11 / 93-95	Fair
South Prong (headwaters)	Current / 108 / 90-95	Good			
	Historic / 200 / 81-89	Fair	North Prong @CR676 Nichols	Current / 3 / 94-94	Fair
Owens Branch	Current / 12 / 93-95	Fair	Lithia Springs	Historic / 56 / 80-88	Poor
Mizelle Creek	Historic / 11 / 80-81	Good		Current / 6 / 92-92	Poor
	Current / 9 / 92-93	Fair	Alafia @ US 301	Current / 199 / 90-95	Good
	Current / 12 / 93-95	Good		Historic / 231 / 80-89	Good
Fishhawk Creek	Current / 3 / 94-95	Good		Historic / 3 / 81-81	Poor
Bell Creek	Current / 15 / 92-94	Fair	Alafia @ US 41	Current / 199 / 90-95	Fair
Turkey Creek	Current / 7 / 92-92	Fair	Turkey Creek @ SR 60	Current / 75 / 90-95	Fair
	Current / 60 / 91-95	Fair		Historic / 169 / 80-89	Poor

Data obtained from Hand, 1996; DEP 305(b) report.

The Hillsborough County EPC currently collects monthly water quality data at seven stations along the Alafia River (since 1974). Station locations include the mouth of the Alafia (sta. 74), mid-river at Bell Shoals Road (sta. 114), Turkey Creek (sta. 111 and 151), mouth of the North Prong (sta. 115), mouth of the South Prong (sta. 116), and the South Prong head waters (sta. 139). Water quality parameters included chlorophyll a,

various nitrogen and phosphorus species, bacteria, dissolved oxygen, salinity, turbidity, and biological oxygen demand. Bacteria data (fecal and total coliform) were compared to State surface water quality standards. These standards state that at any given sampling, fecal coliform bacteria must not exceed 800 mpn/100ml, and total coliform bacteria must be $\leq$ 2400 mpn/100ml. and presented in Table 5-3.

Table 5-3. Monthly Bacteriological Data (Fecal and Total Coliform) Percent Non-compliance of State Surface Water Quality Standards.

Station Number	Location	Total Percent Non-Compliance	Fecal Percent Non-Compliance
74	Mouth of the Alafia	6.9	5.3
111	Turkey Creek	82.0	84.8
151	Turkey Creek	15.3	8.8
114	Mid-river at Bell Shoals Rd.	17.9	7.6
115	Mouth of the North Prong	15.3	6.9
116	Mouth of the South Prong	11.9	6.3
139	South Prong headwaters	15.1	9.4

Data obtained from monthly water quality samples collected by HCEPC 1974 - 1995.

1-1 THE SOUTH PRONG

Phosphate mining occurs in the South Prong drainage basin and is considered the major pollutant source. The historic and current water quality measured at three points along the South Prong were rated good (including water at the mouth of the South Prong) (Table 2). The headwaters historically had fair water quality but current data suggest an improvement. Owens Branch and Mizelle Creek located upstream of Lithia-Pinecrest Road near Welcome currently exhibit fair to fair/good water quality respectively.

Trends in the HCEPC water quality data at the mouth of the South Prong (sta 116), include a decrease in chlorophyll *a* concentrations, a slight and steady decrease in total phosphorus concentrations, an increase in turbidity, and a marked decrease in bacteria after 1980 with little change from that point on. The only notable trend in the upper

reaches of the South Prong (sta. 139) between 1974 and 1995 was a two-fold decrease in total phosphorus. Bacteria standard non-compliance was less than 12 percent at the mouth, and less than 15 percent at the headwaters.

1-2 THE NORTH PRONG

The North Prong of the Alafia River has been heavily impacted by phosphate mining activities including mine pits, clay settling ponds, and phosphate processing plants. The North Prong has had fair to poor water quality and exhibited considerably worse water quality than the South Prong (Table 2). Samples collected from the North Prong near Mulberry and Nichols were given a fair rating. Poley, English and Thirtymile creeks converge into the North Prong near the Hillsborough/Polk county line. Poley and English creeks were given fair ratings while Thirtymile creek was considered the most polluted and rated poor. Additional water quality sampling of the North Prong is recommended due to the small sample size (Table 2).

Water quality trends at the mouth of the North Prong (sta. 115) include a decrease in chlorophyll *a*, inorganic nitrogen, and phosphorus concentrations, and an increase in turbidity. Standard non-compliance at the mouth of the North Prong for total coliform bacteria was 18 percent and 8 percent for fecal coliform bacteria.

1-3 THE LOWER ALAFIA RIVER

Turkey creek flows to the Alafia approximately two miles upstream of Lithia-Pinecrest Road and was given a poor to fair rating (Table 2). Lithia Springs poor water quality enters the river three miles further downstream. Limited sampling of Fishhawk creek just downstream of Lithia Springs was given a good rating while Bell creek water quality near Bell Shoals Road was rated fair. Water quality of the Alafia river at US 301 was given a good rating while a fair rating was given to river samples collected at US 41. Additional sampling of the upper reaches of the Lower Alafia River should be conducted.

Water quality trends in Turkey creek (sta. 111 and sta. 151) were limited to a decrease in chlorophyll *a* concentrations. The data set at the mid-stream station (sta. 151) was too small to identify trends. The mid-river station (sta. 114) showed a slight increase in chlorophyll *a* and turbidity for the time period. Total phosphorus at the mid river station decreased over time while the concentration bacteria exhibited a marked decrease after 1985. Chlorophyll *a* decreased at the mouth of the Alafia (sta. 74) while total phosphorus decreased slightly from prior to 1990.

Non-compliance bacteria standards in the lower Alafia river were similar to that of the North and South Prongs with the exception of the Turkey creek station (sta. 111). The mid river (sta. 114) and mid Turkey creek stations had bacteria non-compliance of less than 15 percent. Bacteria non-compliance at the mouth of the Alafia river was the

lowest of all stations at less than seven percent. Unlike all other stations, the Turkey creek station did not comply with standards 82 and 85 percent (total and fecal coliform bacteria respectively) and identifies the need for source identification. There is adequate bacteria sampling (biweekly) of Lithia Springs (one of only two swimming areas within the Alafia River Basin approved by the State/County). Within a three year period (Sept. 1995 to Sept. 1998), Lithia Springs was closed four times due to elevated bacteria. The three year average total and fecal coliform bacteria concentrations at Lithia Springs were 371 mg/l and 83 mg/l respectively.

1-4 BUCKHORN AND ARCHIE CREEK

A number of studies are available detailing flood elevations in the Alafia River Basin**.** These offer information such as the size and location of the area, flood profiles, frequency elevations for various recurrence intervals, and methods of analysis. One such study is the Archie Creek/Coastal Areas & Buckhorn Creek Watersheds: Stormwater Management Master Plan, conducted by Singhofen & Associates, Inc. (1988).

Buckhorn Creek is one of the larger tributaries to the Alafia River. The Buckhorn Creek Watershed lies north of the Alafia River, east of Providence Road and west of State Road 640 (Lithia-Pinecrest Road). The primary objective of this study is to identify existing flooding problems and present a “Preferred Stormwater Management Master Plan” to alleviate the existing problems within the watershed as well as minimize future flooding from new development. Flood elevations were developed for the mean annual, 5-, 10-, 25-, and 100- year 24 hour storm events. The 5.023 acres watershed was modeled using Soil Conservation Service (SCS) methodology to generate peak runoff rates and the Explicit Channel Simulation Model (“EXPLC”) to determine the peak water surface elevations.

1-5 LAKES

There are at least seventeen lakes and one reservoir within the Alafia River’s political and hydrologic basin. These water bodies are listed in Table 5-4 along with the sub-basins, location (section, township, range and latitude/longitude), and lake size. The typical water quality values for Florida Lakes published in Friedemann and Hand (1989) were used to compare the water quality of the Alafia watershed lakes.

Table 5-4. Lakes within the Alafia River Watershed.

Lake	Sub-basins	STR	Lat	Long	Approx. Acreage	Adopt	Water Quality

Browns	Bell Creek	313021	274941	815625	10	no	
Carlton	Political	073221	274245	821530	35	yes	District
Chapman	Delaney	212920	275644	821848	17	no	
Grady	Bell Creek	263020	275032	821640	200	yes	District
Gornto	Delaney	212920	275642	821902	16	yes	
Hickory Hammock	Buckhorn Creek	342920	275455	821720	26	yes	District
Hurrah	S. Prong	303122	274505	820725	10	no	
Hutto	Fishhawk Creek	253023	275037	821532	9	no	
Kathy	Delaney	202920	275641	821924	21	no	
Medard Reservoir	Turkey Creek	362921	275450	821000	770	yes	District DEP
Meade	Delaney	222920	275651	821742	14	no	Hills. Co.?
Rolling Hills	N. Prong	363023	274937	815753	43	no	
Scott	Poley Creek	182921	27586	815625	291	no	
Starlight	none	73020	275316	822028	10	no	
Ten Mile	Delaney	212920	275626	821855	19	no	
Unnamed #2	Political	223221	274055	821145	43	yes	
Wee	Delaney	152920	275713	821748	13	no	
Wimauma	Political	093220	274230	821850	135	yes	District

The “Political” sub-basins indicates that the lake resides within the Alafia River political boundary but outside the hydrologic basin. The "Adopt" column indicates whether lake levels are adopted for the lake, or adoption is pending. The "Water Quality" column indicates if the lake has been sampled, and the responsible agency is noted (Dist=SWFWMD, HCEPC=Hillsborough County Environmental Protection Commission, FDEP=Fl. Dept. of Env. Protection, LW=LakeWatch).

The Edward Medard Reservoir (a.k.a. Pleasant Grove Reservoir) was sampled once in January 1979 by district staff. The sample indicated the water quality was quite hard and mineralized. In addition, the reservoir’s turbidity, alkalinity, fluoride, suspended solids and biochemical oxygen demand (BOD) exceeded the values found in 90 percent

of the lakes in Florida. High BOD values suggested the presence of elevated organic matter decay. Typical sources include floating or aquatic vegetation recycling, resuspension of organic bottom sediment, stormwater runoff or some combination of each. One of the two State/County approved swimming areas within the Alafia River Basin is located on the Medard Reservoir. Biweekly bacteria samples are collected to compare to fecal and total coliform bacteria State standards. The swimming area was closed due to noncompliance of standards sixteen times between Sept. 1995 and Sept. 1998. The three year average total and fecal coliform bacteria concentrations are 1003 mg/l and 246 mg/l respectively.

Hickory Hammock, Carlton, and Grady Lakes were sampled once in January 1979 by district staff. The Hickory Hammock sample revealed that it was a fairly clear, slightly acidic lake with somewhat colored water. It was noted that the Hickory Hammock Lake suffered from occasional algae blooms and a BOD value greater than 95 percent of Florida lakes. Lake Carlton was found to be a clear, acidic, colored lake with a high BOD value; Lake Carlton's pH was lower and BOD was higher than 95 percent of the lakes in Florida. Based on the January 1979 sample, Lake Grady was a clear, slightly acidic, highly colored, somewhat mineralized lake with BOD values higher than 90 percent of Florida Lakes. In 2000, Lake Grady was the subject of intensive water quality sampling as the result of the formation of an in-lake sinkhole (HCEPC, 2000).

Lake Wimauma was sampled January 1979, 1980 and 1981 by district staff. These data revealed a clear, acidic, somewhat mineralized lake with a pH value lower than 90-95 percent of lakes in Florida. Unlike the other Alafia watershed lakes, Lake Wimauma water quality data suggested that organic pollution was not a problem. Based of these data, Lake Wimauma generally had the best water quality of all the Alafia River watershed lakes.

1-6 ATOMOSPHERIC DEPOSITION

Most atmospheric deposition studies conducted in the Tampa Bay area have been regional in nature, hence, little data is available from within the confines of the Alafia River Basin. Dixon (1994) noted that the shape of an airshed cannot be rigidly defined because it varies nearly instantaneously with atmospheric conditions. One must keep in mind that pollutants can be transported and dispersed over thousands of miles, making source attribution difficult. Despite location of pollutant source, the fact is atmospheric deposition is a potential source of nutrients and toxic materials in the Alafia River watershed and data of a regional nature is more than adequate. Furthermore, many anthropogenic sources of airborne contaminants that may affect surface waters within the Alafia River watershed could be a considerable distance outside of the watershed. There are, however, a number of sources with measurable nitrate-nitrite emissions in proximity to the Alafia River Basin. A partial list of these sources include Cargill Fertilizer, Inc., Farmland Industries, Inc., IMC-Agrico Co., Mobil Mining and Minerals Co., and Mulberry Phosphate, Inc (Dixon et al., 1996).

A nitrogen budget for Tampa Bay, which includes the Alafia River watershed, suggests that as much as 27 percent of the nitrogen and 31 percent of the total phosphorus entering the Bay comes from rainfall and dry deposition directly on the surface of the Bay (Zarbock et al., 1994). Moreover, U.S. Environmental Protection Agency-sponsored studies suggest that as much as 67 percent of the total nitrogen loading to Tampa Bay may enter the Tampa Bay watershed via aerial deposition (Tampa Bay National Estuarine Program 1994). In addition to nutrients, atmospheric deposition can be a source of metals including zinc, lead, mercury, cadmium, and copper.

Brezonik and others (1983) found that although the lowest deposition rates of phosphorus occur in rural and coastal areas, greater rates occur in mining and agricultural areas. This finding is important since 85 percent of the Alafia River basin include mining and agricultural areas. Sources of nutrients and metals include power generation facilities, mass-burn incinerators, various industrial operations, as well as transportation. Table 5-5 summarizes atmospheric data typical for the Alafia River basin.

Table 5-5. Bulk Atmospheric Deposition Data Typical for the Alafia River Basin. Metals are in units of g ha^{-1} yr^{-1} and nutrients are in units of kg ha^{-1} yr^{-1} unless indicated.

Constituent	Mean	n	Location/ Source	Constituent	Mean	n	Location/ Source
Aluminum	540.62 493.36	42 44	Plant City/1 Ft. Lonesome/1	Total Phosphorus	1.76 1.31	42 43	Plant City[1] Ft. Lonesome[1]
Copper	6.78 7.48	42 44	Plant City/1 Ft. Lonesome/1	Total Nitrogen	12.85 7.34	42 43	Plant City[1] Ft. Lonesome[1]
Lead	5.17 5.87	42 44	Plant City/1 Ft. Lonesome/1	Organic-N	6.73 1.92	42 43	Plant City[1] Ft. Lonesome[1]
Zinc	67.65 91.40	42 43	Plant City[1] Ft. Lonesome[1]	TKN-N	10.02 4.31	42 43	Plant City[1] Ft. Lonesome[1]
Nitrate+Nitrite-N	2.83 3.02	42 43	Plant City[1] Ft. Lonesome[1]	Inorganic-N	6.13 5.57	42 43	Plant City[1] Ft. Lonesome[1]
Ammonia-N	3.30 2.55	42 43	Plant City[1] Ft. Lonesome[1]	pH (SU)	4.5-4.6	?	West Central FL[2]

[1]Dixon et al.,1996; [2]Walkins et al., 1990.

1-7 POINT SOURCE POLLUTION

Point source discharges are regulated by the Florida Department of Environmental Protection under authority of the USEPA for the NPDES (National Pollutant Discharge Elimination System) permitting system. Permit holders are required to provide monthly or quarterly operating reports for their facilities to the FDEP for each month they have a discharge. The monthly operating reports provide the results of laboratory analyses for

the parameters of concern (i.e., for any effluent chemical concentrations that may potentially exceed state water quality standards). The monthly operating reports were obtained for the five-year period from June 1990 through June 1995 for each of the NPDES permit holders in the Alafia River watershed.

Table 5-6 is a list of the permitted surface water discharges to the Alafia River. These discharges include activities associated with phosphate mining and processing and municipal domestic wastewater treatment plants.

Table 5-6. Permitted Surface Water Discharges to the Alafia River.

Facility	Facility
Cargill Fertilizer Inc. - Bartow Phosphate Plant	IMC Agrico Co. - Kingsford/Haynesworth Mine
Cargill Fertilizer Inc. - Hookers Prairie Mine	IMC Agrico Co. - New Wales Phosphate Plant
Cargill Fertilizer Inc. - Riverview Phosphate Plant	IMC Agrico Co. -Nichols Phosphate Plant
CF Industries Inc. - Bartow Phosphate Plant	Lakeland, City of - Domestic WWTP.
Coronet Industries - Animal Feed Processing Plant	Meadowlands Regional - Domestic WWTP.
Estech Inc. - Agricola Phosphate Chemical Plant	Mobil Mining Electro Phosphate Plant (Closed)
Estech Inc. - Silver City Mine (Closed)	Mobil Mining - Nichols Phosphate Plant
Farmland Hydro - Green Bay Phosphate Plant	Mulberry, City of - Domestic WWTP.
IMC Agrico Co. - Ft. Lonesome Mine	Mulberry Phosphate - Mulberry Phosphate Plant
IMC Agrico Co. -Hopewell Mine	TECO - Big Bend Electrical Plant
IMC Agrico Co. - Kingsford Mine	Hillsborough County, Valrico, - Domestic WWTP.

Table 5-7 is a list of domestic wastewater facilities that could potentially impact the Alafia River Basin. Limited water quality compliance and capacity (mgd) data are available for these sites.

Table 5-7. Domestic Wastewater Treatment Facilities.

NPDES	NAME	LOCATION	CITY	TREATMENT PROCESS SUMMARY
N	ALAFIA RIVERFRONT, INC.	8867 BARCIN CIRCLE	RIVERVIEW	EXTEND. AER.
N	CHAPARRAL MHP WWTP	HWY 301 N, N OF I-75	RIVERVIEW	EXTEND. AER.

N	HIDDEN RIV TRAVEL RESORT	12500 MCMULLEN LOOP	RIVERVIEW	EXTEND. AER.
N	DAVPAM MHP	WILLIAMS & BUFFALO AVE	MANGO	EXTEND. AER.
N	CEDARKIRK CAMP	N OF LITHIA RD W OF HWY 39	LITHIA	EXTEND. AER.
N	PINECREST ELEM SCH	PINECREST ELEM SCH	LITHIA	EXTEND. AER.
N	VALRICO HILLS MHP	SR 60, E OF BRANDON	VALRICO	EXTEND. AER.
N	MASTERS ECONOMY INN	6010 SR 579 N	SEFFNER	EXTEND. AER.
N	CITRUS HILLS RV PARK	SR60 1 MI TURKEY CREEK RD	VALRICO	EXTEND. AER.
N	BUCKHORN ELEM SCH	DURANT RD NEAR MILLER	VALRICO	EXTEND. AER.
N	KINGSWAY OAKS	KINGSWAY & WHEELER RD	SEFFNER	EXTEND. AER.
N	CHATTEAU FORREST MHP	604 N KINGWAY RD	SEFFNER	EXTEND. AER.
N	ALAFIA R CAMPERS RESORT	9812 GIBSONTON DR	RIVERVIEW	EXTEND. AER.
N	PREVATT MHP	11416 US HWY 92	SEFFNER	EXTEND. AER.
N	HILLS. ALT. RESIDENCE PRGM		SEFFNER	EXTEND. AER.
N	TURKEY CRK JR. HS&ROBINSON ELEM	5005 S. TURKEY CREEK RD	PLANT CITY	EXTEND. AER.
N	TRAPNELL ELEM SCH	TRAPNELL RD NEAR HEATHCOE	PLANT CITY	EXTEND. AER.
N	BRIARWOOD MHP	4002 SMITH RYALS RD	PLANT CITY	EXTEND. AER.
N	DURANT HS WWTP	TRKY CRK &SUMMERFIELD RD	PLANT CITY	EXTEND. AER.
N	KING RICHARDS COURT MHP	BIG BEND RD AND US 301	RIVERVIEW	EXTEND. AER.
N	OAKSIDE MHP	US 301 S	RIVERVIEW	EXTEND. AER.
N	PROVIDENCE BAPTIST CH	5416 PROVIDENCE RD	RIVERVIEW	EXTEND. AER.
N	RIVERBAY PLAZA	UNC TOM RD & US30 (NE)	RIVERVIEW	EXTEND. AER.
N	RIVERLAWN MH & RV PARK	8215 STONER RD	RIVERVIEW	EXTEND. AER.
N	HILLSB CO REST AREA I-75N	I-75 N 5 MILES N MANATEE & HIL	RIVERVIEW	EXT. AER., w/surge & fltrs
N	RIVERGLEN WWTP	BOYET.&MCMULLEN BOOTH RD	RIVERVIEW	EXTEND. AER.
N	RIVERVIEW SHOPPING CENTER	7415 US HIGHWAY 301	RIVERVIEW	EXTEND. AER.
N	CROFT'S MHP (JIROCOLE, INC.)	4707 W. TRAPNELL RD.	PLANT CITY	EXTEND. AER.
N	CRAWFORDS 3 B'S MHP	HOLLOWAY & EAST TURKEY RD	PLANT CITY	EXTEND. AER.
N	SPRINGHEAD ELEM SCH	NESMITH & SPARKMAN	PLANT CITY	EXTEND. AER.
N	VALRICO HILLS (FKA BRNDN-VALRICO)	VALRICO RD .5 MI S SR 60	BRANDON	ACTIVATED SLUDGE
N	SHERWOOD FOREST	US 301 & BLOOMINGDALE AVE	BRANDON	EXTEND. AER.
N	FEATHEROCK	2200 E SR 60	BRANDON	EXT AER & CONT STAB
Y	VALRICO AWTP	1167 N DOVER RD	DOVER	TYPE I / OXID DITCH DOM. AWWT PLANT
N	DOVER ELEM SCH	NELSON & DOWNING ST	DOVER	EXTEND. AER.
N	MCINTOSH UTIL	12716 US92	DOVER	EXTEND. AER.
N	MOBIL OIL CORP.	BREWSTER PRIVATE RD	BRADLEY	EXTEND. AER.
N	IMC FORT LONESOME MINE	SR39 & SR674	BRADLEY	EXTEND. AER.
N	PLANTATION OAKS MHP	700 N. KINGSWAY RD	SEFFNER	EXTEND. AER.
N	HILLSB CORRECTIONAL INST	SR672 1 MI E OF US301	BALM	EXTEND. AER.
N	TWN AND COUNT MHP	1221 N VALRICO RD	VALRICO	EXTEND. AER.
N	BRANDON TP	113 S MT CARMEL RD	BRANDON	EXTEND. AER.
N	BLOOMINGDALE TWN CNTR	BLOOMINGDALE RD	BRANDON	EXTEND. AER.
N	STARLITE MHP	5230 SR 60	BRANDON	EXTEND. AER.
N	BROOKSIDE MANOR	BELL SHOAL RD&ROSEMEAD ST	BRANDON	EXTEND. AER.
N	GIBSONTON ELEM SCH	GIBSONTON RD	GIBSONTON	EXTEND. AER.
N	NISTAL PARK	US 41&SYMMS RD	GIBSONTON	EXTEND. AER.
N	SHADY SHORES MHP	HONEYWELL RD OFF SYMMES	GIBSONTON	EXTEND. AER.
N	EASTWOOD EST MHP WWTP	OHIO ST & US41	GIBSONTON	EXTEND. AER.
N	E BAY RACEWAY	BURTS RD	GIBSONTON	EXTEND. AER.
N	ALAFIA MOBILE PLAZA	11888 US41 S	GIBSONTON	EXTEND. AER.

N	COUNTRY HAVEN ON BULFG CRK	RICHMOND ST	GIBSONTON	EXTEND. AER.
N	RIVERWALK VILLAGE MHP	8518 GIBSONTON DR	GIBSONTON	EXTEND. AER.
N	MADISON AVENUE MHP	5353 MADISON AVE	GIBSONTON	EXTEND. AER.
N	SOUTHERN PINES MHP	2975 SR60	VALRICO	EXTEND. AER.
N	STRAWBERRY RIDGE WWTP	SR60 TO MULRENNON RD	VALRICO	ADV. SEC. QUAL. EFF & EFFL DISP. SYS.
N	OAKHILL MHP	124 OAKHILL KEY CT	VALRICO	EXTEND. AER.
N	VALRICO STATION	SR60	VALRICO	EXTEND. AER.
N	TWIN OAKS PLAZA	US41 N BULFG CRK	GIBSONTON	TRCK FIL. LAUND MAT EFFL & EXT. AER.
N	RIVERVIEW OAKS SHOP. CNTR	US301 AND GIBSONTON DR	GIBSONTON	EXTEND.AER.
N	LITTLE TADPOLE MHP	SYMMES RD	GIBSONTON	EXTEND. AER.
N	BULLFROG CREEK MHP	E BAY RD N OF SYMMES RD	GIBSONTON	EXTEND. AER.
N	WARING INDUST PARK-PHASE III	HOLDEN RD E SIDE OF AIRPORT	LAKELAND	TYPE III EXTEND. AER.
N	HIGHLAND APTS	4211 HANCOCK AVE SE	HIGHLAND CITY	TYPE III EXTEND. AER.
Y	W. CARL DICKS WATER RECLAM. FAC.	1825 GLENDALE ST	LAKELAND	HIGH RATE TRCKL FLTR
N	VILLAGE WATER LTD	E END OF MAINE AVE	LAKELAND	EXTEND. AER.
N	LAKEFRONT TRAILER PARK	410 HIBRITEN WAY	LAKELAND	EXTEND. AER.
N	EATON PARK MHP	3301 MAIN AVE	EATON PARK	TYPE III EXTEND. AER.
N	SEMINOLE FERT. INC HOOKERS PRAIRIE	21/2 MI E OF BRADLEY JCT	BRADLEY JUNC.	EXTEND. AER.
N	HIGHLAND CITY PLAZA	US98 CR540 (CLUBHOUSE RD.)	HIGHLAND CITY	EXT AER W/SAND FILT & PERC / EVAP. PONDS
N	OSCAR J POPE ELEM. SCH. WWTP	2730 MAINE AVE	EATON PARK	TYPE III EXTEND. AER.
N	OSCAR J POPE ELEM SCH WWTP	2730 MAINE AVE	EATON PARK	TYPE III EXTEND. AER.
N	VALENCIA EST MHP WWTP	3325 BARTOW HWY US98	LAKELAND	EXTEND. AER.
N	SW REGIONAL WWTF PHASE I	.09 MI W SR37 1.75 MILE	MULBERRY	EXT. AER. OXYD DITCH
N	SEMINOLE FERT. CHEM. COMP. SW	3.5 MI E OF MULBERRY US60	MULBERRY	EXTEND. AER.
Y	CITY OF MULBERRY WWTP	2ND ST S OF SR60	MULBERRY	TYPE I EXTEND. AER.
N	AGRICO CHEMICAL PIERCE	OLD HWY 37	PIERCE	EXT. AER. - went to septic
N	SPRING HILL MHP	SR60 AND CO LINE RD	MULBERRY	EXTEND. AER.
N	INTERNAT. MINERALS & CHEMICAL	1 MI S OF SR640, CO LINE RD	MULBERRY	EXTEND. AER
N	OAKMONT MHP	OLD TPA BAY HWY	LAKELAND	DUAL SAND FILTER SYS.
N	EVERGREEN MOTEL & MHP	6650 NEW TPA HWY	LAKELAND	TYPE III EXTEND. AER.
N	VILLAGE - LAKELAND THE	REYNOLDS RD	LAKELAND	EXTEND. AER.
N	SANLAN RANCH CAMPGROUND	2925 SANLAN RANCH DR	LAKELAND	TYPE III EXTEND. AER.
N	BONNY SHORES MHP	164 BONNY SHORES DR	LAKELAND	TYPE III EXTEND. AER.
N	ANGLERS COVE W	E REYNOLDS RD 3/4 MI S SR542	LAKELAND	EXTEND. AER.

