

Data Collection, Assessment and Planning Studies

RESOURCE

PLANNING

DEPARTMENT

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

1989

July 10, 1989

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**DATA COLLECTION, ASSESSMENT AND PLANNING STUDIES
RESOURCE PLANNING DEPARTMENT**

INTRODUCTION

The Central and Southern Florida Flood Control District was created in 1949 to manage and operate the large federally constructed flood control projects including canals, reservoirs and other water control structures. The District was also involved in the acquisition of lands for these flood control projects. Since the creation and implementation of the Water Resources Act of 1972 (Chapter 373, F.S.) the District's function has expanded considerably. The District has been delegated the responsibility by the state to prepare water management plans as well as to issue both surface water management and water use permits, for the 16 county area of the District. The District function thus changed from a flood control District to a multi-objective water resource management agency.

To reflect this expanded responsibility the District's name was changed to South Florida Water Management District in 1973. Since then, the State has delegated more and more responsibilities to the District.

Additional responsibilities delegated by the state legislators, translate to additional water resources objectives and measures to be met by the five Water Management Districts. In addition, the Florida Department of Environmental Regulation's (DER) State Water Use Plan and Local Government comprehensive plans have also set forth objectives and measures dealing with water resources on regional and local levels, many of which relate to areas of responsibility of the Water Management Districts. However, most of the objectives and measures are complementary to the District's legislative responsibilities.

One important part of the District's duties involves research and planning studies which form the basis for regulatory, operational and construction activities. These studies are carried out primarily by the Resource Planning Department. To ensure that research and planning adequately support other activities, specific objectives must be identified and measures developed to assure the success of the efforts. As stated in our Mission, the District manages water and related resources for the benefit of the public and in keeping with the needs of the region. Objectives and measures specified in State, regional and and/or local plans provide an appropriate input to the formulation and assessment of District objectives and measures. However, the District's key responsibilities stem from Chapter 373, F.S. and the various rules and regulations developed therefrom. Additional objectives may derive from legally binding agreements such as permits, memoranda of agreement or contractual obligations.

The primary statutory authority subject areas which the District implements are:

- a) general research and planning directives found in Chapter 373, Part I, Florida Statutes;
- b) consumptive water use permitting directives found in Chapter 373, Part II, Florida Statutes;
- c) water well permitting directives found in Chapter 373, Part III, Florida Statutes;
- d) surface water improvement management and permitting directives found in Chapter 373, Part IV, Florida Statutes; and

- e) Save Our Rivers land acquisition directives found in Chapter 373, Part V, Florida Statutes.

The policies the District follows in implementing this authority are stated in Section 373.016, Florida Statutes. They are:

- a) provide for the management of water and related land resources;
- b) promote the conservation, development and proper utilization of surface and ground water;
- c) develop and regulate dams, impoundments, reservoirs, and other works and to provide water storage for beneficial purposes;
- d) prevent damage from floods, soil erosion, and excessive drainage;
- e) preserve natural resources, fish, and wildlife;
- f) promote the public policy set forth in s. 403.021 (discourages pollution);
- g) promote recreational development, protect public lands, and maintain the navigability of water bodies;
- h) otherwise promote the health, safety and welfare of the people of Florida.

Both the statutory authority and policies are important in setting the subject and content of District research and planning output.

The District's Mission Statement derives from the legislative requirements. It identifies the key elements of the District's activities and the mechanisms through which the mission will be accomplished. Research and planning are identified as contributing to the accomplishment of this mission. The Mission Statement reads:

"The Mission of the South Florida Water Management District is to manage water and related resources for the benefit of the public and in keeping with the needs of the region. The key elements of the Mission are: Environmental protection and enhancement, water supply, flood protection, and water quality protection."

"The Mission is accomplished through the combined efforts of planning and research, operations and maintenance, community and government relations, land management, regulation and construction. Inherent in the Mission is the responsibility to assist the Public and Government Officials by protecting water resources and by identifying and recommending options for incorporating water resources considerations into land use decisions."