Source: DEP Domestic Wastewater Program.

Table 5-8 is a list of industrial wastewater facilities that could potentially impact the Alafia River Basin.

Table 5-8. Industrial Waste & Long Term Petroleum Cleanup (PET) Sites.

NPDES	NAME	CITY	LOCATION
N	AGRICO	PICNIC	
N	BORDEN, INC	FT LONESOME	BIG FOUR MINE
N	BRANDON CAR SPA. INC.	BRANDON	9995 ADAMO DR
N	BRANDON DAIRY	BRANDON	BRYAN & BRACKEN RD
N	BREWSTER PHOSPHATE	BRADLEY	

N	BULLFROG DAIRY, INC	BRANDON	WILLIAMS RD
Y	CARGILL FERT, INC. - E TPA CHEMICAL PLANT	RIVERVIEW	8813 US41S & RIVERVIEW DR
Y	CARGILL FERT, INC. - E TPA PLANT CLOSED GYP STACK	RIVERVIEW	8813 US41 S
Y	CORONET INDUSTRIES, INC.	PLANT CITY	4082 CORONET RD
N	COLUMBIA DAIRY, INC	LITHIA	THOMPSON RD
N	CYPRESS CREEK CAR WASH	VALRICO	3526 BELL SHOALS RD
N	D. SHAMBAUGH	LITHIA	19043 REDBIRD LN
N	DIAMOND PRODUCTS COMPANY	SEFFNER	435 CANNING PLANT RD
N	DIAMOND S DAIRY	MANGO	CR 574
N	DUPREE TROPICAL FISH FARM	BALM	14621 DUPREE RD
N	EWELL INDUSTRIES,INC-HOPEWELL RD	BRANDON	1211 HOPEWELL RD
N	EXXON 4-9124	BRANDON	615 W. BLOOMINGDALE AVE
Y (PET)	EXXON STATION NO. 4-6437	BRANDON	700 W. BRANDON BLVD
N	FINA OIL	BRANDON	925 E. BRANDON BLVD.
Y	FL ENGINEERED CONSTRUCTION PRODUCTS CORP.	SEFFNER	6324 CR579
N	GIBSON SPEED WASH	GIBSONTON	US 41
N	GIBSONTON SPEEDWASH	GIBSONTON	US 41
N	HIGHWAY 92 SPEED WASH	SEFFNER	HWY 92 E.
N	HOBBS DAIRY	RIVERVIEW	BLOOMINGDALE
N	IMC BREWSTER BOGGY BRANCH 1AL 001	LONESOME MINE	2 MI E OF SR39
N	IMC FERTILIZER LONESOME MINE	FT LONESOME	SR674
N	IMC FERTILIZER-KINGSFORD MINE SA-K8	MULBERRY	CR 640
N	IMC-AGRICO COMPANY - BIG BEND TERMINAL	MULBERRY	BIG BEND RD, S OF GIBSONTON
Y	IMC-AGRICO COMPANY - BIG FOUR MINE	MULBERRY	LONESOME/HAYNESWORTH MINE RD
Y	IMC-AGRICO COMPANY - HOPEWELL MINE	MULBERRY	SR39, 3 MI. S OF SR60, HOPEWELL
Y	IMC-AGRICO COMPANY - LONESOME MINE	MULBERRY	SR39,1-1/2 MI NE OF SR674, FT LONESOME
Y	IMC-AGRICO COMPANY - PORT SUTTON TERMINAL	MULBERRY	4802 PORT SUTTON RD.
N	MAIDEN HILL DAIRY	VALRICO	BROWING RD
N	MARTINEZ BROTHER'S DAIRY	RIVERVIEW	RHODIN RD
N	MARTINO'S DAIRY	BOYETTE	BALM & BOYETTE RD
N	MITSUI & COMPANY/IMC	GIBSONTON	1 MI W OF GIBSONTON OFF US41
N	MOBIL MART CAR WASH	BRANDON	548 EAST BRANDON BLVD.
Y (PET)	MOBIL SERVICE STA. #02-J6B	BRANDON	802 W BLOOMINGDALE BLVD.
N	PEBBLE CREEK DAIRY	GIBSONTON	BALM-RIVERDALE RD
N	PRUITT RANCH PHOSPHATE TAILINGS REC		CR39, 4.5 MILES S OF SR64
N	PURITY DAIRY	RIVERVIEW	PROVIDENCE RD
Y	RHODINE ROAD BORROW PIT	BALM	RHODINE RD
N	RINGHAVER EQUIPMENT COMPANY	RIVERVIEW	9797 GIBSONTON DR
N	RIVERVIEW SPEED WASH	RIVERVIEW	KASH N KARRY BLVD
N	ROBINSON DAIRY	MANGO	SR574
N	RUSSELL DAIRY	MANGO	SR39
N	RUSSELL DAIRY	BRANDON	SR574
N	RYALS DAIRY	LITHIA	CULBREATH RD
N	SEGREST FARMS	GIBSONTON	6180 BIG BEND RD
N	SELMONT ENTERPRISES, INC.	BALM	15228 MCGRADEY RD
N	SIMMONS FARMS	LITHIA	13725 HOBSON SIMMONS RD
N	SIPPLE DAIRY	MANGO	TANNER RD
N	SPRING VALLEY DAIRY	RIVERVIEW	BOYETTE RD
N	STAR DAIRY	RIVERVIEW	US 301
N	TONY'S DAIRY	RIVERVIEW	US 301
N	TOP QUALITY ENTERPRISES, INC	BRANDON	4311 S. JOHN MOORE RD

Y	TRADEMARK NITROGEN CORPORATION	BRANDON	PO BOX 1750
N	TURKEY CREEK SPEED WASH	GIBSONTON	TURKEY CRK RD
N	US 92 SPEEDWASH	SEFFNER	11501 HWY 92 E
N	VALRICO/CITGO	VALRICO	2510 SR60 E
N	VAN WATERS AND ROGERS, INC.	RIVERVIEW	US 41-A, ROUTE 3
Y (PET)	VENTO OIL #16	RIVERVIEW	7402 US 301 S.
N	AGRICO CHEMICAL CO	PIERCE	OLD CR 37
Y	AGRIFOS, LLC - NICHOLS MINE	NICHOLS	CR640 & ANDERSON RD
Y	AGRIFOS, LLC - NICHOLS PREP PLANT	NICHOLS	CR 640
N	AGRIFOS, LLC- PHOSSY WATER POND	NICHOLS	NICHOLS MINE
N	ALUMINUM CO. OF AMERICA - FT. MEADE	FT MEADE	CR630 WEST
Y	AOC, L.L.C.	LAKELAND	4620 N GALLOWAY RD
N	AUTO IMAGE USA	LAKELAND	5126 US HWY 98 N
N	AUTOSTAR INDUSTRIES, INC.	LAKELAND	5204 US HWY 98 S
N	BETHSAIDA, INC.	LAKELAND	4315 HAMILTON RD
N	BODOLAY/PRATT DIV PACKAGE MACH	LAKELAND	5015 N FRONTAGE RD
N	BONE VALLEY SERVICE CO., INC	MULBERRY	PRAIRIE MINE RD
Y	BORDEN, INC.	LAKELAND	5004 N. COMBEE RD
N	BROWNING-FERRIS INDUSTRIES	LAKELAND	3939 US HWY 98 S
N	CARPENTER COMPANY, INC.	LAKELAND	5100 S. FRONTAGE RD
Y (PET)	CIRCLE K #0007	LAKELAND	1001 NEW TPA HWY
N	COMPRESSED AIR PRODUCTS, INC.	MULBERRY	4090 SR60 E
N	COOK'S PROCESS. INC (FRMLY FRUITBUD JUICE CORP)	LAKELAND	3155 WINTER LAKE RD
Y	CSX TRANSPORTATION - WINSTON YARD	LAKELAND	1700 WILKINSON RD (S OF 92)
Y (PET)	CSXT WINSTON YARD FACILITY	LAKELAND	1925 DRANE FIELD RD
N	CTL DISTRIBUTION INC	MULBERRY	BONNIE MINE RD
N	CUSTOM CHEM. CORP. (FRMRLY WESTVACO CORP.)	MULBERRY	SR 60 E
Y	CYTEC INDUSTRIES, INC. - BREWSTER PLANT	BREWSTER	BREWSTER CHEMICAL PLANT
Y (PET)	EXXON STATION #4-4265	LAKELAND	316 E MEMORIAL BLVD
Y	FLORIDA JUICE PARTNERS, LTD.	LAKELAND	4100 FRONTAGE RD S
N	FLORIDA TILE	LAKELAND	ONE SIKES BLVD
N	FMC CORPORATION	LAKELAND	FAIRWAY AVE
N	FRANKLIN COACH WASH AND DETAIL SHOP	LAKELAND	SW SIDE OF CREVASSE ST. & UNION DR.
Y (PET)	GROVE PARK AMOCO STATION	LAKELAND	1301 HWY 985
N	HOOKERS PRAIRIE/AGRICO CHEM CO	BRADLEY JUNC.	
N	HYDROCHEM INDUSTRIAL SERVICES, INC.	LAKELAND	2735 INDUSTRIAL PARK DR
Y	IMC-AGRICO COMPANY - FOUR CORNERS MINE	MULBERRY	POLK/HILLS/HARDEE/MANATEE COS
Y	IMC-AGRICO COMPANY - FT. GREEN MINE	MULBERRY	POST OFFICE BOX 2000
Y	IMC-AGRICO COMPANY - HAYNESWORTH MINE	MULBERRY	2 MI N SR630, 2 MI W SR 37, BREWSTER
Y	IMC-AGRICO - KINGSFORD/HAYNESWORTH BIG 4 MINES	MULBERRY	DOC DURRANCE RD
Y	IMC-AGRICO - KINGSFORD/HAYNESWORTH/BIG 4 MINES	MULBERRY	DOC DURRANCE RD
N	IMC-AGRICO - M-BERRY PREP LIMESTONE PROCESS. PLT.	MULBERRY	881 PRAIRIE MINE RD
Y	IMC-AGRICO CO - NEW WALES CHEMICAL PLANT	MULBERRY	HWY 640 AT HILLS/POLK CO. LINE
Y	IMC-AGRICO CO - NICHOLS CHEMICAL PLANT	MULBERRY	CR676, 2-1/4 MI S OF SR60, NICHOLS
Y	IMC-AGRICO - NORALYN/PHOSPHORIC/CLEAR SPRGS MNES	MULBERRY	2 MI SW OF HOMELAND
Y	IMC-AGRICO CO - OVERSTREET MINE	MULBERRY	SR471 N, KATHLEEN
N	IMC-AGRICO CO - P21 PHOSPHOGYPSUM STORAGE	MULBERRY	BONNY MINE RD
Y	IMC-AGRICO COMPANY - PAYNE CREEK MINE	MULBERRY	S OF SR630,E OF GREEN SPRINGS RD
Y	IMC-AGRICO COMPANY - PIERCE DRY MILL	MULBERRY	PIERCE RD
Y	IMC-AGRICO COMPANY - SOUTH PIERCE CHEMICAL PLANT	MULBERRY	NORTH OF CR630, E OF SR37
N	JUICE BOWL PRODUCTS INC	LAKELAND	2090 BARTOW RD

N	KINGS FORD MINE	BRADLEY JUNC.	
Y	LAKELAND LARSON MEMORIAL PLANT	LAKELAND	2020 E. US92
Y	LAKELAND MCINTOSH PLANT	LAKELAND	3030 E LAKE PARKER DR
N	MASTERS CAR WASH	LAKELAND	3855 US HWY 98 S
N	MID-FLORIDA FREEZER (AKA ALLSUN PUR	HIGHLAND CITY	US HWY 98 & SR544
Y (PET)	MIRIAM CAR WASH	LAKELAND	5301 S FLORIDA AVE
N	MOBIL CHEMICAL CO	NICHOLS	NICHOLS RD
Y	MOBIL MINING & MINERALS CO. - ELECTRO PHOS PLANT	MULBERRY	1155 PEBBLEDALE RD
N	MOBIL/H.O.GRANT	NICHOLS	
N	MULBERRY ETHANOL FACILITY	MULBERRY	CR 555
Y	MULBERRY PHOSPHATES, INC.- MULBERRY CHEM. PLANT	MULBERRY	SR60, 2 MI E OF MULBERRY
N	PALMETTO MINE/AGRICO CHEM CO	PIERCE	
N	PANDA-KATHLEEN, L.P.	LAKELAND	800 MCCUE RD
N	PINE VALLEY DAIRY, INC.	LAKELAND	4520 OLD TPA RD
N	PIPER AIRCRAFT INC/LAKELAND	LAKELAND	S DRANEFIELD RD
Y	POLK COUNTY PARKWAY-SECTION 4A	LAKELAND	US98 AT BROOKS ST
N	PRINCIPATO SAUSAGE COMPANY	LAKELAND	3620 VENTURA E DR
N	RIDGE GENERATING STATION, L.P.	LAKELAND	3131 K-VILLE AVE OFF CR542
N	RIDGE LUMBER	LAKELAND	2544 MCJUNKIN RD
N	SADDLE CREEK MINE	LAKELAND	RR 33
N	SARGEANT FARMS	LAKELAND	KNIGHTS-GRIFFIN
Y	SHELL CHEMICAL CORP.,LAKELAND PLANT	LAKELAND	2525 S COMBEE RD
Y (PET)	SHELL SHORT STOP #3/FORE OIL CO	LAKELAND	5869 US HWY 98
Y (PET)	SPARKY'S FOOD STORE #122	LAKELAND	2320 MEMORIAL HWY
N	SUNPURE LTD.	HIGHLAND CITY	US98 N OF WALLACE RD
N	SWIFT CHEMICAL CO SILVER CITY MINE	BRADLEY JUNC.	
N	T/A MINERALS CORP	MULBERRY	SR 37
Y (PET)	TEXACO LOC NO. 24-203-1335	LAKELAND	1605 E EDGEWOOD DR
N	TRI-BRO, INC	LAKELAND	8804 HARRISON RD
N	TROPIC STAR SEAFOOD, INC.	LAKELAND	3620 VENTURA DR E
N	UNION CAMP CORP	LAKELAND	2808 NEW TPA HWY
N	UPS TRUCK LEASING	LAKELAND	655 MCCUE RD
N	USS AGRI-CHEM ROCKLAND SETT AREA N9	ROCKLAND MINE	1 1/4 MI N OF SR630
N	W.R. GRACE	MULBERRY	AKINS AREA
N	WELLMAN-LORD TRUST MINE	LAKELAND	MEDULLA RD

Source: DEP Industrial Wastewater Program.

1-8 WATERSHED STUDIES

A nutrient loading model was developed for the Tampa Bay National Estuary Program (Zarbock et al. 1994) which estimated nitrogen, phosphorus, and total suspended solids (TSS) loads to Tampa Bay from each of the major watersheds, including the Alafia River. To estimate flow in the river, the modelers used gaged flows for sites with long term record. For ungauged areas, a non-linear hydrologic model was developed to estimate the rainfall/runoff relationship. Sources of nutrients and TSS in the model included point and non-point sources, atmospheric deposition, and groundwater. Tampa Bay segment loads were estimated for four periods in time: benchmark (ca.

1940), worst case (ca. 1976), existing (1985-1991), and future (ca. 2010).

Based on the model estimates, non-point sources contribute the greatest percentages of the total loads of nitrogen (78 percent), phosphorus (67 percent) and total suspended solids (95 percent) in the Alafia River watershed for the existing conditions (Table 5-9). Among the point sources (domestic, industry and springs), industry contributes most of the phosphorus loading and springs contribute to most of the total nitrogen load. According to recent data collected by SWFWMD's Ambient Groundwater Quality Monitoring Program, Lithia and Buckhorn Springs alone are among the most nitrate-rich springs in Southwest Florida. These springs combine to contribute nitrate loads at a rate of 157 tons/year or 22 percent of the total nitrate loads to Tampa Bay.

The future estimated loads for the Alafia River watershed were not reported, however, Hillsborough Bay, the bay model segment receiving the load from the Alafia River, demonstrated a modest increase in total loading of nitrogen and total suspended solids, and a small decrease in phosphorus loading. The small increase in total nitrogen loading (from 1600 tons nitrogen per year for existing conditions to 1700 tons per year for future conditions) was a result of higher non-point source loads, and lower fugitive emissions loads. Fugitive emissions are incidents of chemical spills of nitrogen and phosphorus, primarily from the processing and transport of fertilizer chemicals and products.

Table 5-9. Estimates of loading and corresponding percentages of the total loads for the Alafia River watershed, adapted from Zarbock et al., 1994, "Estimates of Total Nitrogen, Total Phosphorus, and Total Suspended Solids Loadings to Tampa Bay, Florida". Estimates are for conditions (1985-1991). 'TN' = total nitrogen, 'TP' = total phosphorus, 'TSS' = total suspended solids.

	Tons/Year Total Load		
	Total N	**Total P**	**TSS**
Point Sources	121	192	285
Non-Point Sources	429	384	5208

Total	**550**	**576**	**5493**

	Percent of the Total Load		
	Total N	**Total P**	**TSS**
Point Sources	22	33	5
Non-Point Sources	78	67	95
Total	**100**	**100**	**100**

The contribution of on-site wastewater treatment systems (OWTS, or septic tank systems) and land application of wastewater residuals to the total nutrient load to Tampa Bay was recently (Ayers Associates, 1995). The total load from wastewater residual application sites in the Alafia River watershed was the third highest among the Tampa Bay watersheds behind the Hillsborough and Manatee watersheds with estimates of approximately 200 tons per year of total nitrogen, and between 300 and 400 tons per year of total phosphorus. The total load from OWTS was estimated to be approximately 45 tons of nitrogen, and 18 tons of phosphorus. If these estimates are of the proper magnitude, the combined loads are considerably less than loads predicted from the estimated total load of nitrogen (½ less) from all non-point and point sources in the Alafia River watershed estimated by Zarbock et al. (1994).

1-9 TOTAL MAXIMUM DAILY LOADS PROCEDURE

The Clean Water Act requires that the state develop more comprehensive lists of all polluted water bodies so that the public will have a clear picture of which waters are polluted and when they will be cleaned up. The Florida Department of Environmental Protection was given the responsibility to develop procedures for listing impaired water bodies, determine the water bodies that will require a TMDL (Total Maximum Daily Load) (Section 303d list) and to set TMDLs for those water bodies. Once these load targets are established, the Alafia CWM can review and prioritize the water bodies in water quality improvement efforts. To that end, the CWM team can assist local governments to cooperate with state agencies to make regional choices about which sources of pollution to clean up, and in what manner the clean up will occur.

1-10 WATER QUALITY DATA

Data is available though many different state agencies, local governments, volunteer organizations and utilities including the Southwest Florida Water Management District. A partial list of water quality data sources include:

- **Polk County Water Resources Department**

  Polk County Water Resources Division maintains a monitoring program for 84 lakes within the county. There are numerous man-made private Polk County lakes within the Alafia River watershed. They are not regularly monitored by the county.

- **Florida Lakewatch Volunteer Monitoring Program**

  Florida Lakewatch is a volunteer program developed by the University of Florida to monitor water quality in Florida lakes. Water quality samples are collected monthly on most program lakes, and samples are tested for concentrations of chlorophyll a, total phosphorus, and total nitrogen. In 1993, the list of parameters was expanded for a large number of the participant lakes, to include pH, total alkalinity, specific conductance, color, chloride, iron, silica, sulfate, calcium, magnesium, sodium, and potassium. Lakewatch is partially funded by the FDEP, and the data are provided to FDEP for use in water quality assessments. In Hillsborough County there are 150 lakes currently in the program.

- **Hillsborough County Lake Monitoring Program (Lamp)**

  Hillsborough County, in cooperation with the SWFWMD and the University of Florida Lakewatch Program, has enlisted volunteers for a lake monitoring program for nearly 150 lakes county wide, some of which are in the Alafia River watershed. The University of Florida Lakewatch program is a volunteer monitoring program, with active volunteers on some 600 lakes statewide. The program is supported in part by the Florida State Legislature through FDEP, and the data are available to water management agencies, as well as the public. In Hillsborough County, volunteers collect water samples and take measurements of water clarity monthly from their lakes. The samples are collected by county personnel, and delivered to the University of Florida laboratory where they are analyzed for nutrients and chlorophyll a. Samples are also collected periodically for analysis of other constituents, including pH, total alkalinity, specific conductance, color, chloride, iron, silica, sulfate, calcium, sodium and potassium. The University of Florida Lakewatch staff also provide training for volunteers in sample collection methods, habitat assessment, and lake management principles.

- **Hillsborough County Stream-waterwatch Program**

  Stream-Waterwatch is a program initiated by Hillsborough County in 1998 to develop volunteer monitoring of streams and rivers in Hillsborough County. In addition to collecting water chemistry samples, volunteers learn about principles of water management and become more involved in resolving local issues

affecting their flowing waters. The pilot Stream-Waterwatch program was funded by the Florida Game and Freshwater Fish Commission (now the Florida Fish and Wildlife Conservation Commission); funding is now shared between Hillsborough County and the SWFWMD. As with the LaMP program (2-7, above), Stream-Waterwatch will provide water managers and citizens with water chemistry and biological data for better assessing stream conditions and identifying management issues.

1-11 FLOW MEASURING STATIONS WITHIN THE WATERSHED

The United States Geological Survey (USGS) and District maintain several stage and flow measuring gages within the watershed (Table 5-10). Periods of record and frequency of measurement vary among the stations. Elsewhere within the watershed, the District measures stages on lakes with adopted levels and at its structures. The following Figures provide the names and locations (GS) of the gaging stations along with peak discharge rates for various frequency events at these and other locations in the riverine system.

Table 5-10. USGS Gaging Stations within the Alafia Basin - (note - 1975 data).

Gage Station Number	Stream or Lake Location	S-T-R	Latitude/ Longitude	Period of Record	Maximum Discharge or Stage	Minimum Discharge or Stage
2-3010	N. Prong	10-30-22	27°52'00"N 82°06'00"W	23 yrs.	9570 cfs	3.6 cfs
2-3013	S. Prong	9-29-22	27°48'00"N 82°07'04"W	12	2600 cfs	1.3 cfs
2-3013.5	Little Alafia	24-29-21	27°56'30"N 82°09'00"W	8	974 cfs	0 cfs
2-3015	Alafia	16-30-21	27°52'30"N 82°13'00"W	42	45,900 cfs	6.6 cfs

2-3016	Lithia Sprgs.	17-30-21	27°52'00"N 82°14'00"W	17	79 cfs	27 cfs
2-3013.14	Mizelle Cr.	27-30-22	27°52'00"N 82°06'17"W	5	33 cfs	0.77 cfs
2-3009	Scott Lake	17-29-24	27°58'00"N 81°56'00"W	20	169.19 ft.	160.28 ft.
2-3013.68	Medard Res.	36-29-21	27°55'00"N 82°10'08"W	4	59.4 ft.	50.48 ft.

Source - Hydrobiologic Assessment of the Alafia and Little Manatee River Basins, Dames and Moore, June, 1975.

1-12 GOVERNMENTAL AND OTHER WATERSHED ACTIVITIES

The Alafia River extends over two counties, and includes several metropolitan areas. All of these governmental units share interests in the Alafia River watershed. In addition, the federal government, the state, SWFWMD and HCEPC share regulatory responsibility for activities that potentially affect the water quality of surface and ground water. Some of the major management and planning entities and programs concerned with the Alafia River watershed are discussed in the following subsections.

- **Tampa Bay Swim Plan**

  Tampa Bay, the receiving water for the Alafia River, is ranked number one on the District's SWIM list of priority water bodies in need of restoration. The original SWIM Management Plan was approved by the SWFWMD Governing Board and by FDEP in 1988 (SWFWMD 1992b). The primary goals of the Tampa Bay SWIM program are to reverse the environmental degradation of the Tampa Bay estuarine system; to optimize water quality and habitat values, to support a thriving, integrated biological community; and to ensure the maintenance of a productive, balanced ecosystem complimentary with human needs and uses of the resource (SWFWMD 1992b). The original Tampa Bay SWIM plan identified 18 priority projects, all of which have either a direct or indirect effect on water quality in sub-basin water bodies as well as Tampa Bay. These projects include water quality assessment, prioritization of urban sub-basins (i.e., development of screening tools to estimate the relative non-point pollutant loads for Tampa Bay sub-basins), habitat restoration, and urban stormwater rehabilitation projects. The initial focus of the management plan was on the construction of physical restoration and rehabilitation projects. An updated SWIM management plan for Tampa Bay was completed in 1996.

- **Tampa Bay Estuary Program**

The Alafia River drains into Tampa Bay, which is one of 22 estuaries in the United States that are a part of the National Estuary Program (NEP). The NEP was created under the Clean Water Act and is administered by the USEPA. The Tampa Bay Estuary Program (TBEP) was established in 1991 to assist the community in developing a comprehensive plan to restore and protect Tampa Bay. The management committees are composed of private and public agencies and organizations. The document, "Charting the Course" management plan outlines the proposed action plans to address water and sediment quality, and natural systems issues in Tampa Bay and its watershed (TBEP 1996).

Water quality reached a low-point in Tampa Bay during the mid- to late-1970s, when widespread blooms of algae clouded the bay waters. The algae's blooms decreased the depth to which light penetrated, resulting in the loss of large areas of seagrass. Increased loading of nitrogen was identified as the cause of the algae blooms in the bay. Water quality has since improved. Most water quality gains have been attributed to advanced wastewater treatment, which can remove up to 90 percent of the nitrogen discharged to the bay. Municipal sewage treatment facilities now contribute 9 percent of the total nitrogen loadings to the bay, down from 40 percent in the mid-1970s. As the contribution of point sources has declined, NPS have assumed greater importance. NPS of nitrogen will likely increase over the coming decades, as the population of the Tampa Bay region continues to grow (TBNEP 1996).

The TBEP management objectives for water quality in Tampa Bay are to maintain and gradually reduce in-bay loadings of nitrogen and TSS. To achieve these objectives, the TBEP Management Plan presents action plans addressing the stormwater runoff, wastewater, atmospheric deposition, and toxic contaminant components of bay pollution. A schedule and cost estimate is presented with each action plan, and the key or lead implementing agencies are identified (TBEP 1996). Federal funding of the TBEP ended in 1997 with the completion and adoption by local governments of the Comprehensive Conservation Management Plan outlined in "Charting the Course." However, the implementation of the plan will continue under the locally funded TBEP.

Contributing to the goals of the TBEP, the FDEP recently finalized TMDLs for each of the Tampa Bay segments (Decision Document for Technical Approval/Disapproval of TMDL Submittal for Tampa Bay, Florida, approved and signed by Robert F. McGhee, Director, Water Management Division, USEPA Region 4, June 18, 1998).

The Tampa Bay SWIM program and the TBEP are complementary programs, and have worked together on all aspects of Tampa Bay restoration. Ultimately, PLRGs will be set for Tampa Bay sub-basins. The process of setting PLRGs brings together federal, state, district and local regulatory agencies to agree upon the pollutant reductions necessary to achieve predetermined restoration goals.

The process for implementing PLRGs has not been determined, but creative methods for achieving compliance with the sub-basin specific PLRGs, and for apportioning the pollutant reductions among the various contributors should be possible.

SECTION 2. SURFACE WATER QUALITY ISSUES

2-1 ACTION PLAN: SURFACE WATER QUALITY

Below are surface water quality issues, goals and actions identified by the Alafia Watershed Land and Water Linkage Task Force that fall under the water management responsibilities of the District:

Task Force Issues:

- Acid spills from fertilizer processing facilities.
- Runoff from streets in developments.
- Dead end canals with poor water exchange.
- Domestic/municipal wastewater discharges, including package treatment plants.
- Agriculture non-point source pollution.
- Impacts of Bell Shoals water withdrawals by Tampa Bay Water and Cargill on Tampa Bay fisheries and wildlife.
- Hardened shoreline structures reducing natural filtration function provided by native vegetation.
- Impacts of recreation on water quality (e.g., motorboats).
- Poor air quality reduces water quality.
- Deal with septic tank-based developments in or near floodplains.

Task Force Goals:

- To put a Hillsborough County moratorium, by 2002, on septic systems for new development directly on the Alafia River and develop the initiative to identify older and poor functioning systems and replace or hook to county water where available.
- To eliminate road flooding, river flooding, house flooding, etc. through adequately

structured drainage and retention of stormwater.

- To employ best management practices of stormwater in both agricultural and urban land development and land uses.

- To promote and fund ELAPP to buy river frontage land where vacant by renewing funding after 2000. Accelerate such purchases on lands already identified and combine with SWFWMD program to increase buying power.

- To identify where stormwater - sewage, fecal and industrial pollutants are entering the watershed, including those sources in Polk County and develop a corrective action plan to remediate, prior to permitting additional development.

- To ensure the proper design and development of mining facilities such that the chances of a major spill are minimized or practically eliminated.

- To ensure a swimmable/fishable river.

- To improve water quality through restoration of seagrasses and other natural vegetation along the banks of the Alafia River.

- To develop cooperative incentive based approach to encourage reduction in nutrient loadings in order to achieve/maintain goals of swimmable/fishable for the Alafia River.

- To establish water quality standards for the river and to implement best management practices to protect river water quality and enhance recreation uses. Also to monitor water quality along specific parts of the river.

- To improve water quality through restoration of sea grasses and other natural vegetation along the banks of the Alafia River.

- To reduce St. Augustine lawns along the Alafia River through public education.

Task Force Actions:

- Provide natural water quality management through the conservation and preservation of natural lands along the river corridor.

- Increase/improve regulation of point and non-point sources of pollution including industrial, agricultural and stormwater.

- Improve standards and increase enforcement fines for mining facility violators.

- More restricted development of river-front lands, coupled with stewardship and

vigilance.

- Improve agency coordination concerning water quality.

- Moratorium on septic systems for new development on the Alafia River. Development initiative to replace older and poor functioning systems or hook up to public water where available.

Below are surface water quality issues, goals and actions identified by the Alafia River CWM Team:

ISSUE 1 - Nutrient Pollution.

Water quality in the Alafia River, Alafia tributaries, lakes and other water bodies in the watershed, has been degraded over time due to high nutrient loads from point and non-point sources in their individual watersheds. Nutrient loads will likely increase as urban development extends into the relatively undeveloped agricultural and upland areas of the watershed.

Water quality in the Alafia River, Medard Reservoir and other water bodies in the watershed, have been degraded over time due to high nutrient loads from point and non-point sources in their individual basins. Nutrient loads will likely increase as urban development extends into the relatively undeveloped agricultural and upland areas of the watershed.

a. **Sub-Issue: Increased development and within the basin of the Alafia River watershed will increase the non-point source loading of nitrogen, phosphorus, and suspended solids in some basins within the watershed**. For the purposes of this project, the simple non-point load screening model developed for the Hillsborough River watershed should be applied to each of the sub-basins in the Alafia. The model estimates the existing loading potential for total phosphorus, total nitrogen, and total suspended solids (TSS), and predicts future changes in potential loading assuming land within each sub-basin is developed to the extent predicted in the county comprehensive plans.

b. **Sub-Issue: Non-point source pollutant (nutrient runoff) loads to lakes and tributaries in the Alafia River watershed will likely increase as development in the watershed increases**. Increased nutrient loading will likely increase the frequency and/or magnitude of algae blooms with possible fish kills. Small, shallow lakes with little development presently will likely experience the greatest and most rapid change in water quality as their watersheds are developed.

c. **Sub-Issue: Tampa Bay National Estuary Program has identified nitrogen as the limiting nutrient to the growth of phytoplankton in Tampa Bay, which is the ultimate receiving water body for the Alafia River**. Based upon a study of

the sources of nutrient loading in Tampa Bay, the Alafia River watershed contributed substantial loadings of nitrogen to the Bay from point and non-point sources. Reducing nitrogen loads to Tampa Bay will improve water quality and clarity, and permit the re-establishment of sea grass beds that were once widespread in the bay.

d. **Sub-Issue: The Alafia River was determined to be the highest contributor of nitrate to Tampa Bay than any other major tributary (Flannery, 1989)**. Lithia and Buckhorn Springs discharge nearly one quarter (22 percent) of the total nitrate to the Alafia River (approximately 157 tons annually).

e. **Sub-Issue: The land application of residuals from wastewater and on-site waste treatment systems (septic tank systems) may be major sources of nitrogen and, to a lesser extent, phosphorus in the Alafia River watershed**. The potential loading of nitrogen from land application sources should be identified and remedial action should be taken.

Goal:

No net increase in nutrient loading to the Alafia River; and manage nutrient loads to eliminate hypereutrophic conditions in lakes, streams, and river reaches in which they occur.

Strategies:

1. Implement the District's responsibilities outlined in the Tampa Bay National Estuary Program (NEP) action plans for nitrogen load reduction for the Alafia River watershed.

2. Develop pollutant load reduction goals for water bodies exhibiting poor water quality in the Alafia River watershed.

Actions:

1. Design a sampling program to assess the typical or background concentration of nutrients in water of the Alafia River, its tributaries, lakes within the basin, and the Medard Reservoir.

2. Determine pre-development (background) phosphorus loads to the Alafia River, to identify a feasible target for possible control of phosphorus loading in the watershed.

3. Develop a eutrophication/nutrient loading model for the Alafia River. Through modeling, identify basins and water bodies with the greatest nutrient loading potentials.

4. Utilizing data and conclusions from actions 2 and 3, develop and implement nutrient reduction plans.

5. Develop and continue to support efforts to expand, improve, and implement educational water resource programs that promote better understanding of water resource-related issues and their linkage to resource users. Such programs include the Adopt-a-Pond Program, Florida Yards and Neighborhoods Program, and similar existing programs.

ISSUE 2 - Toxic Contamination.

The presence of toxic substances, including heavy metals, pesticides and other chemicals, potentially could threaten the habitat of aquatic organisms in the Alafia River. Though not often detected in water samples, these contaminants accumulate to measurable quantities in sediments, and in some cases may bio-accumulate in the tissues of higher animals that are dependent for food on the organisms contaminated by toxic substances.

a. **Sub-Issue: Widespread use of pesticides in agricultural operations could have impacts on aquatic organisms (plant and animal) in the river and in the receiving estuary**. Pesticides, including insecticides, herbicides and fungicides, are primarily agricultural in origin. The Tampa Bay estuarine drainage areas in Florida were ranked second in the Nation in the highest per-unit-area application of the more hazardous pesticides (Pait et al. 1992). Endosulfan use on tomato crops was primarily responsible for these high ratings. Other pesticides used in the Tampa Bay estuarine watershed include the herbicide 2,4-D; the insecticides chlorpyrifos, diazinon, and methamidophos; and the fungicide chlorothalonil (Pait et al. 1992). An analysis of sediment quality in nine Atlantic and Gulf coastal areas of Florida identified the Tampa Bay as one of three areas of concern (MacDonald Environmental Sciences, Ltd. 1994). Therefore, it would be advantageous to quantify the level of pesticides in the Alafia River especially in areas of heavy agricultural activity (i.e., South Prong).

b. **Sub-Issue: Toxic contaminants including heavy metals, pesticides and other chemical substances may accumulate in the sediments.** Heavy metals and other chemical toxins are often present at low, nearly unmeasurable concentrations in water quality samples. However, these pollutants often are associated with suspended solids and accumulate in sediments. Evidence of pollution is therefore often detected in the sediments rather than in water samples.

Goal:

Increase the levels, quantity, accuracy and source information (including airborne deposition) of contaminant assessment.

Strategies:

Develop sufficient data to identify and map areas of the Alafia River watershed with elevated sediment concentrations of pollutants.

Actions:

1. Design a sampling program to assess the typical or background concentration of toxic materials in water and sediments of the Alafia River and its tributaries, and the Medard Reservoir.

2. Implement the sampling design, and identify the agencies responsible for sample collection, analysis and reporting. (Cooperators: District, FDEP, HCEPC, USEPA, local governments).

3. Map areas of toxic data coverage. Identify basins with no or inadequate sampling coverage, and basins that are suspected to have sources of contamination.

4. Provide information and educational service to citizens and resource users concerning opportunities and requirements for the safe use and disposal of chemicals.

5. Integrate agency education programs such as Xeriscape, Adopt-a-Pond, pamphlets and brochures, and the Hillsborough stormwater facility stenciling program. Provide funding for their continuation and expansion.

ISSUE 3 - Pathogens and Public Health Impacts.

The presence of bacteria, viruses, and protozoa in the Alafia River can restrict recreational use of the river, and poses a potential threat to drinking water supplies and public health.

a. **Sub-Issue: Bacteria concentrations in Turkey Creek have historically often been out of compliance with state water quality standards.** The Hillsborough County Environmental Protection Commission undertook a monthly water quality data collection effort between 1974 and 1995. Eighty-two percent of the total coliform and 85 percent of the fecal coliform data were not in compliance with class III State standards. Additional sampling is needed to identify the source,

and verify current levels of the bacteria.

b. **Sub-Issue: Lithia Springs and Medard Reservoir are the only official swimming areas in the Alafia Basin. Medard Reservoir has often experienced closures due to elevated bacteria. Lithia Springs has had few closures due to elevated bacteria.** To determine exceedances for monthly time periods, a minimum of 5 samples per month must be collected for class I waters, and 10 samples per month must be collected for class III waters. However, for both class I and class III waters, state standards specify that fecal coliform shall not exceed 800 per 100 ml and total coliform shall not exceed 2400 per 100 ml on any one day. It has been recognized that viral testing of water is a better indicator of harmful bacteria present, therefore, the use of viral rather than bacteria indicators should be encouraged.

c. **Sub-Issue: The enteric protozoa *Cryptosporidium* and *Giardia* in surface water and groundwater.** These two protozoa can inhabit the digestive tracts of animals including humans, causing diarrhea. The disease poses a threat primarily to the very young and the aged, as well as those with weakened immune systems. Once the animal is infected, these protozoa produce oocysts (*Cryptosporidium*) and cysts (*Giardia*), which are excreted in the animals wastes. The oocysts and cysts are inactive but viable stages of the protozoa life-cycle, and are very resistant to the environment as well as to common water treatment methods. If they are ingested they may cause infection, beginning the life-cycle again. Though probably always present in natural waters, recent large outbreaks of enteric disease have been attributed to these protozoa, increasing awareness of and concern about these organisms in drinking water supplies. Cattle are particularly susceptible to *Cryptosporidium* and are a probable source of this protozoa where cattle are maintained in concentrations near lakes, streams and rivers. It is anticipated that these protozoa will be of greater concern in the future as better surveillance for these pathogens is implemented.

Goal:

Increase knowledge of bacteria, viruses, and protozoa presence in locations other than designated swimming areas (i.e., Turkey Creek) that threaten the river and swimmers.

Strategies:

1. Determine the need for and levels of access to the river for swimming.

2. Determine the need for enhanced data collection of microbial indicators and pathogens in the river.

3. Determine where within the river septic tanks are a potential source and highlight

the possible need for more stringent density standards and mandatory inspections of septic tanks to ensure they are operating properly.

4. Work to alter State and Federal bacterial water quality standards for the closure of public bathing sites, as determined by the first two strategies (a suite of standards rather than just fecal and total coliforms).

ISSUE 4 - Data Gaps and Monitoring Needs.

There are no surface water quality data for many areas of the Alafia River watershed. Furthermore, the interval, frequency and quality of existing data is often inadequate and/or poor, limiting its usefulness to managers and planners for making informed decisions.

a. **Sub-Issue: We were unable to locate no historical or current water quality data for Buckhorn Creek, Rice Creek, Little Fishhawk Creek, McCollough Branch, McDonald Branch, Sloman Branch, Thirtymile Creek, English Creek, and Poley Creek basins. There are very limited water quality data for the South Prong and North Prong as well as Fishhawk Creek, Mizelle Creek, and Bell Creek basins.** An extensive bi-monthly water quality sampling program (primarily nutrients) is currently underway of twelve stations on the North Prong (the Florida Phosphate Council). A lack of adequate data from these tributaries will hamper monitoring water quality changes in, and will make it more difficult to efficiently manage the water quality. More sampling is needed.

b. **Sub-Issue: Parameters including mercury, arsenic, cadmium, copper, and lead are infrequently sampled in most waters.** In the case of mercury, the laboratory detection limit (typically between 0.1 and 0.5 µg/l) is often much greater than the state water quality standard (0.012 µg/l). For lead, the STORET records for the Alafia River watershed show detection limits ranging from 1 to 1000 µg/l, whereas the state standard for lead is 5.33 µg/l at a total hardness of 150 mg/l. Many of the early records in the STORET database dating to the early 1970s suggest high concentrations of lead and mercury in the Alafia River, but it is unclear if the reported concentrations actually exceeded the laboratory detection limits. Furthermore, sample contamination may also be a problem when trying to detect the extremely small concentrations represented by many of the state standards. Determining if these and other metals exceed the state standards for water quality samples is often not possible from the historical data and for most present-day data. The contaminants of concern in Tampa Bay were polycyclic aromatic hydrocarbons (PAHs, benzo (a)anthracene and benzo(a)pyrene). Lower priority contaminants of concern were arsenic, cadmium, chromium, copper, mercury, as well as the PAHs chrysene, fluoranthene, phenanthrene, and poly-chlorinated biphenyls (PCBs).

c. **Sub-Issue: Atmospheric deposition of airborne substances and particles is**

a potential source of nutrients and toxic materials in the Alafia River watershed. A recently completed nitrogen budget for Tampa Bay, which includes the Alafia River watershed, suggests that as much as 27 percent of the nitrogen and 31 percent of the total phosphorus entering the Bay comes from rainfall and dry deposition directly on the surface of the Bay (Zarbock et al. 1994). Moreover, U.S. Environmental Protection Agency-sponsored studies suggest that as much as 67 percent of the loading of total nitrogen delivered to Tampa Bay may originate from aerial deposition on the Tampa Bay watershed (Dixon 1994). In addition to nutrients, other contaminants in atmospheric deposition include zinc, lead, mercury, cadmium, copper, and other metals. More data will be necessary to accurately determine the distribution of pollutants of aerial origin in the watershed.

d. **Sub-Issue: Toxic contaminants including heavy metals, pesticides and other chemical substances have been detected in the sediment at sites in the lower Alafia River.** These observations are based on a limited number of samples and it is not known how these substances are distributed in the river, or to what extent the sources of the toxins are current or historical in origin (this sub-issue is also discussed in greater detail in Issue #2, 'Toxic Contamination').

e. **Sub-Issue: The extent and the sources of *Cryptosporidium* and *Girardia* contamination of the Alafia River are not well known.** It is suspected that dairies, feedlots, and other high-density animal husbandry operations in the watershed may be significant sources (see also Issue #3, 'Pathogens and Public Health Impacts').

Goal:

Prioritize monitoring and ambient data collection needs in the watershed (surficial aquifer in the coastal areas, basins without information, etc.).

Strategy:

Improve efficiency and coordination in water quality data collection within the District, and among agencies/ local governments.

Actions:

1. Use existing water quality information (ambient assessments) to prioritize river reaches and associated basins for monitoring.

2. Compile a comprehensive map of all monitoring sites in the Alafia River watershed, including responsible agencies, frequencies, and parameters sampled. (Cooperators: District, FDEP, HCEPC, Hillsborough and Polk Counties, others). Water quality monitoring is often required of phosphate operations as

part of dredge and fill, and environmental resource permit issuance, therefore, these data should be researched, obtained, and included in the monitoring site map.

3. Develop a system to exchange information and coordinate sampling procedures and protocols among all agencies and interested entities (utilize EPC and TPC E-net, environmental network).

ISSUE 5 - Groundwater Discharge Effects on Surface Water Quality.

The Alafia River receives discharge from Buckhorn Springs and Lithia Springs, and from smaller groundwater sources along its length. Generally declining flows of groundwater will have effects on quality in the areas of discharge and potentially in downstream segments and the estuarine habitats.

a. **Sub-Issue: See nutrient pollution Issue 1.**

ISSUE 6 - Stormwater Runoff Pollutant Loading.

Stormwater runoff can be a significant source of nutrients, metals, suspended solids, bacteria, pesticides, petroleum hydrocarbons, and PCB's. The greatest percentage of stormwater runoff is still discharged untreated from both agricultural and urban developments that existed before Stormwater management rules were implemented. Priorities for this issue include determining locations of potential stormwater retrofits, address wetlands, surface and ground water interactions, and intergovernmental coordination.

Goal:

Identify location of most intense areas of stormwater runoff and prioritize steps for improvement.

Strategies:

1. Determine pollutant load reduction goals for all basins.

2. Manage District-owned lands as models to demonstrate the most innovative and effective practices and technologies for activities with the potential to affect water quality.

3. Manage surface waters to maximize the treatment potential of natural or restored systems without degradation of such systems.

4. Coordinate land acquisition with the regional need to remediate non-point sources of pollution.

5. Employ stormwater designs that use the entire drainage basin and reduce discharge to pre-development levels. Bioretention in ditches, swales and depressions are methods to achieve this goal. Other methods include infiltration trenches for roof runoff, trash traps in street drains and reuse of stormwater runoff.

6. Mandate better designs for stormwater ponds that include longer residence times, an open water permanent pool (<9 feet deep), and a wide littoral shelf to provide more than one process for removing pollutants. The Conservation Wet Detention design incorporates all these characteristics.

7. Develop environmentally friendly methods for controlling nuisance vegetation in stormwater ponds. More research is needed and guidelines published that can be used by the people responsible for pond maintenance. The Adopt-A-Pond program needs to be expanded as part of a maintenance strategy and to encourage citizen education and participation.

8. Remove accumulated stormwater sediments as needed to protect water quality and wildlife. Pre-treatment basins cleaned out on a regular schedule will reduce the cost of treating the entire pond and will improve the aesthetics of the treatment pond. Methods for determining this schedule needs to be developed. This could include a biological assay, sediment sampling or benthic invertebrate diversity indices.

9. Inspect all storm water pipes, inlets, ditches, swales, catch basins, manholes, flumes, pond inflow and outfall structures and discharge pipes after major rain events. Special attention should be paid to removing built-up debris and vegetation and repairing deteriorating structures. Also upland areas contributing sediments because of erosion need special attention and correction.

10. Reduce the source of air pollution from automobiles, power plants and industrial processes to help clean up stormwater runoff.

11. Purchase land for stormwater detention and promote regional stormwater systems to solve pollution problems in existing urban and agricultural areas. Developing a master plan to decide watershed capacities should be a first step in land acquisition. Mitigation banks could be a part of this strategy.

12. Monitor downstream habitats to learn how well stormwater management systems improve degraded natural aquatic systems or maintain the integrity of more pristine wetlands and streams.

13. Encourage local governments to develop adequate, dedicated funding sources to address stormwater infrastructure deficiencies.

14. Reduce impervious paved surfaces, focusing on parking space and design requirements for large commercial developments.

15. Encourage basin wide stormwater pollution control measures throughout the watersheds. This can be carried out through entities such as a Florida Yards & Neighborhoods Program and local governments.

16. Improve compliance with and enforcement of stormwater permits.

17. Continue stormwater management design research. Water treated by stormwater management systems approved by the District often still do not

    comply with state water quality standards. More research is needed to improve pollution removal and to reduce storm runoff further.

18. Require fewer and/or smaller parking spaces for developments, particularly malls and multi-family dwellings and encourage parking lot designs that use swales and permeable paving. Redesign of existing parking lots might be encouraged by basing stormwater utility rates on impervious surfaces.

19. Make an inventory of all pipes entering the river and its tributaries and identify the source of each. Develop and implement strategies to reduce and improve inventoried discharges to the Alafia River.

20. Publish a stormwater maintenance manual suitable for homeowners associations.

ISSUE 7 - Inter/Intra-Agency Coordination.

As the population in the Alafia River watershed and the encompassing region continues to expand, impacts to the watershed will require coordination between the many agencies and public interest groups concerned with water management to minimize impacts.

a. **Sub-Issue: Due to the groundwater contamination potential and the presence of potential pollution sources within the Alafia River watershed, proactive strategies are needed for long-term groundwater quality protection.** Areas requiring ground-water quality protection include recharge areas for springs, and areas highly susceptible to ground-water contamination. High density septic tank usage, agriculture, and phosphate mining/processing up gradient of the springs, pose a potential water quality threat. An action plan should be developed to protect the springs by implementing recommendations in

AGWQMP's Lithia Buckhorn report (if not already done). Encourage participation from the USGS, FDEP, SWFWMD, and the local governments.

Goal:

Develop strong, possibly formal, links and mechanisms between agencies, within agencies and with the public to coordinate and communicate water quality issues and activities.

Strategies:

1. Expand and formalize the Alafia River CWM workgroup (or other task force groups as appropriate) as a forum for the presentation of data, ideas, issues and conflicts for discussion and consensus resolution. A single, public workgroup for the Alafia River watershed would be able to address issues from a watershed perspective and coordinate activities that have consequences for multiple AORs.

2 . Support the District's D-BUG efforts to ensure availability and transparency of information contained in District databases. Make District databases widely available to outside agencies and the public, possibly through the Internet.

ISSUE 8 - Effects of Sewage Waste Residuals Disposal on Ground and Surface Water Quality.

Areas in the Alafia River watershed have been used for the disposal of solid sewage wastes. Although ordinances are in place regulating this activity, data are sparse regarding the effects of this sewage disposal on nearby surface and ground waters and the effectiveness of related ordinances. An assessment of water quality in streams near areas of sewage waste disposal should be conducted.

Strategy:

Assessments should be of surface and water quality in areas which have been used for the disposal of sewage waste residuals. If problem conditions are found, ordinances concerning disposal of these materials should be reviewed for their effectiveness.

Actions:

1. Identify areas in the Alafia River watershed that are used for the disposal of sewage waste residuals.

2. Design a surface water quality monitoring program to examine water quality in areas of sewage residual disposal, including non-affected control sites.

3. Review the effectiveness of existing ordinances for maintaining surface water

quality and suggested model ordinances if problems with existing ordinances are found.

ISSUE 9 - Water Quality Protection through Public Land Acquisition.

Both the Southwest Florida Water Management District and the Hillsborough County Environmental Lands Program have purchased tracts in the Alafia River Watershed to be placed in public ownership. Various studies have shown that buffer strips around streams and other water bodies is an effective way to protect water quality. Land acquisition programs should continue in the Alafia watershed in order protect the resource including its water quality. The preservation of lands near the river channel should act to maintain water quality and biological integrity of the Alafia River.

Strategy:

Continued public land purchases in the watershed should include selection criteria to protect water quality in the Alafia River and its tributaries.

Actions:

1. Incorporate water quality criteria in the selection process for land acquisition. Such criteria can be used to protect areas that have good water quality or to restore water quality in areas where intensive land uses may be converted to vegetated land cover

2. Prioritize lands in the Alafia River watershed for acquisition based on value to natural resources, including habitat value and relations to water quantity and quality.

ISSUE 10 - The Effect of Phosphogypsum Impoundment Structure Failures on Surface Water Quality.

The Alafia River has a history of catastrophic and minor earthen dam/levy breaches that release caustic acids and clay settling pond waters. The most common causes for past failures of earthen dams used for impoundment of liquid industrial wastes from phosphate mining and processing operations have been insecure foundations, inadequate supervision of construction, poor routine inspections, and/or inadequate maintenance (FAC, Chapter 62-672). The recent uncontrolled discharge occurred on December 7, 1997 from atop the Mulberry Phosphates, Inc.'s waste gypsum stack located at Mulberry, Florida. Approximately 54 million gallons of highly acidic process water flowed into a tributary of the Alafia River and eventually to the estuary at the mouth of the river and Tampa Bay. Approximately 5 million pounds of aquatic fauna in the path of the spill was killed along with much of the aquatic flora.

Strategy:

Determine underling causes, review existing industry practices, rules, regulations and statutes pertaining to phosphogypsum impoundment structures. Propose alternative best management practices for construction, quality assurance, design and operations of such structures and recommend measures to prevent a recurrence of these failures.