To translate the general statutory requirements into specific management-oriented objectives needed to achieve our mission requires an appreciation of the implementation mechanisms available. In cases where implementation is through District action, objectives and measures should relate to management alternatives which the District can implement. This would apply when the research and planning output is used by the SFWMD itself as a basis for regulatory action, project design and construction, or development and implementation of operations and maintenance methods and procedures. In other cases, the research and planning

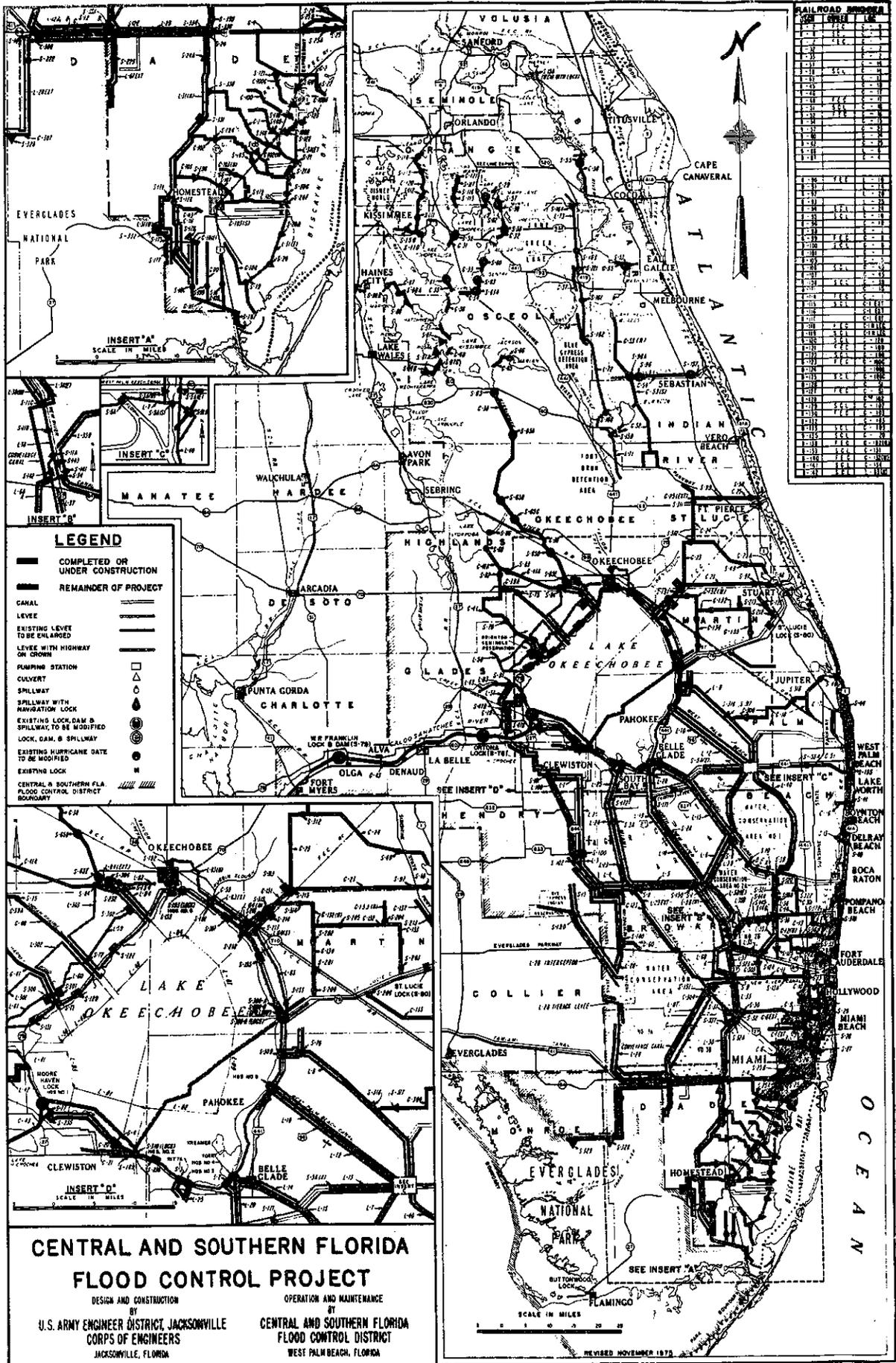
output may form a part of a broader decision matrix and the District's objective may be limited to providing technical or scientific evaluations. For example, the District may provide technical data and assessments or preliminary evaluations of alternative water supply systems for use by local government in their planning process.