Actions:

1. Actively participate in the FDEP Phosphogypsum Impoundment Technical Advisory Forum and recommend procedural and regulatory measures to prevent a recurrence of impoundment failures.

2. Recommend disallowing all decant pipes that are laid through the impoundment dams and recommend syphon type decant pipes.

3. Recommend perimeter seepage ditch/storage areas that will contain the volume of the process water atop the waste gypsum stack. This additional area could contain a dam breach.

4. Study the feasibility of emergency tankers to spray lime into the spill front as it flows down river. The lime can help naturalize the acid.

ISSUE 11 - Water Quality Trends and Dissolved Oxygen Concentrations in the Alafia River.

Increasing trends in several constituents in the Alafia River watershed could be attributable to agricultural and residential land use. Changes in agricultural practices and increased water use efficiencies in the last several years may, however, have alleviated some of these problems. Trends and concentrations in the Alafia River at previously studied sites should be reexamined to determine if water quality trends in the river are improving, declining, or showing no change.

There have also been periodic violations of Class III dissolved oxygen standards in the tidal reaches of the Alafia River, but these have all involved daytime readings. A more thorough study of dissolved oxygen concentrations in the Alafia River estuary should be conducted with emphasis on nighttime and predawn readings. If problems with hypoxia (oxygen deficiency) are found, assessments should be conducted to determine causative factors.

Strategy:

Reexamine water quality trends and dissolved oxygen concentrations in the Alafia River

and evaluate factors contributing to these conditions.

Actions:

1. Using existing data sources (USGS and HCEPC), reexamine trends in water quality constituents in the Alafia River.

2. During the summer months evaluate dissolved oxygen concentrations in the Alafia River estuary. If problem conditions are observed, investigate factors contributing to such conditions.

3. Assess agricultural irrigation runoff to streams.

Projects:

Project Name: Alafia River Basin Surface Water Data Collection
Project Description: The cooperative funding data program between the District and the United States Geological Survey provides basic data collection to support District regulatory and resource management initiatives, focusing on surface water flow, levels, and water quality. These data are critical for assessing flooding events, developing surface water management master plans for local governments, facilitating habitat restoration projects, and supporting the District's water resource assessment projects as well as development of minimum flows and levels and CWM initiatives. The proposed budget will cover 14 surface water sites and 8 water quality sites. The costs for this program are split between the District and the United States Geological Survey.
Location: Watershed
Participants: SWFWMD/USGS
Implementation Schedule: 10/1/00-11/30/00
How Financed: 50% SWFWMD, 50% USGS

Project Name: Sumner Road Stormwater Management Improvement
Project Description: The goal of this project is the construction of a stormwater pond and wetland system to treat stormwater runoff from 127 acres of agricultural lands draining directly to Bullfrog Creek, and, ultimately, Tampa Bay, a SWIM priority waterbody. The major land use in the Bullfrog Creek Basin is agriculture and erosion occurs due to man-made alteration of the natural drainage system. Severe erosion is impacting the existing conveyance system and wetland areas. Flooding is also a common occurrence along Sumner Road during heavy rains. Phase I consists of a seven-acre stormwater pond proposed to control sediment deposition, provide water quality treatment, restore floodplain forest and marsh habitat, and reduce flooding. A variety of marsh plants and wetland trees, including pickerelweed, soft rush, sweetbay, cypress, popash, and dahoon holly will be installed within 3 ½ acres of the pond to provide wildlife habitat and water quality (i.e. nutrient uptake) functions. The occurrence of street flooding is also expected to decrease significantly. Phase II consists of the implementation of erosion control measures along an existing outfall ditch that will carry

overflow from the stormwater pond directly to Bullfrog Creek.
Location: Bullfrog Creek sub-basin
Participants: SWFWMD/Hillsborough County
Implementation Schedule: 11/1/1998-3/31/02
How Financed: SWFWMD, Hillsborough County

Project Name: Hillsborough Lake/Stream Monitoring Program
Project Description: This is a continuation of the 1997- 2000 Lake Management Program. The goals of the program are: (1) include 120 county lakes in the University of Florida Lake Watch Program that monitors lake water quality throughout the state; (2) training citizen volunteers to collect and measure water quality samples; and (3) training lake property owners in lake management techniques and general public education in water resource and wetland preservation. Using volunteers, it is possible to collect much more water quality data than would otherwise be possible by agency staff alone. These data are available through the Lake Atlas project, as well as through annual reports from the University of Florida. These data are valuable for characterizing the quality of surface waters in a large geographic area, for documenting long term water quality trends, and also for early detection of declining water quality. The program will continue activities related to the Lake Management Program while adding funding for Hillsborough Stream-Waterwatch.
Location: Watershed
Participants: SWFWMD/Hillsborough County
Implementation Schedule: 10/1/00-
How Financed: 50% SWFWMD, 50% Hillsborough County

SECTION 3. GROUND-WATER QUALITY

Ground-water quality is affected by the quality of the recharge waters, the porous media through which the water flows, and the duration of contact with the porous media (Brown 1983). In the Alafia River watershed, ground-water quality may also be affected by mixing with seawater or mineralized waters from lower depths.

3-1 SURFICIAL AQUIFER

The surficial aquifer consists primarily of unconsolidated fine-grained sand deposits which vary in thickness from zero to greater than 50 feet (Wolansky 1979). In the Alafia River watershed, the surficial aquifer is used to a limited extent for residential irrigation and livestock watering. Generally, the quality of the water is good except in the tidally influenced areas along the coast (Brown 1983). Water quality in the surficial aquifer is affected by precipitation, agricultural practices, septic systems, discharges from the Floridan aquifer, and the location of the freshwater/saltwater interface. Table 8 presents water-quality data for three surficial aquifer wells (wells 1, 2 and 3) located in or near the Alafia River watershed. Well 1 is the closest coastal well with surficial aquifer water-quality data. These wells are selected showing representative ranges of water quality.

The ionic content, a measure of the quantity of materials dissolved in water, is high in the surficial aquifer along the coast of Hillsborough County. High total dissolved solids (TDS), chloride, and sulfate in the Alafia River watershed are due to mixing with seawater and the upward leakage of mineralized waters through fractures in the Floridan aquifer. Within five miles of the coast, TDS levels in the surficial aquifer generally range from 250 mg/L to 500 mg/L (AGWQMP 1990) (FDEP Drinking Water Standard for TDS is 500 mg/L). As indicated in Table 8, an elevated TDS value of 728 mg/L was measured at well 1, located in southern coastal Hillsborough County. The high TDS and sulfate levels observed in this surficial well may be indicative of seawater intrusion. The infiltration of urban and agricultural runoff, may also contribute to high TDS in the surficial aquifer. The location of the saltwater front in the Alafia River migrates in response to tidal and stream flow fluctuations and can be found significant distances inland (AGWQMP 1990). In the portion of the Alafia River watershed, the ionic content of the surficial aquifer is low, with TDS content generally less than 360 mg/L (AGWQMP 1996). Water from wells 2 and 3, located in the eastern portion of the watershed, exhibits TDS levels between 51 mg/L and 355 mg/L.

Iron levels in the surficial aquifer may approach or exceed the drinking water standard of 0.3 mg/L. Elevated iron levels (well 1) result from the natural abundance of iron in sediments, organic material, and rainfall. High iron levels in surficial aquifer wells may also result from iron-producing bacteria.

Nitrate levels are frequently higher in the surficial aquifer (well 2) than in the Upper Floridan aquifer. However, it was not possible to confirm this generalization for the Alafia River watershed due to the limited amount of surficial aquifer water quality data. Elevated nitrate levels in the surficial aquifer result from the application of nitrate fertilizers in agricultural areas and the presence of septic systems and leaking underground sewage pipes (AGWQMP 1990). High nitrate levels may also be associated with cattle operations.

3-2 INTERMEDIATE AQUIFER

The ionic content of water in the intermediate aquifer is generally higher than that of the surficial aquifer ground water. This is because ground-water residence times in the intermediate aquifer are longer that in the surficial aquifer. In addition, the clay, marl, limestone, and phosporite deposits that comprise the intermediate aquifer are more soluble and contribute ions to solution much more readily than the quartz-rich sediments of the surficial aquifer (SWFWMD 1991). Intermediate ground water is potable throughout most of the area. Only the coastal well 1 has high TDS in the watershed. Ionic concentrations steadily decrease inland from Tampa Bay and reach a minimum in the central watershed. Concentrations begin to increase in the southeastern part of the watershed. This can possibly be attributed to phosphate mining activities. Rutledge (1987) notes that contamination of deeper aquifers can be accelerated by breaching of the confining layer caused by mining or inter-aquifer connector wells.

Table 9 presents water-quality data for three intermediate aquifer wells (wells 1, 2 and 3) located in the Alafia River watershed. Well 1 is the closest coastal well with intermediate aquifer water-quality data.

High total dissolved solids (TDS), chloride, and sulfate in the Alafia River watershed are due to mixing with seawater and the upward leakage of mineralized waters through fractures in the Floridan aquifer. Within five miles of the coast, TDS levels in the intermediate aquifer generally range from 250 mg/L to 600 mg/L (AGWQMP, 1990). As indicated in Table 9, an elevated TDS value of 355 mg/L was measured at well 1, located in southern coastal Hillsborough County. The high TDS level observed in this intermediate well may be indicative of seawater intrusion.

Iron levels in the intermediate aquifer may approach or exceed the drinking water standard of 0.3 mg/L. Elevated iron levels (well 1) result from the natural abundance of iron in sediments, organic material, and rainfall.

3-3 UPPER FLORIDAN AQUIFER

Throughout the Alafia River watershed, the surficial aquifer is separated from the Upper Floridan aquifer by the intermediate aquifer system semi-confining units. The thickness of the semi-confining units averages about 150 feet (SWFWMD 1993). The semi-confining unit is as thick as 300 feet. The underlying Upper Floridan aquifer is a continuous series of carbonate units consisting of limestone and dolomite. Due to contact with soluble limestone and evaporites, ground water from the Upper Floridan aquifer usually contains greater mineral content and hardness than ground water in the surficial aquifer (Tables 5-11 and 3-13). Water quality will vary as a function of residence time in the aquifer, with longer residence times generally resulting in greater mineral content. Table 5-12 presents water quality data for three Upper Floridan aquifer wells located in the Alafia River watershed.

Ground water from well 1, located in the coastal portion of the watershed, exhibits high sulfate and TDS values (Table 10). Proximity to the coastal saltwater interface results in higher mineral and TDS concentrations. Wells 2 and 3 exhibit water quality characteristic of inland ground water.

Table 5-11. Water Quality in Selected Surficial Aquifer Wells.

Physical Parameters	Well 1	Well 2	Well 3	Potable Standard[3]
pH, field	5.6	6.6	8.5	> 6.5
Temperature, °C	25.4	23.4	27.5	n/s
Specific Conductance, (µmhos/cm)	1500.0	598.0	45.0	n/s

Total Hardness (mg/L as $CaCO_3$)	226.6	n/d	3.0	n/s
Major Ions (mg/L)				
Dissolved Solids (calculated)[1]	727.6	355.0	51.0	500.0
Bicarbonate[2] (mg/L as $CaCO_3$)	n/d	137.0	0.74	n/s
Calcium	64.0	54.0	0.29	n/s
Carbonate[2]	n/d	< 2.0	< 0.10	n/s
Chloride	332.0	30.0	7.0	250.0
Fluoride	0.10	0.29	0.20	4.0
Iron	6100.0	< 30.0	< 0.03	0.3
Magnesium	16.0	22.0	0.54	n/s
Nitrate	n/d	16.6	< 0.001	10.0
Phosphate	n/d	n/d	0.03	n/s
Potassium	14.0	25.0	0.01	n/s
Sodium	120.0	18.0	3.2	160.0
Sulfate	150.0	42.0	< 0.1	250.0

Data source: Ambient Ground-Water Quality Monitoring Program database (AGWQMP, 1996).
[1]Represents calculated value for TDS (180°C).
[2]Calculated value.
[3]Exceptions apply, See F.A.C, Chapters 62-550, 62-551, 62-555, & 62-560, FDEP Rules.
n/s: no standard; n/d: no data
1 10902-0, ROMP TR 9-2 - 274555 822336 - sample date: 6/30/93
Hillsborough County (total depth: 20 ft. casing depth: 10 ft.)
2 732-0, BOYETTE - 275113 821626 - sample date: 4/11/96
Hillsborough County (total depth: n/d casing depth: n/d)
3 737-0, ROMP 48 WT MONITOR - 274427 820837 - sample date: 8/20/85
Hillsborough County (total depth: 14 ft. casing depth: 10 ft.)

Table 5-12. Water Quality in Selected Intermediate Aquifer Wells.

Physical Parameters	Well 1	Well 2	Well 3	Potable Standard[3]
pH, field	7.2	7.2	8.1	> 6.5
Specific Conductance, (µmhos/cm)	598.0	n/d	n/d	n/s

Total Hardness (mg/L as $CaCO_3$)	259.0	131.0	196.0	n/s
Major Ions (mg/L)				
Dissolved Solids (calculated)[1]	355.0	138.0	219.0	500.00
Bicarbonate[2] (mg/L as $CaCO_3$)	207.0	144.0	233.0	n/s
Calcium	61.0	28.5	44.4	n/s
Carbonate[2]	n/d	0.01	0.01	n/s
Chloride	55.0	4.18	4.42	250.00
Fluoride	n/d	0.27	0.54	4.00
Iron	1464.0	n/d	n/d	0.30
Magnesium	n/d	14.5	20.7	n/s
Nitrate	n/d	< 0.38	< 0.38	10.00
Sodium	24.0	2.43	7.74	160.00
Sulfate	17.0	6.52	7.63	250.00

Data source: Ambient Ground-Water Quality Monitoring Program database (AGWQMP, 1996).
[1]Represents calculated value for TDS (180°C).
[2]Calculated value.
[3]Exceptions apply, See F.A.C, Chapters 62-550, 62-551, 62-555, & 62-560, FDEP Rules.
n/s - no standard

1 976-0, BRADBURN WELL - 275223 821950 - sample date: 1/5/95
Hillsborough County (total depth: 80 ft. casing depth: 63 ft.)
2 11708-0, ROY DAVIS-HRS - 275055 820954 - sample date: 3/3/87
Hillsborough County (total depth: 54 ft. casing depth: 41 ft.)
3 958-0, S.A. MASTEN-HRS - 274940 820514 - sample date: 3/4/87
Hillsborough County (total depth: 240 ft. casing depth: 99 ft.)

Table 5-13. Water Quality in Selected Upper Floridan Aquifer Wells.

Physical Parameters	Well 1	Well 2	Well 3	Potable Standard[3]
pH, laboratory	7.1	7.4	7.8	> 6.5
Temperature, °C	23.9	25.0	24.5	n/s
Specific Conductance, (µmhos/cm)	1974.0	140.0	295.0	n/s

Total Hardness (mg/L as $CaCO_3$)	949.0	n/d	n/d	n/s
Major Ions (mg/L)				
Dissolved Solids (calculated)[1]	1520.0	98.0	180.0	500.00
Bicarbonate[2] (mg/L as $CaCO_3$)	145.0	60.98	170.73	n/s
Calcium	243.0	n/d	33.0	n/s
Carbonate[2]	n/d	< 2.0	< 2.0	n/s
Chloride	172.0	11.0	7.0	250.00
Fluoride	n/d	0.21	0.57	4.00
Iron	140.0	< 20.0	< 20.0	0.30
Magnesium	83.0	1.0	14.0	n/s
Nitrate	n/d	3.4	< 0.01	10.00
Phosphate	n/d	n/d	n/d	n/s
Potassium	3.80	0.36	0.71	n/s
Sodium	99.0	5.70	10.0	160.00
Sulfate	714.0	< 0.01	0.17	250.00

Data source: Ambient Ground-Water Quality Monitoring Program database (AGWQMP, 1996).
[1]Represents calculated value for TDS (180°C).
[2]Calculated value.
[3]Exceptions apply, See F.A.C, Chapters 62-550, 62-551, 62-555, & 62-560, FDEP Rules.
n/s: no standard; n/d: no data

1 985-0, Well 220 at ADAMSVILLE - 274928 822255 - sample date: 1/5/95
Hillsborough County (total depth: 80 ft. casing depth: 33 ft.)
2 1072-0, MOSELEY - 275340 821633 - sample date: 9/19/91
Hillsborough County (total depth: 80 ft. casing depth: n/d ft.)
3 1068-0, RAMSEY - 275152 820501 - sample date: 9/18/98
Hillsborough County (total depth: 205 ft. casing depth: n/d ft.)

3-4 AREAS SUSCEPTIBLE TO GROUND-WATER CONTAMINATION

The USEPA's DRASTIC methodology has been applied to all five water management districts to identify areas susceptible to ground-water contamination. The DRASTIC methodology was developed to evaluate the ground-water pollution potential of any hydrogeologic setting, greater than 100 acres in size, with existing information

(SWFWMD 1988). The seven parameters used to evaluate the DRASTIC pollution potential are: (1) Depth to Water, (2) Net Recharge, (3) Aquifer Media, (4) Soil Media, (5) Topography, (6) Impact of the Vadose Zone, and (7) Hydraulic Conductivity. The end product of the DRASTIC methodology is a map depicting color-coded areas of ground-water pollution potential. Each area is assigned a pollution index which ranges from 23 (lowest pollution potential) to 230 (highest pollution potential). For a detailed discussion of the DRASTIC methodology, the reader is referred to USEPA/600/2-85/018, May 1985.

The DRASTIC methodology was developed to be applied universally, and as such, may provide misleading results for certain hydrogeologic systems. Swancar and Hutchinson (1992) found that the DRASTIC indices do not agree with the results of ground-water chemistry analyses in the northern part of the SWFWMD. Within the Alafia River basin, the DRASTIC index generally shows the potential for contamination to the Floridan and intermediate aquifer to be very low and a high potential for contamination to the surficial aquifer.

The potential for ground-water contamination in wetland areas is a function of the level of connection between the wetland and underlying aquifers. In the Alafia River watershed, there are very few natural lakes. Connection through sinkhole-related formations to the intermediate or Floridan aquifer may exist in natural and man-made lakes and phosphate pits. During the early history of Lake Grady, a sinkhole formed and drained the lake. The sinkhole was filled and the lake reestablished. Wetlands due to sinkholes are very few in the Alafia watershed. There is very little recharge in the area and most of the rainfall occurring in the area flows across the ground surface as runoff rather than recharging the intermediate or Floridan aquifer.

Although discharge areas and areas with little recharge have a lower ground-water contamination potential, any change in the head gradient can alter this susceptibility. Areas of large ground-water withdrawals, which were naturally discharge areas or had little recharge prior to pumping, may become recharge areas due to lowered heads in the aquifers. This concept is referred to as induced recharge.

The Alafia River watershed is an area of potential induced recharge due to intense agricultural and public supply pumping withdrawals. Ground-water withdrawals from the upper Floridan aquifer have lowered its potentiometric surface water levels creating a potential induced recharge area. When an aquifer changes from discharging to recharging conditions, the potential for ground-water contamination in the surficial aquifer increases. The degree of ground-water contamination potential in areas of an induced recharge depends on both hydrogeologic properties (such as thick, low-permeability clays in the Hawthorn Group sediments) and the rate of ground-water withdrawal, and therefore can be variable over time.

DRASTIC indices and other hydrogeologic indicators are measures of susceptibility to ground-water contamination and are independent of the presence of actual pollutant

sources. A high pollution potential does not indicate that ground-water contamination will occur, only that contamination could occur if pollutant sources were present. Potential pollutant sources in the Alafia River watershed include landfills, borrow pits, mining activities, stormwater ponds, septic systems, and urban and agricultural runoff. Ground-water may also be contaminated through the inadvertent release or spill of industrial or agricultural chemicals or waste products. A detailed discussion of the potential for ground-water contamination from man-made byproducts in the Tampa Bay area is presented by SWFWMD (1995a).

SECTION 4. AVAILABLE DATA

Local, regional, state and federal agencies compile data pertaining to ground and surface water resources in the Alafia River watershed. The District has a comprehensive hydrologic conditions monitoring program. Conditions that are monitored include rainfall, evaporation, lake levels, ground-water levels, springflow, water quality, and river discharge and stage elevation. Map 7 depicts SWFWMD hydrologic monitoring sites located within the Alafia River watershed.

4-1 UNITED STATES GEOLOGICAL SURVEY

The United States Geological Survey (USGS) collects, analyzes and reports water quality for several stations within the Alafia River watershed, primarily at road crossings of major tributaries. The data in many cases represent the best available historical flow and water quality data available. However, the USGS has, within the last few years, greatly reduced its water quality monitoring program.

4-2 FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

For the Surface Water Ambient Monitoring Program, the FDEP is establishing a statewide monitoring network of river and lake stations for the regular collection of water quality samples. The FDEP also contracts with the water management districts, through the Ambient Ground Water Quality Monitoring Program, to collect surface water samples from water bodies.

4-3 THE HILLSBOROUGH COUNTY ENVIRONMENTAL PROTECTION COMMISSION

The Hillsborough County Environmental Protection Commission (HCEPC) maintains a monitoring program for the regular collection and analysis of water quality samples from lake and stream stations throughout Hillsborough County. Within the Alafia River watershed are nine monitoring stations (HCEPC 1995).

4-4 SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

The Ambient Monitoring Program will collect water quality information on more than 300 lakes District wide. Samples are collected from each lake on a three-year rotation (i.e., a group of 100 lakes is sampled in the summer and winter each year; a second group is sampled the following year, and so on, until the fourth year when the first group is sampled again). Samples are tested for a broad range of typical water quality parameters, including nutrients, chlorophyll, metals, and cations. Some of these lakes are within the Alafia River watershed. The District also has an extensive ground-water quality monitoring program.

4-5 TAMPA BAY WATER

Tampa Bay Water supplies water from wellfields and reservoirs to a portion of the Alafia River Watershed and has a ground-water quality database covering Pasco, Hillsborough and Pinellas Counties.

SECTION 5. REGULATORY AUTHORITY AND SPECIAL RULES

The FDEP plays the lead role in the regulation of water quality within the Alafia River watershed. In some realms of management and regulation, the Department has delegated responsibility to the water management districts, including stormwater management, SWIM planning and implementation, and environmental permitting. In addition, authority has been granted by FDEP to the HCEPC to perform many of the FDEP responsibilities for management and permitting within Hillsborough County.

5-1 DOMESTIC WASTEWATER RESIDUALS

Areas of the Alafia River watershed are used for the land spreading of domestic residuals (sludge). Residuals contain pollutants that have been removed from wastewater during the treatment process. Chapter 62-640, F.A.C., Domestic Wastewater Residuals, regulates these activities. Domestic residuals are usually spread on land and allowed to dry. Thereafter, they may be used as a soil supplement for certain agricultural uses if water quality standards are met. They are sometimes used directly in a wet state. Residuals disposal sites must be approved by FDEP, and groundwater monitoring at the sites is required, if an exceedance is found, to assure that pollution is not occurring.

SECTION 6. GOVERNMENTAL AND OTHER WATERSHED ACTIVITIES

The Alafia River extends over two counties, and includes several metropolitan areas. All of these governmental units share interests in the Alafia River watershed. In addition, the federal government, the state, SWFWMD and HCEPC share regulatory responsibility for activities that potentially affect the water quality of surface and ground water. Some of the major management and planning entities and programs concerned with the Alafia River watershed are discussed in the following subsections.

6-1 MINERALIZATION OF THE COASTAL FLORIDAN AQUIFER

Withdrawal of water from the aquifer reduces the water pressure which ultimately causes lake levels to decline in the Ridge area, and seawater to intrude along the coastal areas into the freshwater portion of the Floridan. Similarly, over pumping can result in up-coning, or the upward movement of sulfate and other mineral-rich waters into previously good quality waters. It also results in induced recharge from the intermediate and surficial aquifer systems to the Floridan Aquifer. A SWUCA research study has begun at the SWFWMD.

SECTION 7. GROUND-WATER QUALITY ISSUES

7-1 ACTION PLAN: GROUND-WATER QUALITY

Below are ground-water quality issues, goals and actions identified by the Alafia Watershed Land and Water Linkage Task Force that fall under the water management responsibilities of the District:

Task Force Issues:

1. None identified

Task Force Goals:

2. None identified

Task Force Actions:

3. None identified

Below are ground-water quality issues, goals and actions identified by the Alafia River CWM Team:

ISSUE 1 - Best Management Practices.

In many areas of the watershed nutrient and sediment loading from agricultural lands could be reduced by implementation of best management practices. Agricultural irrigation pumping percolates through the soil to recharge the surficial aquifer and this water is the source of base flow seepage into the Alafia River. Problem areas should be identified where non-point source nutrient loading is excessive. Using methods established by the District agricultural exemption program and the NRCS, best management practices should be implemented. For operations that are exempt, best management practices should be encouraged if excessive nutrient loading is documented.

Strategy:

Pursue the implementation of best management practices to reduce non-point source nutrient loading to the river from agricultural lands.

Actions:

1. In conjunction with the assessment of agricultural irrigation runoff and water quality trends in the watershed, identify sub-basins where nutrient loading is high.

2. Identify those specific operations where implementation of best management practices would significantly reduce non-point source pollution.

3. Based on status of the operation (exempt or nonexempt) recommend and implement best management practices as appropriate.

4. Education of the public in efficient irrigation application rates.

Projects:

Project Name: Update of Future Land Use GIS Data
Project Description: Future land use is an important parameter for watershed-based modeling of future watershed conditions. The project is intended to update the future land use data layer for the District's Geographic Information System (GIS). It will involve obtaining current, accurate future land use maps for all 98 units of local government within the District, conforming the individual maps to a generalized set of future land use categories and preparing a districtwide GIS database of future land uses that can be use for a variety of analyses.
Location: watershed
Participants: SWFWMD
Implementation Schedule: 10/1/00-
How Financed: SWFWMD

Project Name: Davis Tract Habitat Restoration
Project Description: Tampa Bay is the District's top priority Surface Water Improvement and Management (SWIM) program waterbody, is a category I (most in need of restoration) under the State's Unified Watershed Assessment and Watershed Restoration Priorities, and is considered an "estuary of national significance" with the designation of the Tampa Bay Estuary Program. Since 1950, about 50 percent of the bay's natural shoreline and 40 percent of its seagrass acreage were lost as a result of physical destruction and water quality impairment. This resulted in a decline in the aesthetic, recreational, and commercial value of the bay, as well as a loss of habitat for native plants and animals. The Davis Tract 100 acre project is a component of the

overall 232 acre "Kitchen" restoration effort (eastern Tampa Bay, in cooperation with Hillsborough County). The project will involve restored and enhanced coastal habitats ("habitat mosaics"), inclusive of uplands and various estuarine wetland communities (open water, marshes, mangrove forests, etc.). As feasible, the project also will provide some stormwater treatment of runoff from area roadways and subdivisions prior to its drainage in the bay. The Davis Tract parcel is proposed to be part of a regional green space park managed by the County for the "Kitchen"; in addition, SWIM, the County, and FDEP may pursue the "Kitchen" becoming Tampa Bay's fourth Aquatic Preserve. The Davis Tract narrative and budget have been combined under the umbrella of W347 (Port Redwing Habitat Restoration); accordingly, please refer to W347 for project specifics for the Kitchen restoration effort.
Location: Watershed
Participants: SWFWMD
Implementation Schedule: 01/16/1997-12/31/2004
How Financed: SWFWMD

ISSUE 2 - Effects of Septic Tank Densities on Nearby Ground and Surface Water Quality.

High septic tank densities now exist within the town of Ruskin and South Brandon. Water quality conditions in surface and ground waters in that region, however, are poorly documented. Studies should be performed in areas of high septic densities to determine if water quality in those regions has been impacted. If so, the feasibility and cost effectiveness of extending centralized sewer into those areas should be assessed.

Strategy:

Studies should be performed in areas of high septic tank densities to determine if pollution of nearby surface or ground waters is occurring. If problems exist, consideration should be given to extending centralized sewer service into areas of high septic tank concentrations.

Actions:

1. A water quality sampling program should be implemented in the region of high septic tank densities in Ruskin and other areas.

2. If significant surface or groundwater pollution is occurring as a result of high septic densities, the feasibility of extending central sewer system service to the area should be evaluated. More stringent density standards from the State and mandatory inspections of septic tanks to ensure they are operating properly could be implemented.

3. Sewer utilities should be extended to these areas.

ISSUE 3 - Effects of Sewage Waste Residuals Disposal on Ground and Surface Water Quality.

Areas in the Alafia River watershed have been used for the disposal of solid sewage wastes. Although ordinances, state and federal rules are in place regulating this activity, data are sparse regarding the effects of this sewage disposal on nearby surface and ground waters and the effectiveness of related ordinances. An assessment of water quality in ground water and streams near areas of sewage waste disposal should be conducted.

Strategy:

Assessments should be of surface and ground-water quality in areas which have been used for the disposal of sewage waste residuals. If problem conditions are found, ordinances concerning disposal of these materials should be reviewed for their effectiveness.

Actions:

1. Identify areas in the Alafia River watershed that are used for the disposal of sewage waste residuals.

2. Design a surface and ground-water quality monitoring program to examine water quality in areas of sewage residual disposal, including non-affected control sites.

3. Review the effectiveness of existing ordinances, state and federal rules for maintaining ground and surface-water quality and suggested model ordinances if problems with existing ordinances are found.

ISSUE 4 - Water Quality Protection through Public Land Acquisition.

Both the Southwest Florida Water Management District and the Hillsborough County Environmental Lands Program have purchased tracts in the Alafia River watershed to protect water resources. Various studies have shown that buffer strips around streams and other water bodies are an effective way to protect water quality. Land acquisition programs should continue in the Alafia watershed in order protect water quality. The preservation of lands near the river channel should act to maintain water quality and the biological integrity of the Alafia River.

Strategy:

Continued public land purchases through SOR, P2000, Florida Forever and SWFWMD. These lands in the watershed should include selection criteria to protect water quality in

the Alafia River and its tributaries.

Actions:

1. Incorporate water quality criteria in the selection process for land acquisition. Such criteria can be used to protect areas that have good water quality or to restore water quality in areas where intensive land uses may be converted to vegetated land cover.

2. Identify lands in the Alafia River watershed for acquisition based on value to natural resources, including habitat value and relations to water quantity and quality. As well as protection of recharge basins of springs.

3. Identify lands for acquisition due to their beneficial recharge to potable aquifers.

Projects:

Project Name: Alafia River Corridor
Project Description: The Alafia River project contains parcels of land along the Alafia River corridor from Bell Shoals Road and extends upstream to the headwaters of the river. The river's natural floodplain is a mixture of hardwood swamps and upland hammocks.

Pursuant to Section 373.1391(1)(a), Florida Statutes, lands within the project are managed and maintained in such a way as to ensure a balance between public access, general public recreational purposes, and restoration and protection of their natural state and condition.

The District has entered into an interlocal agreement with Hillsborough County wherein the County has lead responsibility for these jointly purchased lands.
Location: Alafia River watershed upstream from Bell Shoals Road
Participants: SWFWMD/Hillsborough County
Implementation Schedule: 10/1/00-
How Financed: SWFWMD, Hillsborough County

ISSUE 5 - Data Gaps and Monitoring Needs.

There are no surface or ground water quality data for many areas of the Alafia River watershed. Furthermore, the interval, frequency, and quality of existing data are often inadequate and/or poor, limiting its usefulness to managers and planners for making informed decisions.

a. **Sub-Issue: Parameters including mercury, arsenic, cadmium, copper, and lead are infrequently sampled in most waters.** In the case of mercury, the

laboratory detection limit (typically between 0.1 and 0.5 µg/l) is often much greater than the state water quality standard (0.012 µg/l). For lead, the STORET records for the Alafia River watershed show detection limits ranging from 1 to 1000 µg/l, whereas the state standard for lead is 5.33 µg/l at a total hardness of 150 mg/l. Many of the early records in the STORET database dating to the early 1970s suggest high concentrations of lead and mercury in the Alafia River, but it is unclear if the reported concentrations actually exceeded the laboratory detection limits. Furthermore, sample contamination may also be a problem when trying to detect the extremely small concentrations represented by many of the state standards. Determining if these and other metals exceed the state standards for water quality samples are often not possible from the historical data and for most present-day data. The contaminants of concern in Tampa Bay were polycyclic aromatic hydrocarbons (PAHs, benzo (a)anthracene and benzo(a)pyrene). Lower priority contaminants of concern were arsenic, cadmium, chromium, copper, mercury, as well as the PAHs chrysene, fluoranthene, phenanthrene, and poly-chlorinated biphenyls (PCBs).

b. **Sub-Issue: There is a need for continuous and efficient ground-water quality monitoring to detect potential pollution problems before they become widespread.** In some areas of the Alafia River basin, ground-water quality samples may be collected infrequently and/or monitoring wells may be sparsely distributed in space. As a result, there is the potential for ground-water pollution to go unnoticed until the problem has become widespread. The problems reflect the fact that the need for ongoing water-quality data collection must be balanced with other objectives. Some government agencies, such as the U.S. Geological Survey, have reduced the number of wells from which water-quality data are collected, due to budget restrictions. There is, however, the potential to maximize data collection efforts and minimize environmental costs by optimizing the spacing and timing of water-quality sample collection. The water management districts are funding a study to examine the temporal variability of ground-water quality. The study results may indicate that semiannual rather than quarterly ground-water quality samples are sufficient to characterize water-quality changes which would allow more wells to be sampled with the same budget. A similar study could be performed to identify an optimal spatial network of ground-water quality wells.

c. **Sub-Issue: There is no comprehensive map or report which identifies the location of all potential pollution sources in the Alafia River basin.** To thoroughly delineate areas requiring ground-water quality protection, it is necessary to identify both areas susceptible to ground-water contamination and the location of potential pollution sources. Unfortunately, information regarding potential pollution sources is distributed amongst numerous government agencies. The FDEP has data regarding the location of landfills and Superfund sites. Local land use maps may show the locations of septic systems and

industrial and agricultural operations. The Department of Transportation may have information regarding the location of borrow pits used for road construction. The SWFWMD has information regarding the location of agricultural, commercial, industrial, and mining operations which have water use permits.

The locations of some pollution sources are unknown and would require additional data collection and evaluation. A gasoline plume is an example of ground-water contamination where the location of the original pollution source may be unknown. A comprehensive identification of all potential pollution sources within the Alafia River watershed would involve a significant cooperation among numerous agencies.

f. **Sub-Issue: Due to limitations of the DRASTIC methodology in areas of karst geology, additional methods should be developed and applied to identify areas susceptible to ground-water pollution in the Alafia River watershed.** The DRASTIC methodology, while useful in many respects, does not account for all of the factors affecting the potential for ground-water pollution in karst hydrogeologic systems. An alternative approach used by Swancar and Hutchinson (1992) is to evaluate the chemical and isotopic composition of ground water to identify high recharge areas which are more susceptible to contamination. The Swancar and Hutchinson study presented regional patterns in the ground-water pollution potential for the entire District. However, ground-water pollution potential maps were not developed at the watershed or local scale. An improved map of the ground-water pollution potential in the Alafia River watershed could be created using Swancar and Hutchinson's approach or a revised DRASTIC methodology. A revised DRASTIC methodology is currently being developed through a cooperative effort between the FDEP, Florida Geological Survey, U.S. Geological Survey, and the water management districts. The revised methodology is termed the Florida Aquifer Vulnerability Assessment (FAVA).

g. **Sub-Issue: Limited ground-water quality data are available for the surficial aquifer in the coastal portion of the Alafia River watershed.** Generalizations regarding coastal ground-water quality in the surficial aquifer are based on regional water quality data combined with an understanding of the local hydrogeology. The nearest coastal wells are located about two miles outside the watershed boundary. The coastal area is particularly important due to the potential influences of Cockroach Bay, the Alafia River, and Tampa Bay on ground-water quality.

h. **Sub-Issue: Toxic contaminants including heavy metals, pesticides and other chemical substances have been detected in the sediment at sites in the lower Alafia River.** These observations are based on a limited number of samples and it is not known how these substances are distributed in the river, or

to what extent the sources of the toxins are current or historical in origin (this sub-issue is also discussed in greater detail in Issue #2, 'Toxic Contamination').

i. **Sub-Issue: The extent and the sources of *Cryptosporidium* and *Girardia* contamination of the Alafia River are not well known.** It is suspected that dairies, feedlots, and other high-density animal husbandry operations in the watershed may be significant sources (see also Issue #3, 'Pathogens and Public Health Impacts'). The upper tributaries of the Alafia river contribute to ground-water recharge.

Strategy:

Improve efficiency and coordination in water quality data collection within the District, and among agencies.

Actions:

1. Use water quality information (ambient assessments) to prioritize river reaches and associated basins for monitoring.

2. Compile a comprehensive map of all monitoring sites in the Alafia River watershed, including responsible agencies, frequencies, and parameters sampled.

3. Develop a system to exchange information and coordinate sampling procedures and protocols among all agencies and interested entities.

4. Establish minimum flows and levels for the Alafia River, Lithia and Buckhorn springs.

Projects:

Project Name: Agricultural Land Use Projections Project
Project Description: Forecasts of changes in agricultural acreage for specified commodities.
Location: Watershed
Participants: SWFWMD
Implementation Schedule: 8/1/98-1/1/01
How Financed: SWFWMD

Project Name: Lower Alafia - Minimum Flows
Project Description: Chapter 373.042 requires that a minimum flow will be established for a given watercourse that shall be the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. The current

schedule for adoption of MFL requires that the minimum flows for the Alafia River be established by 2001. An understanding of these ecosystems is needed so that relationships between minimum flows and significant harm can be evaluated in a defensible manner. It is necessary for a number of reasons to document the abundance, diversity, and distribution of plants and animals that are associated with these resources under seasonally changing flow conditions. Physico-chemical variables, e.g., salinity, dissolved oxygen, drainage alterations, and extensive hydrologic data also need to be evaluated. While much of the data can be collected and developed in-house, manpower and time limitations and the specialized expertise required for some analyses dictates that some of it must be consulted out. Therefore, staff is requesting $65,000 for consultant services for these initiatives in the FY 2001 budget.
Location: Watershed
Participants: SWFWMD
Implementation Schedule: 10/1/00-
How Financed: SWFWMD

Project Name: Lake Levels
Project Description: Chapter 373.042, Florida Statutes, requires that minimum water levels shall be established for lakes at the level at which further withdrawals would be significantly harmful to the water resources of the area. The currently proposed schedule for adoption of minimum flows and levels requires establishment of minimum levels for 24 lakes by December 31, 2001. Funding for this project is required for the acquisition of equipment needed to support minimum levels establishment and for the hiring of consultants for review of proposed methodologies.
Location: Alafia River watershed
Participants: SWFWMD
Implementation Schedule: 10/1/00-12/31/01
How Financed: SWFWMD

ISSUE 6 - Ground Water Pumping Discharge Effects on Surface Water Quality.

The Alafia River receives discharge from agricultural runoff along its length. Generally increasing flows of ground-water irrigation runoff have effects on water quality in the areas of discharge and in downstream segments and the estuarine habitats.

Strategy:

Determine cause and effects of ground-water irrigation runoff into the river.

Actions:

1. Use water quality information (ambient assessments) to prioritize river reaches and associated basins for monitoring.

2. Compile a comprehensive map of all agricultural fields in the Alafia River watershed, including crop type, permits and fertilizer/herbicide/insecticide use.

3. Develop a system to exchange information and coordinate with all agencies and interested entities.

Projects:

Project Name: Irrigation Water Conserv. Options for Ag Water Users
Project Description: Consulting contract entered into for purposes of addressing the agricultural water use element of the 2000 Regional Water Supply Plan.
Location: Watershed
Participants: SWFWMD
Implementation Schedule: 8/1/99-7/31/00
How Financed: SWFWMD

ISSUE 7 - Effects of Ground Water Spring Discharge on Surface Water Quality.

Buckhorn, Boyette and Lithia springs are discharging nitrate-rich waters into the Alafia River and Tampa Bay. The springs contribute approximately 157 tons of nitrate annually to the river (AGWQMP 1993). Which is 22 percent of the total nitrogen contributed to Tampa Bay. C.F. Industries, the owners of Lithia and Buckhorn Springs, diverts approximately 14 percent of the combined flow of the springs to their chemical complex at the mouth of the Alafia River. This diversion prevents about 26 tons of nitrate from entering the Alafia River yearly. The Brandon karst terrain is a karst inlier surrounded by Hawthorn Group strata that partly confine the Floridan Aquifer. Drainage in the terrain is internal, through numerous sinkholes and karst conduits. The southern half of the terrain ground water (roughly south of Interstate 4) flows south and southeast, toward the springs and the Alafia River. Hydrochemical facies of spring waters shows that spring waters are chemically similar to Brandon karst terrain waters. There is no chemical evidence river water discharging from springs and little evidence of very deep Floridan water discharge. Changes in land use within the last 10 to 15 years have caused a change in nitrogen sources in the Brandon karst terrain. Water in the karst terrain and Lithia and Buckhorn Springs is largely affected by inorganic fertilizers applied to citrus, with minor animal-waste contributions. It is unclear how much septic tanks, will impact the springs, but the 11,000 septic tanks now present in the area will most likely adversely affect future concentrations of nitrogen in the springs.

Strategy:

Formulate land-use plans that would prevent additional nitrogen loadings to the Brandon karst terrain.

Actions:

1. Evaluate the most recent (1994-1998) nitrogen data from the springs to assess any changes in loading trends since the last District report (Jones, 1994).

2. If nitrogen concentrations have not declined, the District should work with Hillsborough County and all interested parties to formulate land-use plans that would reduce current sources and prevent additional nitrogen loadings to the Brandon karst terrain.

3. Convert residential areas served by septic tanks either to sewers or alternative on-site systems that more effectively remove nitrogen.

4. Dedicate a network of additional monitor wells and sample/test them annually along with existing wells and springs for nutrients, major analytes, and trace organics.

5. Study the use of aquatic plants to control nitrogen in the springs and spring runs discharging into the river.

6. Education of the public and industry as to the downstream effects of lawn and pasture fertilization.

ISSUE 8 - Inter/Intra-Agency Coordination for ground-water quality protection.

As the population in the Alafia River watershed and the encompassing region continues to expand, competing uses for limited water will be the source of greater conflict. Specific resource management goals for the SWUCA, as expressed in the Conceptual Management Strategy, remain largely unchanged: 1) to minimize salt water intrusion in order to protect the ground water system as a water supply source, and 2) to minimize the influence of ground water and surface water withdrawals on lake levels to protect lake functions. Realization of these goals will require a coordinated, regional effort that includes incentives and projects that investigate, correct and prevent harm to the water resource; regulatory initiatives; development of alternative sources; and widespread education efforts. Ensuring that the available water is fairly and equitably distributed will demand coordination between the many agencies and public interest groups concerned with water quality management.

a. **Sub-Issue: Due to the presence of potential pollution sources within the Alafia River watershed, proactive strategies are needed for long-term ground-water quality protection.** Areas requiring ground-water quality protection include recharge areas, existing and potential future wellfields, areas highly susceptible to ground-water contamination, and ground waters adjacent to surface water supplies. The majority of the land area within the Alafia River

basin falls into one of these categories. High density septic tank usage and dairy farming pose a potential water quality threat.

General strategies for ground-water quality protection include regulations, land use management practices, water-quality monitoring, and land acquisition. Regulations and land use management practices can prevent potential pollution sources from being located near areas highly sensitive to ground-water contamination. Wellhead protection programs are one type of regulatory measure that is used to protect ground-water quality in Florida. Wellhead protection programs provide ground-water quality protection by delineating areas to be protected and restricting activities within those areas. The FDEP developed a stateside wellhead protection rule which became effective in May 1995 (Chapter 62-521, Florida Administrative Code). The rule designates a wellhead protection area (WHPA) as the area within a 500-foot radial distance from a potable water well. Many activities regulated by FDEP are restricted within WHPAs. Activities regulated in WHPAs include reuse and land application projects, ground-water discharges, phosphogypsum stacks, underground and aboveground storage tanks, and wastewater treatment and solid waste disposal facilities. In addition to the state wide rule, some local governments have developed their own wellhead protection ordinances. Within the Alafia River basin, Hillsborough County has developed a wellhead protection ordinance and is currently being updated.

Water-quality monitoring can identify changes in ground-water quality which may be indicative of pollution problems. The need for ground-water quality monitoring is discussed as a separate issue. Land acquisition programs can be used to purchase and preserve environmentally sensitive areas such as riverine corridors and recharge areas. Issues regarding land acquisition are discussed within the Natural Systems section of this report.

b. **Sub-Issue: There is no regulatory process in place to ensure that water quality targets and pollutant load reduction goals (PLRGs), once selected, will be achieved.** Pursuant to state water policy, water quality targets and pollutant load reduction goals (PLRGs) have been developed by SWIM for the Lake Thonotosassa basin. PLRGs are also being developed for Tampa Bay, the Hillsborough Bay portion of Tampa Bay, and the Tampa Reservoir of the Hillsborough River. However, the District, as well as other state and local regulatory agencies, has not yet identified ways in which these targets and goals will be incorporated into the regulatory process. If successful incorporation into the regulatory process does not occur, it is unlikely that selected water quality targets and PLRGs will be achieved. Discussions are currently underway concerning procedures that will be adopted by local governments and the regulatory agencies in an effort to ensure that cumulative pollutant loadings from point and non-point source discharges within the Tampa Bay watershed are

consistent with the resource-based water quality targets and PLRGs developed for the bay. An analogous effort is needed for the Alafia River watershed.

Strategy:

Develop strong, possibly formal links and mechanisms between agencies, within agencies and with the public to coordinate and communicate water quality issues and activities.

Actions:

1. Expand and formalize the Alafia River CWM workgroup (or other task force groups as appropriate) as a forum for the presentation of data, ideas, issues and conflicts for discussion and consensus resolution. A single, public workgroup for the Alafia River watershed would be able to address issues from a watershed perspective and coordinate activities that have consequences for multiple AORs.

2. Support the District's D-BUG efforts to ensure availability and transparency of information contained in District databases. Make District databases widely available to outside agencies and the public, possibly through the Internet.

ISSUE 9 - Pathogens and Public Health Impacts.

The presence of pathogenic microorganisms in the Alafia River restricts recreational use of the river and poses a potential threat to drinking water supplies and public health.

a. **Sub-Issue: The state water quality standards for bacteria are frequently exceeded in the Alafia River and several of its tributaries.** The Hillsborough County Environmental Protection Commission (EPC) collects monthly water samples within the Alafia River and several tributaries including Turkey Creek and the North and South Prongs. Total and fecal coliform bacteria concentrations are measured, which serve as indicators of both human and animal fecal pollution. A minimum of five samples per month must be collected for Class I waters, and 10 samples per month must be collected for Class III waters to determine monthly exceedances. Daily standards specify that fecal coliform shall not exceed 800 per 100 ml and total coliform shall not exceed 2400 per 100 ml on any one day for both Class I and Class III waters. Using this standard, the FDEP in their 1998 303(d) publication report that elevated coliform concentrations are of a concern in the following tributaries: Poley Creek, Turkey Creek, English Creek, Thirtymile Creek, Bell Creek, Owens Branch, North Prong, South Prong, and within the Alafia River at Hillsborough Bay.

b. **Sub-Issue: Enteric viruses and protozoa (e.g., *Cryptosporidium* and *Giardia*) are increasingly found in surface water and groundwater samples.**

Recent studies in southwest Florida indicate that pathogenic microorganisms can be detected in surface waters adjacent to urbanized land uses. Other work throughout the U.S. has indicated that viruses, in particular, may be present in ground-water supplies as well. Pathogenic microorganisms can be found in the digestive tracts of animals including humans, and can cause a wide range of illnesses including eye, ear, nose, and upper respiratory ailments, skin irritation, and gastrointestinal infections (e.g., diarrhea). These ailments pose more serious threats to the very young and elderly, as well as those with weakened immune systems. The economic impacts of waterborne disease outbreaks can be significant. Recent estimates of the annual cost of waterborne disease outbreaks in the U.S. range from $500 million to over $2 billion per year (Steahr and Roberts, 1993). Concurrently, the annual risk of contracting a waterborne infection is estimated to range between 1:100 and 1:10,000 which suggests that the investigation of potential sources and methods of removal of microbial pathogens from surface waters is justifiable from both a human health and economic perspective.

Many pathogens are resistant to adverse environmental conditions including protozoa which produce oocysts (*Cryptosporidium*) and cysts (*Girardia*) which are excreted in the animals wastes. The oocysts and cysts are inactive but viable stages of the protozoan life-cycle, and can be very resistant to changes in temperature, pH, and water quality, and are difficult to remove using common water treatment methods. If they are ingested they may cause infection, beginning the life-cycle again. Though commonly found in natural waters, recent large outbreaks such as in Milwaukee, Wisconsin have been attributed to the contamination of drinking water supplies. Young cattle are particularly susceptible to infection by *Cryptosporidium* and are a probable source of these protozoa when maintained in close proximity to lakes, streams and rivers. Commercial and large-scale animal husbandry operations, septic tanks with inadequate setback distances, as well as sludge and septage spreading in the Alafia River watershed have a high potential for contributing bacteria and pathogens to adjacent waters. The presence of pathogenic microorganisms in the Alafia River restricts recreational use of the river, and poses a potential threat to drinking water supplies and public health.

Goal:

Determine the presence/absence of pathogens in the river and, if present, determine potential remediation strategies.

Strategies:

1. Evaluate existing fecal coliform bacteria data and locate areas where concentrations consistently exceed state standards.

2. Determine the need for enhanced data collection for pathogens and implement additional sampling, if necessary.

3. Identify specific sources of pathogens and methods (structural or nonstructural BMPs) to eliminate or reduce pathogen loads to the river and/or its tributaries.

4. Work with local governments to fund and implement BMP's for pathogen load reduction.

5. Determine areas in the river used for recreational swimming and sources of drinking water.

6. Work with the Hillsborough County Department of Health and the Tampa Bay Estuary Program to establish consistent water quality standards for the closure of public bathing sites if sources of pathogen loads cannot be determined or controlled.

Projects:

Project Name: Gibsonton on the Bay Stormwater Infrastructure Improvement Project
Project Description: The Gibsonton on the Bay project is located within the Alafia River watershed which drains to Tampa Bay, a SWIM priority water body. The project involves the design and construction of a drainage system to meet current standards for cross drains, side drains and/or ditches, and to determine and acquire the land needed to provide stormwater treatment and attenuation to reduce flooding potential and improve the quality of the water discharged into the Alafia River. The project is scheduled to be designed and have the land requirements determined in 2000, with construction beginning in FY 2001. The primary benefits resulting from the project will be increased flood protection and an improvement in the quality of the water discharged into the Alafia River. FY 2001 funding is for land acquisition and construction.
Location: Watershed
Participants: SWFWMD/Hillsborough County
Implementation Schedule: 5/31/2000-6/30/2001
How Financed: SWFWMD

Project Name: Balm Road Marsh
Project Description: The project involves the creation of a 30-50 acre floodplain marsh in south-central Hillsborough County that will treat stormwater runoff from approximately 1,025 acres of upstream, active agricultural land prior to discharging into Bullfrog Creek. This project is on lands owned by Hillsborough County, acquired through their Environmental Lands Acquisition Protection Program. The improvement of wildlife habitat and water quality within the Bullfrog Creek Basin is consistent with the goals of the Tampa Bay SWIM Plan, the District's Alafia River Comprehensive Water Management (CWM) Plan, and the Tampa Bay Estuary Program's Comprehensive

Conservation and Management Plan (CCMP). The project will improve water quality within Bullfrog Creek and Tampa Bay. Project design and permitting are being funded through a $200,000 cooperative agreement between the District and Hillsborough County Public Works department. The District's SWIM Program has requested $300,000 in Fiscal Year 2001 District (Alafia River Basin and SWIM) funds for future project construction activities. The District is in the process of securing $712,000 of revenue from outside sources for project construction, which includes $412,000 from the Tampa Port Authority and $300,000 from the EPC Pollution Recovery Fund through the FDEP and the Hillsborough County Environmental Protection Commission (HCEPC). It is planned that the Hillsborough County Public Works will enter into an agreement for the Port Authority funds with FDEP and Hillsborough County Public Works will also enter into an agreement with HCEPC for the Pollution Recover funds.
Location: Watershed
Participants: SWFWMD/Hillsborough Co. Public Works Department
Implementation Schedule: 8/19/1999-12/31/2002
How Financed: SWFWMD/Hillsborough County/Tampa Port Authority/FDEP

CHAPTER VI - NATURAL SYSTEMS

Historically, the Alafia River watershed was once composed of a wide variety of upland, wetland and coastal habitats. Within the last century, many large tracts have been converted from natural land features to phosphate mines, predominantly in the easternmost portions of the watershed. A detailed study conducted in the early 1970s suggested that approximately 47% of the watershed had been developed at that time (Dames & Moore, 1975). By the early 1990s, over 91% of the watershed had been altered by human activities with 74% of the watershed impacted by mining activities and approximately 17% developed for urban, suburban, commercial, industrial and agricultural uses. Population growth in the watershed may eventually lead to the conversion of mining lands in the east to residential land uses. Despite these impacts, some large tracts containing intertidal marsh, mangrove forests, freshwater wetlands, swamps and forested uplands remain undeveloped along portions of the Alafia River floodplain and in the upper watershed.