Since management decisions often require multi-disciplinary input, an important consideration is the extent to which all the required studies are coordinated internally and externally as well as an appreciation for the federal, state and local needs and requirements which may also be supported by the studies.

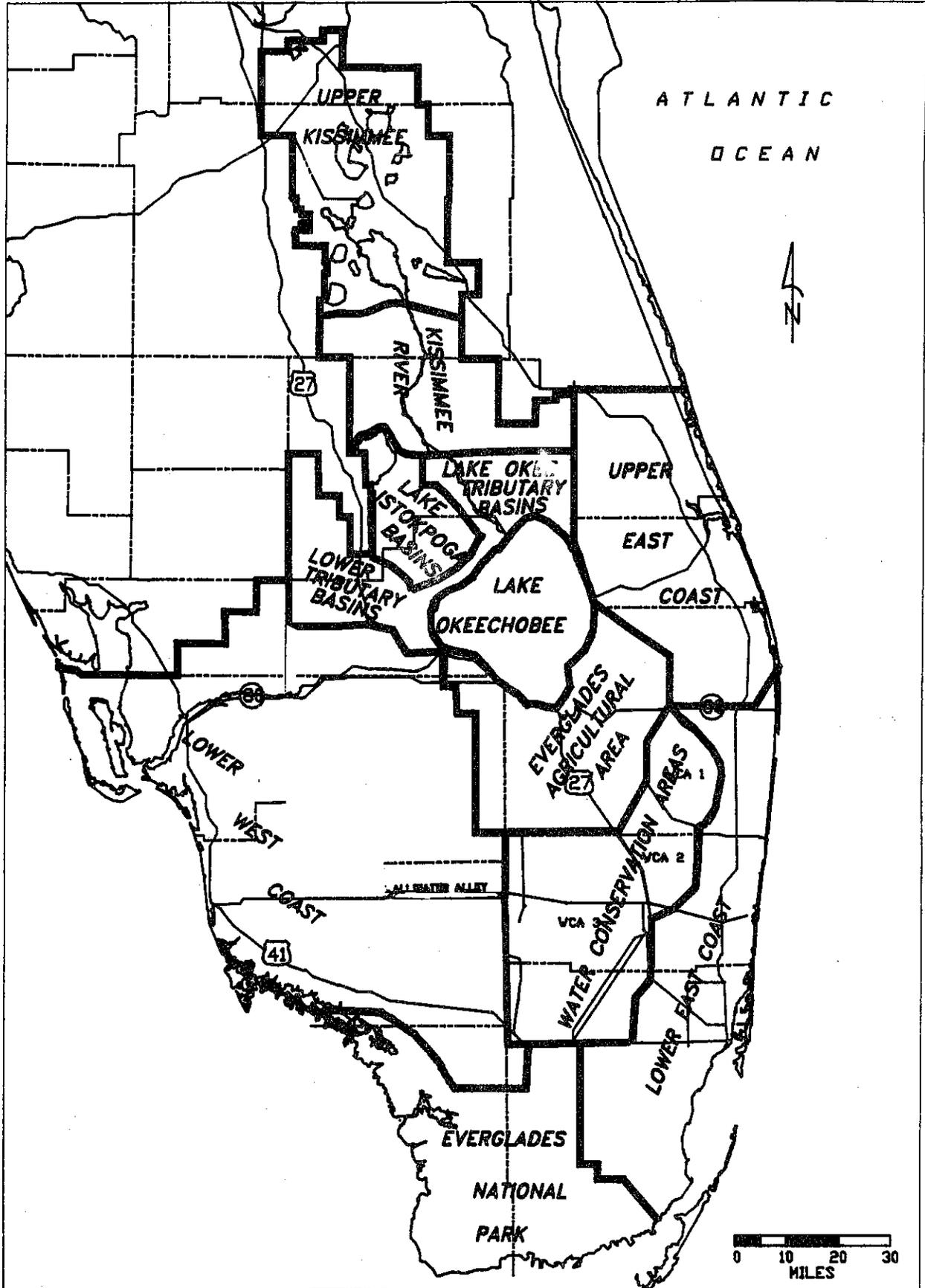
This publication summarizes, by geographic area, the current data collection, analysis and planning activities being pursued by the Resource Planning Department for fiscal year 1988/89. The schedules presented are our best estimates at this time and are subject to change with changing priorities or unanticipated workload. This summary is followed by a list of technical publications, memorandums and reports which represent published output from these and previous activities. A cross-reference, glossary of terms and maps are also provided to aid the reader in using the information.