Many of these remaining pristine areas have been targeted for acquisition and restoration by both the Environmental Lands Acquisition and Protection Program (ELAPP) (Hillsborough County, 2000) and the District (SWFWMD, 2000). Together with other undeveloped lands throughout the watershed, natural lands (uplands and wetlands) comprise slightly more than 8% of the watershed. Generally, the northern and western portions of the watershed are characterized by urban, industrial and commercial activities, while the southern portion is dominated by agriculture and the eastern portion by mining.

The Alafia River flows east to west and originates from both lower Hillsborough County and western Polk County. The river is characterized by a main flowing river and two large tributaries which include the North and South Prongs originating in the northeast and southeast portions of the watershed, respectively. Perennially flowing and intermittent tributaries to the Alafia River include: Buckhorn Creek (including Buckhorn Springs), Turkey Creek, English Creek, Poley Creek, Thirtymile Creek, Sloman Branch, West Branch, Mizelle Creek, Owens Creek, Halls Branch, Chito Branch, McCollough Branch, Fishhawk Creek, Coleman Hammock, Little Fishhawk Creek, Bell Creek, and Rice Creek (Figure 7-1). Additional freshwater flows originate from Lithia Springs, approximately 8 miles from the mouth of the Alafia River.

The Alafia River can be divided into four general sections or reaches: lower, middle, North Prong, and South Prong. The lower reaches of the Alafia River extend from the river's mouth at Tampa Bay to approximately five miles upstream where the river narrows and becomes less tidally influenced. Floodplain habitat along the lower and middle reaches of the river have been developed into single family and estate homes.

Remaining natural areas are typically small, isolated forest fragments used as municipal

parks and recreation areas or held under private ownership.

The middle reaches of the Alafia River extend from the confluence of the North and South Prongs downstream to the U.S. Highway 301 bridge. This segment is characterized by a relatively narrow river width and more extensive undeveloped floodplain habitats. The North Prong of the river extends northeasterly approximately 10 miles with several branching tributaries extending east and west. The South Prong extends approximately 25 miles south and then east after branching from the main river. The eastern portions of the South Prong have been extensively mined.

The adjacent floodplains along the middle and upper (North and South Prong) reaches of the Alafia River include the most extensive areas of natural lands remaining within the watershed and have been targeted for purchase by local and state land preservation programs. While some of these undisturbed lands are in private ownership, some large tracts in public ownership protect several miles of the river, its associated floodplain swamps and the headwaters. These public tracts include lands co-owned by the Southwest Florida Water Management District and the Hillsborough County Environmental Lands Acquisition and Protection Program (ELAPP). These lands have been acquired for their inherent value to protect water resources and wildlife habitats and represent high quality natural systems maintained in permanent conservation status.

The Division of Recreation and Parks (Dept. of Environmental Protection) owns and manages the Alderman Ford State Park located immediately downstream of the confluence of the North and South Prongs. Together all the public lands represent extensive areas of natural floodplain forests and swamps, characterized by dense canopies of mixed hardwoods and cypress. Areas of slightly higher elevation are in mature hammocks of cabbage palm, live-oak, southern magnolia and red cedar. Within these public preserves, natural uplands (e.g. pine flatwoods, oak hammocks, and sandhill features) border the river floodplain forming a diverse landscape of wetland and upland habitats. Wildlife populations supported within these natural areas include common as well as listed species considered significant and of regional importance (Table 6-1).

Table 6-1. Listed Wildlife Found in the Alafia River Watershed.

	Common Name	Scientific Name	FGWFC Designation
Reptiles	Gopher tortoise	*Gopherus polyphemus*	SSC
	Eastern indigo snake	*Drymarchon c. couperi*	T
	Short-tailed snake	*Stilosama extenuatum*	T
	American alligator	*Alligator mississippiensis*	SSC
Amphibians	Gopher frog	*Rana capito*	SSC
Birds	Southern bald eagle	*Haliaeetus leucocephalus*	T
	Florida sandhill crane	*Grus canadensis pratensis*	T
	Southeastern American kestrel	*Falco sparverius paulus*	T
	Snowy egret	*Egretta thula*	SSC
	White ibis	*Eudocymus albus*	SSC
	Little blue heron	*Egretta caerulea*	SSC
	Brown pelican	*Pelecanus occidentalis*	SSC
	Black skimmer	*Rynchops niger*	SSC
	American oystercatcher	*Haematopus palliatus*	SSC
	Least tern	*Sterna antillarum*	T
	Reddish egret	*Egretta rufescens*	SSC
	Tricolored (Louisiana) heron	*Egretta tricolor*	SSC
	Roseate spoonbill	*Ajaia ajaja*	SSC
	Wood stork	*Mycteria americana*	E
	Florida scrub jay	Aphelocama coerulescens	T
	Burrowing owl	*Athene cunicularia*	SSC
Mammals	Sherman's fox squirrel	*Sciurus niger shermani*	SSC
	West Indian (Florida) manatee	*Trichechus manatus*	E
	Florida black bear	*Ursus americanus floridanus*	T
Fish	Common snook	*Centropomus undecimalis*	SSC

Of significance from an ecosystem management perspective is the naturally occurring wildlife corridor which currently exists between the South Prong and the eastern reaches of the Little Manatee River to the south. Because of this important hydrologic and ecological feature, the region between these two watersheds has been targeted for protection by the Environmental Lands Acquisition and Protection Program (ELAPP) and the District.

SECTION 1. LITERATURE REVIEW

The Alafia River and the associated natural systems within its watershed have been described in a variety of publications including: agency project assessments, land acquisition reports, general references, government planning reports, and private consultant reports. Many of these publications cover only select areas of the watershed and limited sections of the Alafia River or its tributaries. Conditions, problems and issues raised in many of these reports are similar and are often applicable to most areas within the watershed. However, few reports treat the entire watershed and natural systems issues in an integrated or comprehensive manner. Information is often project specific and limited in scope, time frame, and locality.

The following publications offer the most comprehensive information describing the natural systems and related floral and faunal resources within the Alafia River

watershed. Additionally, several of the reports identify problems and issues affecting natural systems within portions of the watershed.

1-1 HYDROBIOLOGIC ASSESSMENT OF THE ALAFIA AND LITTLE MANATEE RIVERS (Dames & Moore (1975) for the Southwest Florida Water Management District)

This is a detailed report describing the existing conditions of groundwater and surface water systems in the Alafia and Little Manatee River watersheds circa 1975. The report includes descriptions of the basin's terrestrial and aquatic communities, meteorology, hydrology, and interactions between the biological and hydrological systems. Probably the most interesting aspect of the report is the foreshadowing of a number of issues and progressive recommendations to resolve these issues that have since become increasingly important during the last two decades. Natural systems recommendations and predictions related to the future of the Alafia River and surrounding watershed included: 1) wetlands and green belt lands are of great economic value to the community compared to their value to the individual landowner, especially in ameliorating flood conditions - funds should be used to purchase flood plain lands to protect them from development and 2) a potentiometric ridge in the freshwater aquifers bordering Tampa Bay should be maintained to prevent saltwater intrusion.

1-2 13th YEAR ANNUAL ELAPP REPORT - RECOMMENDATIONS CONCERNING HILLSBOROUGH COUNTY'S ENVIRONMENTAL ACQUISITION AND PROTECTION PROGRAM (ELAPP) (ELAPP Site Assessment Team, ELAPP Site Review Team, ELAPP Site Selection Team of the Hillsborough County Parks and Recreation Department and Real Estate Department (2000))

In 1987, a referendum was approved by the voters of Hillsborough County to collect a .25 mil tax for the purchase or protection of environmentally sensitive lands within the county. The program, administered by Hillsborough County's Parks and Recreation Department, has acquired or participated in the preservation of more than 35,900 acres at a cost of approximately $126.8 million during the first thirteen years of its existence. Many of the sites have received joint funding through agencies such as the Southwest Florida Water Management District, Florida Communities Trust, City of Tampa, City of Temple Terrace, and the Conservation and Recreational Lands Program (CARL). This report describes the current approved site recommendations for future purchase and also lists acquired sites throughout Hillsborough County including the Alafia River watershed area. Site specific management plans for a number of parcels purchased by ELAPP have been drafted which contain descriptions of habitats, wildlife, and flora and would serve as an excellent reference for existing conditions in pristine upland and wetland areas that still remain within the watershed.

1-3 REGIONAL WILDLIFE HABITAT PLANNING IN THE TAMPA BAY REGION (J. W. Beever, Florida Game and Fresh Water Fish Commission (1995))

Beever (1995) presents the methodology and rationale leading to the development and adoption of a regional wildlife habitat plan as part of the Tampa Bay Regional Comprehensive Plan (1992). The plan includes identification and protection of large preserves linked by coastal, riverine (e.g. Alafia), and large mammal wildlife corridors. Implementation techniques to protect identified wildlife habitat include regulation, acquisition, and incentive programs. Difficulties in plan implementation include resolving multiple-use land conflicts, the applicability of conservation biology theory to real world situations, and the need for accurate regional biological information.

1-4 CLOSING THE GAPS IN FLORIDA'S WILDLIFE HABITAT CONSERVATION SYSTEM (Florida Game and Fresh Water Fish Commission (1994))

This landmark technical report presents information identifying lands in Florida necessary for conservation in order to protect long-term habitat needs for rare wildlife populations and other components of biological diversity. Maps and analyses provided in the report are intended for use by decision makers involved in public land acquisition, land-use planning and development regulation.

In the Tampa Bay Region, and in particular for the Alafia River watershed, the report identifies several "hot spots" of biological resources and rare species occurrence records. These include: areas north of County Road 672 (near Balm), the Alafia River near Keysville, and the Alafia River near Lithia where remnant sandhill, scrub, and riparian floodplain forest habitats remain intact.

The report notes that the Tampa Bay region (including the Alafia River area) contains one of the fastest growing populations in Florida, but there are still many areas that contain natural cover and rare species of wildlife. However, the proportion of conservation lands in this region is well below the statewide average (5.5% versus 19.6%), and all four counties in the region are well below the statewide average of 15.2 percent for individual counties (respectively, Pinellas County 1.9 percent, Pasco County 10.4 percent, Hillsborough County 3.5 percent and Manatee County 3.7 percent).

1-5 FISH AND WILDLIFE INVENTORY OF THE SEVEN COUNTY REGION INCLUDED IN THE CENTRAL FLORIDA PHOSPHATE INDUSTRY AREAWIDE ENVIRONMENTAL IMPACT STUDY (Archbold Biological Station (1977) for the U.S. Fish and Wildlife Service)

Prepared by members of the scientific staff at the Archbold Biological Station (Lake Placid, Florida), this 2-volume report plus appendices, is a comprehensive inventory of fish and wildlife resources within a seven-county area (including Hillsborough County). The inventory compiles available data from a variety of sources including: primary literature (e.g., journals, books), agency reports, regional surveys, consultant and conservation organization reports, museum records and specimens, and interviews with local and regional researchers. The information is organized and analyzed to provide

an accurate list of species known to occur in the region and the distribution, habitats, and population levels for each species. County by county wildlife occurrences are tabulated. Annotated species accounts give additional information on life-histories and living requirements.

1-6 ALAFIA RIVER CORRIDOR RESOURCE EVALUATION (Southwest Florida Water Management District (1993))

This document provides an evaluation of environmental conditions within the Alafia River watershed, focusing on 9,166 acres targeted for acquisition through the District's Save Our Rivers/Preservation 2000 Program. This proposed acquisition of this acreage (known as the "Alafia River Corridor") is justified through an examination of available water quality, natural habitat, soils, aerial photography, and land use data by District staff. Since 1993, the District has identified additional lands within the Alafia River Corridor, bringing the total project area to 29,528 acres. As of October 1, 1999, the District (in most cases utilizing joint funding from either Hillsborough County or Polk County), had acquired 3,992 acres fee simple and 1,497 acres less than fee within the project area.

1-7 ALAFIA RIVER CORRIDOR OVERLAY STUDY (Hillsborough County (1993))

The Alafia River Corridor Overlay Study (ARCOS) was developed to protect the natural and cultural resources that comprise the Alafia River Corridor. The Study report includes: 1) Perspectives, providing the reader with analysis of the history and character of the Alafia River Corridor, a review of Hillsborough County's comprehensive plan policies and implementing regulations, a review of other agencies' relative roles and their regulations, and an identification of remaining issues and unresolved problems; 2) Recommended solutions, including suggested performance standards and development review criteria for shoreline treatments, upland treatments, access, and means of reducing visual intrusion; and 3) Implementation suggestions, including a model shoreline construction ordinance.

1-8 ALAFIA RIVER WATERSHED MANAGEMENT PLAN (Hillsborough County Public Works Department/Stormwater Section and Parsons Engineering, Inc. (2002))

Hillsborough County is in the process of developing a management plan for the Alafia River watershed. The plan will cover flood control, water quality, natural systems, and water supply issues with a scheduled completion date of March 2002. Specifically, the plan will take a comprehensive look at the condition of natural systems within the watershed and identify areas for both preservation and restoration. A series of three public meetings will be held to present information and solicit input from stakeholders when the existing conditions analysis is complete, when the conceptual alternatives are ready to be presented, and when final recommendations have been drafted. Based on

the results of the public meetings, a final list of recommended actions will be developed. The recommendations may include such things as construction of habitat restoration and stormwater improvement projects, potential changes to existing environmental regulations, and needed improvements for various maintenance and monitoring programs.

SECTION 2. AVAILABLE DATA

In addition to the information available in the publications described in the Literature Review Section, other information in the form of maps, aerial photographs, GIS data bases, consultant reports, model analyses, monitoring records, and field observations is available from the following sources:

Southwest Florida Water Management District:

- Geographic Information System, including regional land use and land cover, soils, hydrography, topography, groundwater recharge potential.
- Aerial photographs, maps with contours (land elevations).
- Surface water and groundwater levels (hydrologic data base); monthly values for lakes, select wetlands (e.g. marshes, swamps), rivers and streams (stage elevation and discharge values).
- Regional wetland monitoring system (select wetland stations: qualitative and quantitative vegetation data; general wildlife observations).
- Consultant reports submitted as part of permit conditions (e.g. wetlands monitoring for water levels, hydroperiods, vegetation composition and abundance, and wildlife use).
- Surface Water Improvement and Management (SWIM) Program: research studies, restoration sites progress reports and inventories, consultant reports, etc.

Hillsborough County:

- Map of significant wildlife habitat (contiguous acreage >75 acres), periodically updated.
- Integrated Conservation Process (ICP) Plan.

- Historical aerial photographs; Environmental Protection Commission has all 1938 aerial photographs of Hillsborough County on compact disc.

Florida Department of Environmental Protection:

- Florida Natural Areas Inventory (FNAI) site-specific records of floral and faunal occurrences including listed species records, assessment of local and regional importance; part of the Natural Heritage Program; information regularly updated.

Florida Fish and Wildlife Conservation Commission:

- Game species inventories; fisheries reports (population estimates).
- Wading Bird Atlas (inventory of rookeries)
- Non-Game Species Program (species inventories; listed species information, eagle nests)
- Florida Breeding Bird Atlas (all species): extensive surveys to confirm breeding status in all counties of the state (at various levels). Data collected and compiled at the U.S. 7.5 Quadrangle Map level. Atlas not yet published (in progress), data are available.

U.S. Fish and Wildlife Service:

- National Wetlands Inventory (wetland maps, classification, acreages).

Cargill Fertilizer; Intergrated Land Management Plan

- Interactive web based management plan for 1600 acres in the Alafia CWM watershed
- URL
- Includes restoration/management of approximately 11/2 miles of Tampa Bay shoreline, including significant estuarine habitats

Miscellaneous:

- Audubon Society Christmas Bird Counts (published in: American Birds)

SECTION 3. GOVERNMENTAL AND OTHER WATERSHED ACTIVITIES

3-1 LAND ACQUISITION FOR NATURAL RESOURCE PROTECTION AND

CONSERVATION

3-1.1 Conservation and Recreation Lands Program

FDEP'S Conservation and Recreational Lands (CARL) program has long been Florida's major public environmental land acquisition program for the protection and conservation of Florida's natural heritage. Originally funded solely by mineral-extraction severance taxes and documentary stamp fees, the creation of Preservation 2000 provided financial stability for the program. In Hillsborough County, the county's Environmental Lands Acquisition and Protection Program (ELAPP) often collaborates with the CARL program.

3-1.2 Save Our Rivers Program

The Save Our Rivers (SOR) program is financed by the Water Management Lands Trust Fund, administered statewide by FDEP and regionally implemented by the Southwest Florida Water Management District since 1981. According to the District's SOR/P2000 2000 Five-Year Plan, the District has acquired 6,870 acres (5,374 fee simple; 1,496 less than fee) and approved 24,061 acres for purchase within the Alafia River Watershed since the inception of the SOR and Preservation 2000 Programs (see below). These include lands along both the north and south prongs of the Alafia River, the main stem of the Alafia River, and the Medard Reservoir.

3-1.3 Preservation 2000

Preservation 2000 (P2000) is a ten-year, $3 billion land acquisition program approved by the Florida Legislature in 1990. P2000 strengthens and supplements most of Florida's existing land acquisition programs, and by forging partnerships with private and public agencies (e.g. Nature Conservancy, local governments) makes funds available for a wide range of land acquisition and conservation purposes. When appropriate, P2000 funds are applied to support and complement SOR acquisition projects within the Alafia River watershed. The P2000 Program ended at the end of fiscal year 2000-2001 and will be replaced by the Florida Forever Program beginning in fiscal year 2001-2002.

3-1.4 Florida Forever Program

In 1999, the Florida Legislature passed the Florida Forever Act which is the successor program to P2000. Like P2000, the Florida Forever program will provide $3 billion over ten years ($300 million annually). Thirty-five percent or $105 million annually will be allocated to the water management districts for land acquisition, SWIM, water resource development, water supply development, and restoration. At least 50 percent of the WMD allocation must be spent on land acquisition. Of the $105 million provided to the water management districts, SWFWMD will receive 25 percent, or approximately $26 million.

Clearly, Preservation 2000's primary focus was on acquiring land for conservation and preservation. Florida Forever focuses not only on land conservation and preservation through acquisition, but also on water resource development, restoration and recreation in both rural and urban settings.

In creating the Florida Forever program (Section 259.105, Florida Statutes), the Legislature has required each water management district to develop an annual Florida Forever Program Five-Year Workplan. These plans must integrate Surface Water Improvement and Management (SWIM) plans, Save Our Rivers plans, stormwater management plans, water body restoration projects, and other projects that would assist in meeting the goals of the Florida Forever program. The water management districts are required to submit their workplans to the Secretary of the Florida Department of Environmental Protection who, in turn, will submit the plans to the Legislature. Florida Forever bonds will be issued beginning in fiscal year 2001-2002.

3-1.5 Hillsborough County Environmental Lands Acquisition and Protection (ELAPP) Program

The Hillsborough County Environmental Lands Acquisition Program (ELAPP) actively pursues opportunities for acquiring environmentally sensitive lands in Hillsborough County. Land acquisition efforts are frequently in cooperation with other public and private agencies (e.g. FDEP's CARL Program, SWFWMD and the SOR\P2000 Program and The Nature Conservancy). To date, ELAPP has acquired several tracts adjacent to the Alafia River and throughout the watershed. Consideration of additional lands within the watershed is ongoing.

3-1.6 Polk County Environmental Lands Acquisition and Management Program

Created by referendum in November 1994, the Environmental Lands Acquisition and Management Program is set up to acquire, preserve, protect, manage, and restore endangered and environmentally sensitive lands, water resources, and important wildlife habitat. Trust funds for acquisition and management receive funding from the 0.2 mill ad valorem. The Polk County Board of County Commissioners have approved pursuing acquisition on 33 sites, a majority of which have potential acquisition partners (including the District). As of May 2001, 9,946 acres had been preserved under this program with a portion of this acreage located within the Alafia River watershed.

3-1.7 Florida Communities Trust

The Florida Communities Trust (FCT), established by the state legislature in 1989, assists local governments in meeting the natural resource protection requirements of Florida's Growth Management Act (Chapter 163, Part II, F.S.). The trust operates within the Florida Department of Community Affairs (FDCA) as a non-regulatory agency. It provides monies through loans and grants (including matching funds) for land

acquisitions that further the goals of the conservation, recreation, open space, and coastal elements of local governments comprehensive plans. Given that the Alafia River is recognized as a resource protection area, local government programs such as Hillsborough County's ELAPP program are pursuing funding from FCT for land acquisition and habitat restoration.

3-1.8 Nature Conservancy

The Nature Conservancy (TNC) is a nonprofit international organization which works to conserve biological diversity through habitat conservation. The Nature Conservancy, working with Natural Heritage Inventory scientists and other researchers to set conservation priorities, acquires lands for conservation management.

TNC also uses land exchanges, conservation easements, retained life estates, and other arrangements to work with landowners to accomplish habitat protection. Some tax benefits may be available. While TNC cannot act as legal or tax advisor to landowners, the organization has attorneys on staff who will work with landowners' counsel to help land owners achieve their conservation objectives.

TNC also works with private landowners to provide technical assistance on the identification and management of natural resources such as rare species and unusual natural communities. Cooperative management agreements can be flexible in content and can be canceled.

3-1.9 Trust for Public Lands

The Trust for Public Land (TPL) is a national nonprofit land conservation organization founded to protect land for the public's use and enjoyment. Its principal goal is to acquire lands suitable for open space and parks and convey them to public agencies for ownership and management. In addition, TPL provides training and technical assistance to private landowners, local land trusts, and government agencies to enhance their land conservation goals.

3-2 ALTERNATIVE INITIATIVES FOR NATURAL RESOURCES PROTECTION

In addition to the various federal, state and local regulatory programs that attempt to impose protection over the various natural resources of the Alafia River watershed, several initiatives have recently emerged attempting to enhance protection and management of the watershed's natural resources by broadening, improving, developing and integrating management and protection options.

3-2.1 The Alafia River Basin Stewardship Council (ARBSC)

ARBSC was formed by concerned citizens and stakeholders to bring attention and

public input to a number of initiatives within the Alafia River watershed. Those initiatives include water supply, land use, conservation, habitat enhancement and recreational needs. This group represents business and property owners, recreational users, environmentalists and conservationists, as well as those involved through governmental agencies and industry affiliations. Their goal is to protect, preserve and restore the Alafia River, its basin and estuary, thereby safeguarding its resources for future generations by providing direction to important land and water use projects that will impact the basin area.

3-2.2 The Alafia Watershed Land and Water Linkage Task Force (Task Force)

Members of the ARBSC were active participants in the development of the Alafia River CWM plan through their participation in the Alafia Watershed Land and Water Linkage project. This project was funded by Hillsborough County and the District's Alafia River Basin Board to provide a forum for citizen involvement and input into development of the District's Alafia River CWM plan and Hillsborough County's growth management initiatives. The Task Force developed a report entitled Alafia Watershed Land and Water Linkage Project that identifies priority issues, strategies and actions related to the District's four Areas of Responsibility (AORs): water quality, water supply, flood protection and natural systems as well as Hillsborough County's AOR, growth management.

3-2.3 Southwest Florida Water Management District

The District's Comprehensive Watershed Management Program (CWM), which includes the Alafia River Watershed Project, is a watershed approach to surface water management. This approach is the most effective way to integrate a wide variety of resource activities. This program is the District's response to the recent federal and state ecosystem management focus. From a hydrologic standpoint, watersheds are a logical unit within which to apply the ecosystem concept. The District's Governing Board made CWM a Strategic Initiative that directed staff and funding resources to this project. Additionally, a majority of the District's Basin Boards have also made watershed assessments a priority for future cooperative funding proposals and projects.

3-2.4 Alafia River Task Force

The Alafia River Task Force was developed through the FDEP and phosphate industry to address dam failures, gypsum stack issues, and fugitive releases of contaminants associated with phosphate mining and related activities within the watershed. A number of best management practices have already been initiated by the phosphate industry in the upper basin to help reduce nutrient loads as a result of this program.

SECTION 4. NATURAL SYSTEMS ISSUES

Most, if not all, issues related to natural systems within the Alafia River watershed are directly or indirectly related to land development and land use activities. The extent of phosphate mining throughout the eastern watershed has caused widespread changes to the landscape, as natural lands were cleared, excavated, and partially reclaimed. Active mining continues in the watershed, however only a small amount of land remains to be mined in the future. Acute, catastrophic acid spills, which have occurred on several occasions during the last few decades, have had a significant impact on the biological communities which inhabit or utilize the river. Municipal waste water discharges over many decades have also effected the bio-diversity and aquatic health of the natural systems in the watershed. On a more long-term timescale, population growth and urbanization is expected to continue throughout the watershed which will be accompanied by infrastructure, roads, utility systems, landfills, etc. that will continue to shape conditions within the remaining natural systems in the Alafia River watershed. The effects of this growth will present a permanent encumbrance on these natural resources.

As land is developed to serve human cultural needs, the size, condition, distribution, and relative abundance of natural plant communities (i.e. uplands and wetlands) are inevitably and permanently altered. Declines in water quality often result from land development since impermeable surfaces created by roadways, rooftops, and parking lots lead to increased surface water runoff of generally poor quality. Agricultural development and the discharge of pesticides, herbicides, and fertilizers into local watercourses can affect downstream areas. Mining and mining-related activities have negative ecosystem impacts as evidenced by direct native habitat loss or occasional releases of acidic process water into the watershed. As these changes and losses become pronounced, ecosystem conditions, functions, and values are diminished. The Alafia River serves as a prime example of an aquatic ecosystem which has suffered both chronic and acute pollution from many sources over the last several decades.

Past and projected increased land development throughout the watershed's sub-basins will continue to produce adverse impacts to natural systems as more natural lands are converted for human functions. Reductions in biological diversity, habitat quality, wildlife abundance and distributions are expected along with habitat fragmentation - the isolation and loss of corridors for wildlife movement, migration and dispersal. Conservation of critical habitat areas and listed species protection are of highest priority. Low intensity agricultural and reclaimed/restored lands which retain portions of natural areas and forest cover are of secondary ecosystem support value as buffers or wildlife corridors.

In a watershed characterized by increasing population growth and development, even areas already under the protective status of public conservation lands are at risk. Public conservation lands are often threatened by adjoining land uses and development, requests\demands for high intensity and consumptive uses of natural resources, recreational uses, as well as becoming targets to support infrastructure features such as utility lines, roads etc. Without limitations and prohibitions on uses incompatible with

natural resource protection, and renewed support and actions to protect their conservation status and value, natural resources within the watershed are threatened.

In the Alafia River watershed, water supply development and management can have pronounced impacts on natural systems. Surface water and groundwater supply development have the potential to adversely affect surface water systems (the Alafia River and tributaries, lakes, wetlands and the Tampa Bay estuary). Water diversions, impoundments, aquifer and water table withdrawals, and otherwise removing significantly large volumes of water from the same hydrologic system that supports all water-dependent natural systems and their associated living resources (flora and fauna) can have pronounced effects on natural systems.

4-1 ACTION PLAN: NATURAL SYSTEMS

Below are natural systems issues, goals and actions identified by the Alafia Watershed Land and Water Linkage Task Force that fall under the water management responsibilities of the District:

Task Force Issues:

- Upland habitat protection and conservation.
- Impact of ecotourism on natural systems.
- Wildlife habitat and population losses/relocations.

Task Force Goals:

- To delineate within the Land Development Code, natural resource areas and to provide incentives for landowners to preserve, protect, restore and manage the resources.
- To protect and manage springs, natural shorelines, tributaries and islands in the Alafia River from development.
- To reduce non-native invasive plants along the Alafia River's edge (Brazilian Pepper, Melaleuca, Lead Tree, etc.).
- To encourage habitat restoration and enhancement projects that will create incremental natural systems improvements and additions.
- To design wildlife corridors, greenways and large park lands to allow sustainable wildlife populations.

Task Force Actions:

- Establish Alafia basin park lands committee to identify suitable lands, recommend possible purchase funds and seek purchase.

Below are natural systems issues, goals and actions identified by the Alafia River CWM Team:

ISSUE 1 - Impacts from the Development and Operation of Phosphate Mine and Fertilizer Manufacturing Facilities.

Two of the most significant impacts to natural systems resulting from phosphate mining and fertilizer manufacturing within the Alafia River watershed include the direct alteration of wetland and upland ecosystems through land excavation and, on occasion, the release of acidic process water resulting from failed containment berms and structures at fertilizer manufacturing facilities.

With respect to impacting natural habitat within the watershed, phosphate mining is an inherently intrusive and destructive practice. Historically, thousands of acres of upland and wetland habitat(s) were removed or altered through the extraction of underground phosphate ore. In addition, alteration of surface and groundwater hydrology from phosphate pit excavation has resulted in the dewatering and degradation of many adjacent freshwater wetlands. The majority of impacts have occurred in the eastern watershed between the North and South Prongs of the Alafia River. Permitted removal of native habitats (both vegetation and soil) is still ongoing, while habitat reclamation efforts have met with mixed results (King, Toland, and Feiertag 1992). One example, however, of a successful reclamation project is the Hooker's Prairie project located within the headwaters of the South Prong system. This project involves the reclamation of significant areas of sawgrass marsh that provide some water quality and habitat benefits within the watershed. Other completed reclamation projects have demonstrated various degrees of success.

Over the past several decades, intermittent spills of acidic process water have occurred within the Alafia River. The most recent spill occurred on December 7, 1997 in the headwaters of the North Prong in Mulberry, Polk County, Florida. A release of an estimated 50 million gallons of 1% phosphoric acid wastewater from a wastewater storage impoundment occurred as a result of a breach in a containment wall which subsequently affected Skinned Sapling Creek and the Alafia River in both Polk and Hillsborough Counties. The site is operated by Mulberry Phosphates, Inc. which manufactures phosphoric acid. Both human health, wildlife, and the environment were threatened by the release and a fish kill was noted beginning on December 7, 1997. The river pH ranged from 1.8 - 2.0 at the onset of the spill, making it harmful to humans, vegetation and aquatic life (Williges, Neugebauer, and Cook 1998). A damage assessment and recovery plan, coordinated through the National Oceanic and

Atmospheric Administration, was in the final stages of development when Mulberry Phosphates, Inc. announced it was going out of business in early 2001. The recovery plan focuses on freshwater and estuarine habitat restoration to mitigate for damages caused by the spill. Future implementation and funding of the plan is currently being discussed.

Strategies:

1. Develop and implement environmental performance standards (i.e. impact thresholds) for industrial wastewater containment. In 2000, legislation was passed that led to the promulgation of an amended Rule Chapter 62-672 FAC.

2. Develop a restoration plan for the areas of the river which have been impacted by spills and/or restore habitats utilized by the organisms which suffered the greatest mortality (e.g., estuarine fish species).

3. Implement projects to restore impacted habitat(s) and improve water quality throughout the watershed. In particular, focus on riverine flood plain restoration in areas where phosphate mining has had its greatest impact (e.g. South Prong).

4. Develop contingency/emergency spill response plans (e.g., lime treatment) that will reduce catastrophic impacts to the river if future spills should occur.

5. Identify existing mined lands and restoration opportunities within the watershed through the District's SWIM Program, the Florida Institute of Phosphate Research (FIPR), and FDEP's Bureau of Mine Reclamation.

Projects:

Project Name: Mulberry Damage Assessment and Restoration Plan
Project Description: Details the damage associated with Mulberry Phosphate's December 1997 acidic process water spill that occurred in Polk County near Skinned Sapling Creek and discharged to the Alafia River and Tampa Bay. Restoration of freshwater and estuarine wetlands are required of Mulberry Phosphates as compensation for the spill's damage to vegetation and wildlife.
Location (drainage basin): Alafia River watershed
Participants: Mulberry Phosphates, National Oceanic and Atmospheric Administration, Florida Department of Environmental Protection, Polk County, Hillsborough County, Florida Game and Freshwater Fish Commission, Southwest Florida Water Management District
Implementation Schedule: On-going
How Financed: Mulberry Phosphates

ISSUE 2 - Impacts to Natural Systems from Land Use Alterations.

The Florida landscape has changed dramatically since pre-settlement times (circa 1820) and, particularly, within the last 60 years (Kautz 1993). Kautz (1993) provided quantitative information on land use and land cover changes in Florida between the years 1936 and 1987. In 1936, forested areas occupied 60% of the landscape, while areas of marsh occupied 20% (Kautz 1993). In that same year, agricultural areas comprised 17% of the total land area, while urban areas accounted for only 2% (Kautz 1993). By 1987, however, forested areas accounted for only 48% of Florida's landscape, while areas of marsh declined to 9% of the total area (Kautz 1993). In addition, agricultural areas increased to 30% of the total area, while urban areas increased to 13% (Kautz 1993). Like all of Florida, the area occupied by the Southwest Florida Water Management District has undergone these changes as well. The Alafia River watershed, in particular, has experienced a dramatic increase in urban, agricultural, and industrial land uses over the last 70 years. This has resulted in the direct destruction and fragmentation of native wildlife habitat throughout the watershed.

Forest fragmentation results from development activities which tend to divide or separate a forest into smaller patches or fragments. These fragments are, in turn, influenced by the surrounding urban, agricultural, industrial, or other land use pattern. Many fragments (especially those located in urban areas) are affected by hydrologic changes (e.g. lowering of the surface water table), disturbance of the natural fire regime (e.g. fire exclusion), invasion of exotic plant species, and other human impacts (e.g. dumping, recreational usages, etc.) which can affect the natural physical and biological processes associated with a particular ecosystem type (Abrahamson 1984; Abrahamson and Hartnett 1990; Brothers and Spingarn 1992; Ewel 1990; Simberloff 1993; Vince et al. 1989; Wolfe and Drew 1990). In the case of the smallest forest fragments (e.g. <50 acres), "ecosystem dynamics" are driven by "external" rather than internal forces (Saunders et al. 1991). This is due to the fact that fragmentation increases the ratio of forest edge to interior and of nonforest to forest (Hill 1985). Therefore, a smaller fragment has a smaller core area which can be highly affected by physical and biological changes associated with edges (Janzen 1983; Harris 1988). Within the Alafia River watershed, development activities (especially industrial and agricultural expansion) over the last 70 - 80 years have resulted in a patchwork landscape containing a variety of land uses including agriculture (e.g. row crops, pasture, and fish farms), urban and suburban centers (e.g. dredge and fill, commercial, and residential), industry (e.g. phosphate mining, power plants, etc.), and natural habitat. Much of this natural habitat is no longer subjected to natural ecosystem processes (e.g. fire) due to the close proximity of these other land uses. In fact, some of the smallest forest fragments (especially in urban and suburban areas) are in danger of losing their natural characteristics altogether (Turbiville 1996). In outlying areas where larger habitat remnants exist, a network of wildlife corridors should be established to connect these remnants and prevent their fragmentation into even smaller areas.

This Alafia River watershed has experienced significant rates of habitat destruction since the 1920's and 30's. Land clearing for agricultural and industrial (e.g. mining) purposes as well as dredge and fill activities (e.g. Big Bend power plant) has resulted in

a patchwork landscape of disturbed and native habitats. Pine flatwoods, sandhill, and scrub habitat in the western portion of the watershed have been cleared primarily for agricultural and suburban expansion, while, in the eastern portion, these same habitats have fallen prey to extensive phosphate mining operations. However, some fairly large areas of natural habitat (both publicly and privately-owned) still remain within this group. Some of the largest publicly-owned lands containing extensive areas of natural habitat include: the Alafia River South Prong (~1857 acres - pine flatwoods, riparian wetlands), Alderman's Ford Addition (~975 acres - pine flatwoods, scrub, riparian wetlands), Alderman's Ford South Prong Addition (~853 acres - pine flatwoods, riparian wetlands), Balm Boyette (~5000 acres - pine flatwoods, depression marsh, bayhead, cypress dome, oak and sand pine scrub, riparian wetlands), Triple Creek (~700 acres - pine flatwoods, scrub), Rhodine Scrub (~460 acres - pine flatwoods, depression marsh, oak and sand pine scrub), Fish Hawk (~300 acres - pine flatwoods, riparian wetlands), Boy Scout (~430 acres - pine flatwoods, scrub, riparian wetlands), English Creek (~376 acres - pine flatwoods, riparian wetlands), Kitchen (~355 acres - coastal flatwoods, mangrove swamp, hardwood hammock), Bullfrog Creek Scrub (~1600 acres - pine flatwoods, oak scrub, riparian wetlands), Golden Aster Scrub (~1200 acres - pine flatwoods, oak scrub, bayhead, depression marsh), Balm Scrub (~1592 acres - pine flatwoods, oak and sand pine scrub, riparian wetlands), Wolf Branch Creek (~1000 acres - saltern, tidal swamp, riparian wetlands), Medard Reservoir (~1000 acres - phosphate pits, reclaimed land, oak hammock), and Alafia State Park (~6000 acres - phosphate pits, reclaimed land, pine flatwoods, riparian wetlands). Several smaller publicly-owned tracts (<200 acres) are scattered throughout the watershed as well.

The Hillsborough County ELAP Program has taken the lead in purchasing environmentally sensitive land throughout the watershed, partnering with various government agencies, including SWFWMD, FDEP (CARL), and FCT. Many of the aforementioned lands are managed by Hillsborough County, while the District's SWIM Program has completed or planned habitat restoration and/or stormwater projects within disturbed areas on many of these lands.

Strategies:

1. Identify key resource areas in need of protection. Implement necessary resource protection (e.g. land acquisition, conservation easements, management agreements, conservation\stewardship tax incentives etc.).

2. Protect existing public conservation lands.

3. Require mitigation, restoration and compensation for impacts to public lands as a result of infrastructure development on the affected lands.

4. With other government agencies (e.g. HCELAPP), continue to aggressively pursue the purchase of approved lands within the watershed under the SOR/P2000 and Florida Forever Programs.

5. Identify remaining areas of xeric habitat (sandhill, scrub, and xeric hammock) within this watershed and push for acquisition or other protection (e.g. conservation easement) of the largest remaining examples. Restoration of xeric habitat, while difficult to achieve, may be feasible on larger tracts where historic soil types and topography remain intact.

6. Where possible, restore wetland and upland habitats on publicly-owned or other protected lands within the watershed through the District's SWIM section. Upland habitat restoration should be emphasized in future SWIM projects in order to account for ongoing upland habitat destruction throughout this watershed.

7. Support strict local land development codes and upland and wetland wildlife habitat ordinances throughout the watershed, using the District Water Management Plan (DWMP), technical reports, and public communication programs to document the District's support.

8. Support alternatives to groundwater pumping (e.g. desalination) and begin studying methods to restore damaged wetland areas (e.g. rehydration).

9. Support the habitat protection/restoration efforts of the District's SWIM section, the Florida Department of Environmental Protection, the Florida Game and Freshwater Fish Commission, the Florida Marine Research Institute, the Hillsborough County Environmental Protection Commission, the National Marine Fisheries Service, the Southwest Florida Water Management District, the Tampa Bay National Estuary Program, the U.S. Fish and Wildlife Service, and various local governments.

10. Support natural area inventories aimed at describing uncommon, threatened and endangered plants and animals on publically-owned lands and on significant tracts of privately owned lands, especially tracts that might be available for purchase in the future.

11. Support research to better understand the functioning of the natural systems and the management techniques needed to maintain, preserve, and restore natural areas.

12. Continue to support and fund xeriscaping programs and the integration of natural communities into the landscaping plans of developing areas. Re-introduce native plants and xeriscaping into existing developments.

13. Work with Florida and local Greenways groups to connect the remaining natural tracts with corridors for wildlife movement.

Projects:

Project Name: Save Our Rivers/Preservation 2000/Florida Forever
Project Description: Each of these programs provide funds for the purchase of environmentally sensitive lands within District boundaries that are necessary for water management, water supply, the conservation and protection of water resources, and/or the protection of native upland and wetland wildlife habitats. The SOR Program is a non-lapsing fund for the acquisition, management, maintenance and capital improvements of lands in accordance with Section 373.59, Florida Statutes. In creating the Florida Preservation 2000 Act, the 1990 Legislature found that, "The alteration and development of Florida's natural areas to accommodate its rapidly-growing population have contributed to the degradation of water resources, the fragmentation and destruction of wildlife habitats, the loss of recreation space, and the diminishment of wetlands and forests." Through the course of its local and regional water management activities, the District has undertaken the acquisition of lands for a broad spectrum of water resource protection and management projects. These have included: flood abatement, water quality protection and improvement, water supply development, protection of recharge areas, protection of wetland systems (such as headwater swamps and river floodplains) and restoration and management of uplands. Regardless of the primary purpose for which lands are acquired, they should also serve to protect or restore natural systems. In 1999, the Florida Legislature passed the Florida Forever Act which is the successor program to P2000. Like P2000, the Florida Forever program will provide $3 billion over ten years ($300 million annually). Thirty-five percent or $105 million annually will be allocated to the water management districts for land acquisition, SWIM, water resource development, water supply development, and restoration. At least 50 percent of the WMD allocation must be spent on land acquisition. Of the $105 million provided to the water management districts, SWFWMD will receive 25 percent, or approximately $26 million.
Location (drainage basin): Various locations throughout the District (see the District's SOR/P2000 FY 2000 Five-year plan booklet).
Participants: SWFWMD, State of Florida, various local governments
Implementation Schedule: Acquisitions continually ongoing
How Financed: SWFWMD, State of Florida, various local governments

Project Name: Land Acquisition Programs - Various Local Governments
Project Description: Many counties within the District have their own land acquisition programs that provide funding for the purchase of environmentally sensitive lands. Within the Alafia River watershed, both Hillsborough and Polk County have land acquisition programs. The largest of these is the taxpayer-funded Hillsborough County Environmental Lands Acquisition and Protection (ELAP) Program (founded in 1987) which provides 100 million dollars over 20 years for the purchase of environmentally sensitive lands within the county. The District has jointly purchased environmentally sensitive lands with each county.
Location (drainage basin): Various protected lands throughout the Alafia River watershed.
Participants: SWFWMD, State of Florida, Hillsborough County, Polk County

Implementation Schedule: Acquisitions continually ongoing
How Financed: SWFWMD, State of Florida, Hillsborough County, Polk County, FCT

Project Name: Surface Water Improvement and Management (SWIM) Program
Project Description: In 1987, the Florida Legislature enacted the Surface Water Improvement and Management Act (Sections 373.451-373.4595, Florida Statutes). They recognized that water quality in surface water bodies throughout the state had either degraded or were in danger of being degraded and that important functions once performed by associated natural systems were no longer being provided. The functions to be maintained or improved were identified in the SWIM Act. These include: 1) providing aesthetic and recreational pleasure for the state's citizens; 2) providing habitat for native plants and animals, including endangered and threatened species; and 3) providing safe drinking water for the state's growing population as well as attracting visitors and accruing other economic benefits. The Act required that each water management district identify and maintain a priority list of water bodies of regional or statewide significance, and develop plans and programs for the improvement of those water bodies. Water bodies identified by the district's are approved by the state and include the addition of new water bodies or the removal of existing ones. The Alafia River and its tributaries drain directly to Tampa Bay, the SWIM Program's #1 priority waterbody.
Location (drainage basin): Various SWIM habitat restoration and stormwater improvement projects located throughout the Alafia River watershed.
Participants: SWIM Program, SWFWMD (Alafia River Basin Board), State of Florida, Local cooperators
Implementation Schedule: Various SWIM projects implemented continuously throughout the Alafia River watershed.
How Financed: SWIM Program, SWFWMD (Alafia River Basin Board), State of Florida, Local cooperators

ISSUE 3 - Preservation of Watershed and Ecosystem Integrity.

The loss of significant wildlife habitat through the conversion of native ecosystems to human-dominated and controlled landscapes is well documented. Initially, this conversion was the result of widespread harvesting of natural resources, particularly timber. Subsequent impacts resulted from land clearing for agriculture, as well as from mining of limerock, shell, peat, and phosphate deposits. Additional negative environmental effects resulted from the creation of a network of transportation routes and man-made "improvements" to wetlands, waterways, and harbors. These impacts fragmented, degraded, and destroyed natural habitats. Currently, increasing urbanization and continued expansion of mining and agricultural operations within the Alafia River watershed threaten to destroy a majority of native wildlife habitat outside of publicly-owned preserves.

It is critical that both state, county, and local governments determine the appropriate

amount of natural habitat to be acquired or protected in order to supplement existing conservation lands. According to Cox, et al. (1994), the percentage of existing conservation lands in Hillsborough County (3.5%) ranks near the bottom one-third of all Florida counties. Many local and regional government agencies have identified remaining available lands. Each month that passes without positive protective measures for remaining natural habitat results in increased pressures for its continued alteration and destruction.

The key to maintenance of a particular ecosystem(s) is the availability of enough acreage to provide suitable habitat to support a diverse assemblage of plants and animals. First, this is critical so that natural cyclical, seasonal, temporal, catastrophic, and accidental (man-induced) conditions will not destroy all of the critical elements of an ecosystem's components. Second, many large and suitable areas of wildlife habitat are necessary to provide populations of native animals with food, water, shelter, and breeding areas. Third, as areas of natural habitat are being degraded and destroyed on a daily basis, the survival of a variety of plant and animal species depends upon the protection of an assemblage of suitable habitat areas and wildlife corridors which connect both similar and dissimilar habitats. The ability of wildlife to move between areas of larger and smaller habitats is essential. Lack of sufficient resources in a limited area combined with the man-made barriers which prevent native wildlife from foraging for resources increase survival pressure further than many species can withstand. Isolation of wildlife, for example, can lead to loss of genetic integrity, while forest fragmentation leads to changes in plant species, declines in ecosystem diversity, and the spread of non-native plants adapted to "edge conditions."

The protection of wildlife corridors can mitigate these effects to a certain extent. A "wildlife corridor" may be defined as any wildlife habitat or cover, usually linear, that offers a safe route from one habitat to another (Johnson & Beck, 1988). The need for and use of wildlife corridors was recognized as early as the 1930's (Edminster, 1938) and have been used widely ever since for the benefit of game species (McElfresh, et al., 1980) as well as non-game animals (Maehr, 1990).

In creating the Florida Preservation 2000 Act, the 1990 Legislature found that, "the alteration and development of Florida's natural areas to accommodate its rapidly growing population have contributed to the degradation of water resources, the fragmentation and destruction of wildlife habitats, the loss of recreation space, and the diminishment of wetlands and forests." (SWFWMD, 1997). Florida's Water Management Districts were given primary responsibility for land acquisition under the Preservation 2000 Act. Since 1991, SWFWMD has utilized a proactive, resource-based approach to identify wildlife corridors for potential acquisition.

Much of the 300,000 acres of District-owned land is comprised of wildlife corridors located along rivers and other conveyance systems. For example, the District has acquired 16 miles of land along the Hillsborough River, 5.7 miles along the Anclote River (Hill, pers. com.) and, in conjunction with Hillsborough County, 4 miles along the

Alafia River and 4 miles along the Little Manatee River.

One recommendation for providing suitable wildlife habitat involves the protection of large tracts of habitat with wide movement corridors. "Large" habitats can be defined as one square mile of suitable habitat for each target species. Typically, 1/4 to ½ mile wide corridors are recommended to link large habitats. Buffers for rivers are recommended to be a minimum of 550 feet, with upland buffers along wetlands being 1000 (minimum of 500) feet wide. Decreases in available corridor width result in a corresponding decrease in the diversity each habitat will sustain. Unlike the urbanized Tampa Bay watershed, these recommendations are still achievable throughout most of the Alafia River watershed. The preservation and enhancement of remaining natural habitats and corridors should, in the short term, maintain a portion of the native wildlife populations and, in the long term, allow for recolonization of current and future restoration areas.

Loss of habitat is the most significant cause for the collapse of any ecosystem. However, disruption of one or more of the critical components of an ecosystem (e.g. fire) can lead to the degradation of existing native habitat(s). Significant efforts to manage protected areas is essential. The continued exclusion of fire as a management tool, even in smaller nature preserves and parks, cannot continue if the integrity of fire-dependent ecosystems is to be maintained or restored. Citizen education and understanding of basic fire ecology principles are necessary to gain public support of prescribed fire practices. In addition, future residential and commercial developments should be designed to encourage protection of natural habitats and wildlife corridors whenever possible. Voluntary and incentive-based programs which encourage the replacement of non-native ornamental vegetation can increase the value of suburban areas for wildlife use during times of stress in nearby areas of natural habitat.

Goals:

1. Identify and acquire key areas of native habitat, with emphasis on acquisition of core habitat areas and wildlife corridors.

2. Support the continuation of local land acquisition programs (e.g. Hillsborough County ELAPP, Polk County Environmental Lands Acquisition and Management Program, etc.).

Strategies:

1. Implement proper management and protection of natural lands by developing core area and buffer systems along the river and tributaries.

2. Continue to implement the District's Preservation 2000/Save Our Rivers/Florida Forever land acquisition program.

3. Continue to utilize other land preservation options including Less-than-Fee acquisitions.

4. Increase knowledge of alternative housing strategies, promote multi-family housing with greenspace concepts, and emphasize redevelopment of existing land over destruction of undeveloped tracts, using the DWMP to further these ideas.

5. Support all local, city , and county-wide ordinances that increase upland protection, buffer requirements, and the prohibition or control of exotic plants, using the DWMP to further this support.

6. Educate local citizens regarding the environmental and economic value of natural systems. Involve the public in proposed preservation and enhancement plans.

7. Create and support incentive programs for private landowners to manage their lands for ecological benefits to the public.

8. Continue to support and fund the Florida Yards and Neighborhoods Program, while emphasizing the need to eliminate invasive exotic plant species from properties involved in this program.

9. Support natural area inventories aimed at describing uncommon, threatened and endangered plants and animals on publically-owned lands and on significant tracts of privately owned lands, especially tracts that might be available for purchase in the future.

Projects:

Project Name: Save Our Rivers/Preservation 2000/Florida Forever
Project Description: Each of these programs provide funds for the purchase of environmentally sensitive lands within District boundaries that are necessary for water management, water supply, the conservation and protection of water resources, and/or the protection of native upland and wetland wildlife habitats. The SOR Program is a non-lapsing fund for the acquisition, management, maintenance and capital improvements of lands in accordance with Section 373.59, Florida Statutes. In creating the Florida Preservation 2000 Act, the 1990 Legislature found that, “The alteration and development of Florida’s natural areas to accommodate its rapidly-growing population have contributed to the degradation of water resources, the fragmentation and destruction of wildlife habitats, the loss of recreation space, and the diminishment of wetlands and forests.” Through the course of its local and regional water management activities, the District has undertaken the acquisition of lands for a broad spectrum of water resource protection and management projects. These have included: flood abatement, water quality protection and improvement, water supply development,

protection of recharge areas, protection of wetland systems (such as headwater swamps and river floodplains) and restoration and management of uplands. Regardless of the primary purpose for which lands are acquired, they should also serve to protect or restore natural systems. In 1999, the Florida Legislature passed the Florida Forever Act which is the successor program to P2000. Like P2000, the Florida Forever program will provide $3 billion over ten years ($300 million annually). Thirty-five percent or $105 million annually will be allocated to the water management districts for land acquisition, SWIM, water resource development, water supply development, and restoration. At least 50 percent of the WMD allocation must be spent on land acquisition. Of the $105 million provided to the water management districts, SWFWMD will receive 25 percent, or approximately $26 million.
Location (drainage basin): Various locations throughout the District (see the District's SOR/P2000 FY 2000 Five-year plan booklet).
Participants: SWFWMD, State of Florida, various local governments
Implementation Schedule: Acquisitions continually ongoing
How Financed: SWFWMD, State of Florida, various local governments.

Project Name: Land Acquisition Programs - Various Local Governments
Project Description: Many counties within the District have their own land acquisition programs that provide funding for the purchase of environmentally sensitive lands. Within the Alafia River watershed, both Hillsborough and Polk County have land acquisition programs. The largest of these is the taxpayer-funded Hillsborough County Environmental Lands Acquisition and Protection (ELAP) Program (founded in 1987) which provides 100 million dollars over 20 years for the purchase of environmentally sensitive lands within the county. The District has jointly purchased environmentally sensitive lands with each county.
Location (drainage basin): Various protected lands throughout the Alafia River watershed.
Participants: SWFWMD, State of Florida, Hillsborough County, Polk County
Implementation Schedule: Acquisitions continually ongoing
How Financed: SWFWMD, State of Florida, Hillsborough County, Polk County

Project Name: Surface Water Improvement and Management (SWIM) Program
Project Description: In 1987, the Florida Legislature enacted the Surface Water Improvement and Management Act (Sections 373.451-373.4595, Florida Statutes). They recognized that water quality in surface water bodies throughout the state had either degraded or were in danger of being degraded and that important functions once performed by associated natural systems were no longer being provided. The functions to be maintained or improved were identified in the SWIM Act. These include: 1) providing aesthetic and recreational pleasure for the state's citizens; 2) providing habitat for native plants and animals, including endangered and threatened species; and 3) providing safe drinking water for the state's growing population as well as attracting visitors and accruing other economic benefits. The Act required that each water management district identify and maintain a priority list of water bodies of regional or

statewide significance, and develop plans and programs for the improvement of those water bodies. Water bodies identified by the district's are approved by the state and include the addition of new water bodies or the removal of existing ones. The Alafia River and its tributaries drain directly to Tampa Bay, the SWIM Program's #1 priority waterbody.
Location (drainage basin): Various SWIM habitat restoration and stormwater improvement projects located throughout the Alafia River watershed.
Participants: SWIM Program, SWFWMD (Alafia River Basin Board), State of Florida, Local cooperators
Implementation Schedule: Various SWIM projects implemented continuously throughout the Alafia River watershed.
How Financed: SWIM Program, SWFWMD (Alafia River Basin Board), State of Florida, Local cooperators

Project Name: District and Local Geographic Information Systems (GIS) Habitat Mapping Efforts - Various.
Project Description: The District, along with Hillsborough County, have initiated efforts to map significant wildlife habitat and existing wildlife corridors within the Alafia River watershed. These mapping efforts (along with necessary ground truthing and field inspections) are critical for establishing District land acquisition and study area project boundaries to ensure long-term survival of native plant and animal communities and protection of water resources. For local governments, knowing the locations of critical wildlife habitat and corridor areas can assist in the drafting of future land use plans as well as ruling on Developments of Regional Impact (DRI) and other rezoning issues.
Location (drainage basin): Throughout watershed
Participants: SWFWMD, various local governments
Implementation Schedule: On-going
How Financed: SWFWMD, various local governments

Project Name: Florida Yards and Neighborhood Program
Project Description: Hillsborough County was one of the originators of this program. Emphasizes many water conservation and landscape techniques in local neighborhoods. The use of native and drought-tolerant plants is promoted, while the use of exotic plants (in particular, invasive exotic plants) is discouraged.
Location: Hillsborough County
Participants: Hillsborough County, SWFWMD
Implementation Schedule: Project ongoing. Hillsborough County plans to participate in the implementation of more neighborhoods to the FY&N program as long as the program continues.
How Financed: Hillsborough County, SWFWMD

ISSUE 4 - Identification and Protection of Estuarine Aquatic Ecosystems.

Since the late 1800's, Tampa Bay has experienced a drastic reduction in submerged

aquatic vegetation (SAV). According to Lewis et al. (1985), seagrass meadows covered approximately 31,000 hectares (ha) of shallow bay bottom in 1897. However, by 1950 and 1982 this number had declined to 16,500 ha and 8,800 ha, respectively (Lewis et al. 1991). A reduction in nitrogen loading to Tampa Bay during the late 1970's and early 1980's led to an overall improvement in water quality which later resulted in an increase in seagrass coverage. By 1994, seagrass meadows had expanded to cover nearly 10,800 ha of shallow bay bottom, an increase of approximately 23% since 1982 (Johansson and Ries 1997). However, flooding El Nino rains between December 1997 and March 1998 resulted in a dramatic increase in freshwater flows and nutrient loading to Tampa Bay. Stormwater runoff, combined with accompanying nutrient loads, led to a baywide decline in water quality and seagrass growth (personal communication, D. Tomasko, 11/00).

In the shallow waters of middle Tampa Bay and Hillsborough Bay, seagrass coverage increased by 12% and 881% (from 6 to 61 ha), respectively, between 1988 and 1994 (Johansson and Ries 1997). The high percentage increase in both of these areas (in particular, Hillsborough Bay) resulted from a decrease in nitrogen loading to Tampa Bay. This decrease in nitrogen loading is evidenced by a baywide decline in chlorophyll-*a* concentrations between 1982 and 1996 (Tomasko and Ries 1997). Surprisingly, there was no decline in seagrass growth in Hillsborough Bay during the 1997-98 El Nino rains, even though Tampa Bay as a whole experienced a significant decline (personal communication, D. Tomasko, 11/00). The reasons for this are unknown at this time.

Since 1988, SAV has been used as a barometer of the health of the Tampa Bay estuarine system. SAV, especially climax species such as *Thalassia testudium* or *Halodule wrightii* are very sensitive to light and water quality conditions. By measuring the health and relative abundance of these species through aerial photograph interpretation and ground-truthing, the health of the ecosystem can be gauged. This tool has been very useful for the District's SWIM Program and the Tampa Bay National Estuary Program. In order to assess the health of these systems and continue to gauge the health of Tampa Bay, the SAV population should be monitored on a regular basis.

Strategies:

1. Support the continued efforts of the Southwest Florida Water Management District's SWIM Program and a variety of other county, state, and federal organizations in developing habitat restoration and/or stormwater improvement projects that will ultimately improve water quality and clarity (i.e. appropriate conditions for seagrass expansion) within Tampa Bay.

2. Support District and local land acquisition programs and other natural habitat/water resource protection efforts in Hillsborough and Polk counties. Protection of riparian and coastal habitats should be emphasized in order to maintain the quality of water entering Tampa Bay.

3. Continue to monitor the SAV populations within the Tampa Bay estuarine system. This should include the current bi-yearly aerial photograph-interpretation process funded through the SWIM Program as well as ground truthing on an as-needed basis. In the recent past, this process provided extremely valuable information for the region's resource managers.

Projects:

Project Name: Seagrass Mapping (Tampa Bay)
Project Description: Funding is used to continue an ongoing (biannual-every other year) seagrass mapping and monitoring effort in Tampa Bay. Specifically, the District has secured a consultant to provide aerial photography, photointerpretation, mapping, and biological monitoring services in order to generate calculations of seagrass acreage and distribution within each of the named waterbodies. Data from this project will continue to be used as a monitoring tool to assess the health of an important coastal resource and to evaluate the performance of ongoing water quality and habitat improvement projects.
Location (drainage basin): Bullfrog Creek, Big Bend Bayou, Apollo Beach Canal, Wolfbranch, and the confluence of the Alafia River and Hillsborough Bay
Participants: SWFWMD, SWIM Program
Implementation Schedule: On-going (every other year)
How Financed: SWFWMD, SWIM Program

ISSUE 5 - Invasive Exotic Plant Species Control.

Since the late 1800's, lands throughout the state of Florida, including the Southwest Florida Water Management District, have been invaded by hundreds of exotic plant species. Between 1898 and 1967 many of these species were imported by the U.S.D.A. as ornamentals and forage/grain crops (Gordon and Thomas 1994). Once established, several of the most aggressive exotic plant species spread across Florida. The Alafia watershed was particularly susceptible to these invasions. Urbanization, along with the spread of agricultural and mining operations, led to widespread soil disturbance, road construction, and other pathways that resulted in the establishment of invasive exotic plant species within the watershed. Soil disturbance, in particular, is essential for colonization by exotic plant species (diCastri 1989; Ewel 1986; Rejmanek 1989). As a result of these exotic plant invasions, many natural ecosystem processes have been altered including specific fire and hydrologic regimes, soil fertility (e.g. lower pH), and light availability (e.g. shading of understory plants) (Jensen and Vosick 1994).

In 1993, the Florida Exotic Pest Plant Council (EPPC) compiled a list of Florida's most invasive exotic plant species and grouped them according to degree of invasiveness. According to Schmitz (1994, 12-13), there are three categories of invasive exotic plant species. These are defined as:

Category 1 - Species that are widespread in Florida and have an established potential to invade and disrupt native plant communities;

Category 2 - Species that are localized but have a rapidly expanding population, or that have shown a potential to invade and disrupt native vegetation in other areas, or in countries with climates similar to that of Florida;

Category 3 - Species that are widespread and can form dense, monotypic populations, but are primarily found on disturbed sites such as roadsides, agricultural lands, and canal embankments."

There are several Category 1 species located throughout the Alafia watershed. The most abundant of these include *Casuarina equisetifolia* (Australian pine), *Schinus terebinthifolius* (Brazilian pepper), *Dioscorea bulbifera* (air potato), *Paederia foetida* (skunk vine), and *Melaleuca quinquenervia* (melaleuca). *Imperata cylindrica* (cogon grass), a Category 2 species, and *Ricinus communis* (castor bean), a Category 3 species, are also present. These species are eradicated using a variety of techniques and herbicides.

The Alafia River watershed has experienced significant invasions of exotic plant species due primarily to extensive land clearing for agricultural and mining purposes. Historic phosphate mining adjacent to the river in the vicinity of Alderman's Ford Park led to a widespread invasion of skunkvine and air potato within the forested floodplain. In the agricultural areas in and around Balm, cogon grass has spread due to widespread land clearing and soil disturbance. Near the coast, dredge and fill activities and urban development have created pathways for Brazilian pepper and Australian pine, among other exotic and ornamental plants. Windbreaks consisting of Brazilian pepper and Australian pine provided the initial seed source for establishment of these species.

Nearly all publicly-owned and protected lands within the watershed have been invaded by exotic plants to some degree. These lands include the Alafia River Corridor, Wolf Branch Creek, Bullfrog Creek Scrub, Balm Road Scrub, Golden Aster Scrub, and Apollo Beach, among others. The Hillsborough County ELAP Program and the District's SWIM and Land Management Programs continue to play a major role in controlling exotic plant species on these and other sites throughout the watershed.

Strategies:

1. Continue to integrate land management and restoration efforts on public lands for coordinated control of invasive exotic plant species.

2. Educate the general public, local governments, plant nursery industry, and

private land owners on the adverse impacts and long-term consequences of exotic species on natural systems and the need for control and eradication.

3. Seek the cooperation of private land owners (particularly those adjoining public lands and those within wildlife corridor and buffer areas) on the need to control exotic species. Provide information and technical expertise as needed.

4. Encourage and fund further research on exotic plant biocontrol methods (i.e. their mode of spreading and remedial control measures).

5. Continue to support and fund cooperative funding and other projects that focus on eradication of exotic plants.

6. Continue to support and fund the Florida Yards and Neighborhoods Program, while emphasizing the need to eliminate invasive exotic plant species from properties involved in this program.

7. Continue to support the Florida Department of Transportation's (FDOT) efforts to control invasive exotic plant species on FDOT properties and rights-of-way within the watershed.

8. Review and comment on local, city, and county-wide ordinances dealing with eradication of invasive exotic plant species.

9. Support current and future research regarding successful removal techniques of invasive exotic plant species.

Projects:

Project Name: Hillsborough County Nuisance Plant Removal
Project Description: The objective of the project is to provide natural resource management for lands within the Alafia River Basin that have been acquired through Hillsborough County's Environmental Lands Acquisition and Protection Program (ELAPP), the District's Save Our Rivers (SOR) Program, the state's Conservation Area and Recreational Lands (CARL) Program, and the Florida Communities Trust (FCT) Program. Specifically, the project addresses the issue of habitat loss and degradation through the removal of a variety of invasive exotic plant species and, in some cases, replanting with appropriate native plant species. Target exotic plant species include, but are not limited to, Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina Sp.*), cogon grass (*Imperata cylindrica*), air potato (*Dioscorea bulbifera*), and tropical soda apple (*Solanum viarum*).
Location (political basin): Alafia River Basin (Hillsborough County)
Participants: Hillsborough County ELAPP, SWFWMD
Implementation Schedule: On-going since January 1998

How Financed: Hillsborough County ELAPP, SWFWMD

Project Name: Wolfbranch Creek Habitat Restoration
Project Description: Involves the design and implementation of a large-scale habitat restoration project within a 1,000 acre parcel (located adjacent to Tampa Bay between Apollo Beach and Ruskin) purchased through the Hillsborough County ELAP Program. Specific goals of the project include creation and enhancement of approximately 200 acres of freshwater and estuarine wetlands and removal of several hundred acres of existing invasive exotic plant species (e.g. Brazilian pepper and Australian pine).
Location (drainage basin): Wolfbranch Creek
Participants: SWFWMD, SWIM Program, U.S. Fish and Wildlife Service, Gardinier Trust Fund, Hillsborough County ELAPP (land purchase and management), Florida Department of Environmental Protection, Oklawaha Farms, Horticultural Systems, Peninsula Design and Engineering
Implementation Schedule: Wetland construction and initial exotic plant removal completed February 2001. Contracted exotic plant control and maintenance available for one year after project completion. Upland restoration performed as funds become available.
How Financed: SWFWMD, SWIM Program, U.S. Fish and Wildlife Service, Gardinier Trust Fund, Hillsborough County ELAPP (land purchase and management)

Project Name: The Kitchen - Dug Creek, Davis Tract, Port Redwing Tract
Project Description: Involves the design and implementation of a habitat restoration project within approximately 240 acres of submerged, shoreline, riverine, and upland habitats associated with the area of Tampa Bay known as the “Kitchen.” Individual parcels were purchased by the Hillsborough County Environmental Lands Acquisition and Protection Program (ELAPP) and/or the District with the intent of enhancing, restoring, and protecting native habitats. The restoration project will focus on: 1) the design and construction of habitat mosaics (assemblages of habitats naturally found in coastal/estuarine ecosystems, encompassing upland, transitional, intertidal, subtidal, and freshwater habitats) and 2) removal of exotic plant species (mainly Brazilian pepper) on site and replanting with appropriate native species.
Location (drainage basins): Bullfrog Creek and Big Bend Bayou.
Participants: SWFWMD, SWIM Program, Hillsborough County ELAPP (land purchase and management)
Implementation Schedule: Design completed for Davis Tract. Wetland construction for Dug Creek and Davis Tract scheduled for early 2001. Exotic plant removal and upland restoration at Davis Tract ongoing.
How Financed: SWFWMD, SWIM Program, Gardinier Trust Fund, Hillsborough County ELAPP (land purchase and management)

Project Name: Apollo Beach Habitat Restoration
Project Description: Involves the design and implementation of a forty (40) acre or larger Tampa Bay estuarine wetland restoration project at the north end of Apollo Beach

on a 63 acre parcel acquired through the Hillsborough County ELAP Program. Both intertidal wetlands and open water features/channels will be incorporated into project design. Exotic plant species (e.g. Brazilian pepper) will be removed from the site. The project is being coordinated with a Hillsborough County park development process for the site.
Location (drainage basin): Big Bend Bayou
Participants: SWFWMD, SWIM Program, U.S. Fish and Wildlife Service, Gardinier Trust Fund, State of Florida, Hillsborough County ELAPP (land purchase and management), HDR Engineering, Inc.
Implementation Schedule: Design in progress. Construction scheduled for 2001.
How Financed: SWFWMD, SWIM Program, U.S. Fish and Wildlife Service, Gardinier Trust Fund, State of Florida, Hillsborough County ELAPP (land purchase and management)

Project Name: Florida Yards and Neighborhood Program
Project Description: Hillsborough County was one of the originators of this program. Emphasizes many water conservation and landscape techniques in local neighborhoods. The use of native and drought-tolerant plants is promoted, while the use of exotic plants (in particular, invasive exotic plants) is discouraged.
Location: Hillsborough County
Participants: Hillsborough County, SWFWMD
Implementation Schedule: Project on-going. Hillsborough County plans to participate in the implementation of more neighborhoods to the FY&N program as long as the program continues.
How Financed: Hillsborough County, SWFWMD

ISSUE 6 - Non-point Source Loading to Remaining Natural Habitats.

Non-point source pollution comes from many sources and cannot be traced to one specific point, such as pollution from stormwater runoff and the atmosphere. The problem of non-point source loading in streams/creeks, rivers, bays, forested and non-forested wetlands, and other water bodies is acute in Hillsborough County in part because of the close intermingling of surface and groundwater. This issue is of particular concern because of the cumulative impact to remaining natural habitats. Those impacts include increased water quality degradation from nutrient level increases, biological oxygen demand, suspended solids/turbidity, sediment deposition from erosion, heavy metal concentrations, and other impacts associated with stormwater runoff from agricultural, commercial, and residential developments.

One estimate states that, “non-point sources can contribute 30-80% of the total urban oxygen demanding pollutants and contain a level of toxic materials exceeding typical industrial discharges and pathogen levels exceeding that from the chlorinated effluent of treatment plants”, (Enviro-Control Colson 1994). Stormwater runoff carrying fertilizer, pesticides, oils and other contaminants from urban and agricultural lands contributes

nearly half of Tampa Bay's total annual nitrogen loadings and more than 60% of the annual loadings of zinc, mercury, lead and chromium, (Charting the Course 1996). For fecal and total coliform counts, non-point sources account for over 98% of the total loadings. PCB's are another toxic contaminant which enter the environment from non-point sources. One estimate concludes that since 1929, 227,000 Tons of PCB's have entered the environment. As reported in the proceedings of a seminar held in 1987 by NOAA, "non-point sources contribute by far most of the total suspended solids and 30-50% of the nitrogen and phosphorus loadings to Tampa Bay". It has also been observed that nutrient loading can lead to an increase in *Lemna*, *Salvinia*, *Typha*, and primrose willow in enriched wetlands. Enrichment typically leads to a build-up of muck which is detrimental to many rooted submerged species.

Agricultural operations, in many cases, are known to contribute to non-point source pollution. Runoff from agricultural land use practices contributes to increased nutrient levels in downstream areas. These practices include animal feedlot operations and use of pesticides, herbicides and fertilizers. Stormwater is the medium in which these pollutants enter nearby ditches, wetlands or other surface waters. Erosion of soil due to poor management practices contributes to sediment loading of downstream areas. Nationally, over 4 billion tons of sediment are delivered annually into streams and rivers of the contiguous U.S. Almost half of that amount originates from approximately 170 million ha of agricultural lands. It has been found that streams draining agricultural watersheds have on the average considerably higher nutrient concentrations than those draining forested watersheds. A study conducted in Wisconsin showed that, "high levels of agriculture were associated with degraded ecosystems" (Wang, Lyons, Kanehl and Gatti 1997).

Within the Alafia River watershed, the Florida Department of Environmental Protection has recently compiled a list of waters that do not meet applicable water quality standards (303d report, FDEP, 1998). The list is based on water segment assessments from the 1996 305 (b) Water Quality Assessment. The list includes the following waters and their associated water quality issue(s): South Prong Alafia River (coliforms, nutrients), Owens Branch (coliforms, nutrients), Bell Creek (dissolved oxygen, nutrients, coliforms), North Prong Alafia River (dissolved oxygen, nutrients, coliforms), Alafia River at Hillsborough Bay (dissolved oxygen, coliforms, nutrients), Thirtymile Creek (dissolved oxygen, coliforms, nutrients), Buckhorn Spring (nutrients), English Creek (coliforms, nutrients), Turkey Creek (coliforms, nutrients, turbidity), Poley Creek (coliforms, nutrients, turbidity). A comprehensive, watershed management approach to these water quality issues is needed to improve water quality and affected habitats within the Alafia River and, ultimately, Tampa Bay.

Many of the natural habitats within the watershed (in particular, freshwater, riparian, and estuarine wetlands) are threatened by adjacent development, agricultural practices and other land uses which contribute to non-point source pollution. In terms of areas containing valuable/critical remaining habitat affected by non-point source pollution, one nationwide study regards Tampa Bay and Rookery Bay as first and second in the nation

in the highest per-unit-area application of the more hazardous pesticides (Pait et al. 1992). It was also noted that pesticides, including insecticides, herbicides and fungicides are primarily agricultural in origin. Another study by Berndt, et al. (1998), found that the concentration of PCB's and organochlorines in the bed sediments of Bullfrog Creek was among the highest 25 percent of all sampled stream sites within the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program. In addition, Bullfrog Creek receives much of its dry season flow from agricultural runoff adjacent to the creek's headwaters. These findings reflect decades of negative environmental impacts resulting from agricultural development within the watershed.

Within the watershed, the District's SWIM Program and the Hillsborough County Stormwater Department have taken the lead in implementing stormwater improvement and habitat restoration projects aimed at improving water quality through the capture of non-point source agricultural runoff. The capture of this runoff prior to its discharge into streams and waterways is a priority for the SWIM Program. Recent SWIM projects that have been implemented along Bullfrog Creek include the Sumner Road and Balm Road Stormwater Improvement projects. In future years, additional projects focusing on the protection and improvement of water quality and habitat within the Alafia River watershed will be implemented through the SWIM Program and its cooperators.

Strategies:

1. Implement proper management and protection of natural lands by developing core area and buffer systems along the river and tributaries.

2. Develop and implement setbacks and Best Management Practices (BMPs) to protect watercourses from urban/suburban and agricultural runoff.

3. Identify and promote compatible land uses along river core and buffer areas.

4. Where possible, identify "hot spots" of poor water quality and/or habitat degradation and implement water quality improvement projects.

Projects:

Project Name: Sumner Road Stormwater Management Project
Project Description: The District's SWIM Program and Hillsborough County's Stormwater Section joined forces in 1998 to improve water quality within Bullfrog Creek. The Sumner Road project is divided into two phases. Phase I involved construction of a 7.66 acre stormwater pond designed to trap sediments and reduce sediment transport from approximately 127 acres of existing agricultural lands. Phase II involved installation of wetland trees within approximately four acres of the pond, fencing of the entire pond (to prevent livestock from entering), and, if necessary, implementation of erosion control measures along an existing ditch system leading from the proposed

pond to Bullfrog Creek. As a result of this project, water quality within Bullfrog Creek (and, ultimately, Tampa Bay) will improve. In addition, the pond has reduced flooding on Sumner Road and other downstream properties by attenuating peak flow rates from these 127 acres.
Location (drainage basin): Bullfrog Creek
Participants: SWIM Program, Alafia River Basin Board, Hillsborough County
Implementation Schedule: Pond construction completed January 1999. Wetland planting completed December 1999. Exotic and nuisance plant maintenance ongoing.
How Financed: SWIM Program, Alafia River Basin Board, Hillsborough County

Project Name: Balm Road Wetland and Stormwater Treatment Project
Project Description: The District's SWIM Program and Hillsborough County's Stormwater Section joined forces in 1999 to improve water quality at the headwaters of Bullfrog Creek. The project has a wetland and upland restoration component. Wetland restoration activities include the creation of an approximately 30 acre floodplain marsh designed to treat stormwater runoff from 1,025 acres of upstream, active agricultural land prior to discharging into Bullfrog Creek near its headwaters in south-central Hillsborough County. Upland restoration activities will focus on restoring a variety of historic ecological communities on approximately 200 acres of disturbed lands (adjacent to the marsh and Bullfrog Creek) through the removal of agricultural ditches and installation of native upland vegetation. All restoration activities will take place on publicly-owned land purchased through the Hillsborough County Environmental Lands Acquisition and Protection Program.
Location (drainage basin): Bullfrog Creek
Participants: SWIM Program, Alafia River Basin Board, Hillsborough County Stormwater Division and ELAP Program, Florida Department of Environmental Protection
Implementation Schedule: Design in progress; commence construction in 2001.
How Financed: SWIM Program, Alafia River Basin Board, Hillsborough County, Pollution Recovery Trust Fund, Mobil Settlement Fund, Florida Department of Environmental Protection, Tampa Port Authority

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ACRONYMS

ACOE . . . . . Army Corp of Engineers
AORs . . . . . Areas of Responsibility
ASR . . . . . Aquifer Storage and Recovery
BMP . . . . . Best Management Practices
CARL . . . . . Conservation and Recreational Lands
cfs . . . . . cubic feet per second
CWM . . . . . Comprehensive Watershed Management
DWMP . . . . . District Water Management Plan
ELAPP . . . . . Environmental Lands Acquisition and Preservation Program
EMA . . . . . Ecosystem Management Areas
EPC . . . . . Environmental Protetion Commission
ERP . . . . . Environmental Resource Permit
ESL . . . . . Environmental Sensitive Lands
F.A.C. . . . . Florida Administrative Code
FDA . . . . . Flood Detention Area
FDCA . . . . . Florida Department of Community Affairs
FDEP . . . . . Florida Department of Environmental Protection
FDOT . . . . . Florida Department of Transportation
FEMA . . . . . Federal Emergency Management Agency
FIRM . . . . . Flood Insurance Rate Maps
F.S. . . . . Florida Statutes
FWCC . . . . . Florida Fish and Wildlife Conservation Commission
GIS . . . . . Geographic Information System
LaMP . . . . . Lake Monitoring Program
LHFDA . . . . . Lower Hillsborough Flood Detention Area
LOS . . . . . Level of Service
MFL . . . . . Minimum Flows and Levels
mgd . . . . . million gallons per day
MOU . . . . . Memorandum of Understanding
NEP . . . . . National Estuary Program
NGVD . . . . . National Geodetic Vertical Datum
NPDES . . . . . National Pollutant Discharge Elimination System
NPS . . . . . Non-point source
NRCS . . . . . Natural Resources Conservation Service
NTBWUCA . . . . . Northern Tampa Bay Water Use Caution Area
NURP . . . . . Nationwide Urban Runoff Program
OFW . . . . . Outstanding Florida Waters
P2000 . . . . . Preservation 2000
PAHs . . . . . Polycyclic Aromatic Hydrocarbons
PCBs . . . . . polychlorinated biphenyls
PDMD . . . . . Planning and Development Management Department

PLRGs . . . . . Pollutant Load Reduction Goals
RAMP . . . . . Regional Ambient Monitoring Programs
SCS . . . . . Soil Conservation Service
SMS . . . . . Stormwater Management Section
SOR . . . . . Save Our Rivers
SWFWMD or District . . . . . Southwest Florida Water Management District
SWIM . . . . . Surface Water Improvement and Management
TAC . . . . . Technical Advisory Council
TBC . . . . . Tampa Bypass Canal
TBEP . . . . . Tampa Bay Estuary Program
TBRRP . . . . . Tampa Bay Resource Recovery Project
TDS . . . . . Total Dissolved Solids
TEAM . . . . . Tampa Bay Environmental Awareness and Monitoring
TMDLs . . . . . Total Maximum Daily Loads
TPL . . . . . Trust for Public Land
TSS . . . . . Total Suspended Solids
TWRRP . . . . . Tampa Water Resource Recovery Project
USEPA . . . . . United States Environmental Protection Agency
USGS . . . . . United States Geological Survey
WAR . . . . . Water and Air Research
WHPA . . . . . Wellhead Protection Area
WRAPs . . . . . Water Resource Assessment Projects
WUCA . . . . . Water Use Caution Area
WWTP . . . . . Wastewater Treatment Plant