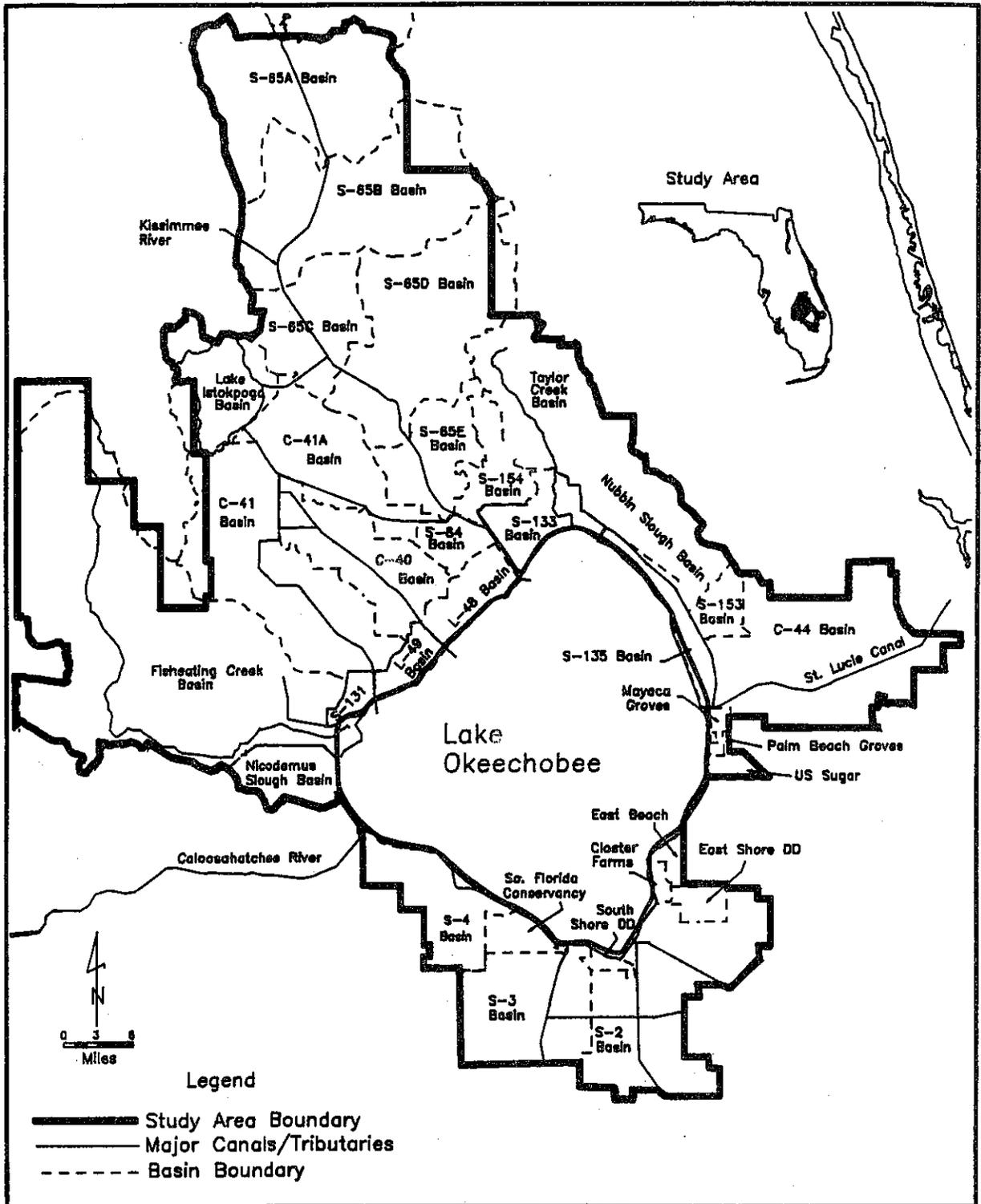
MAPS



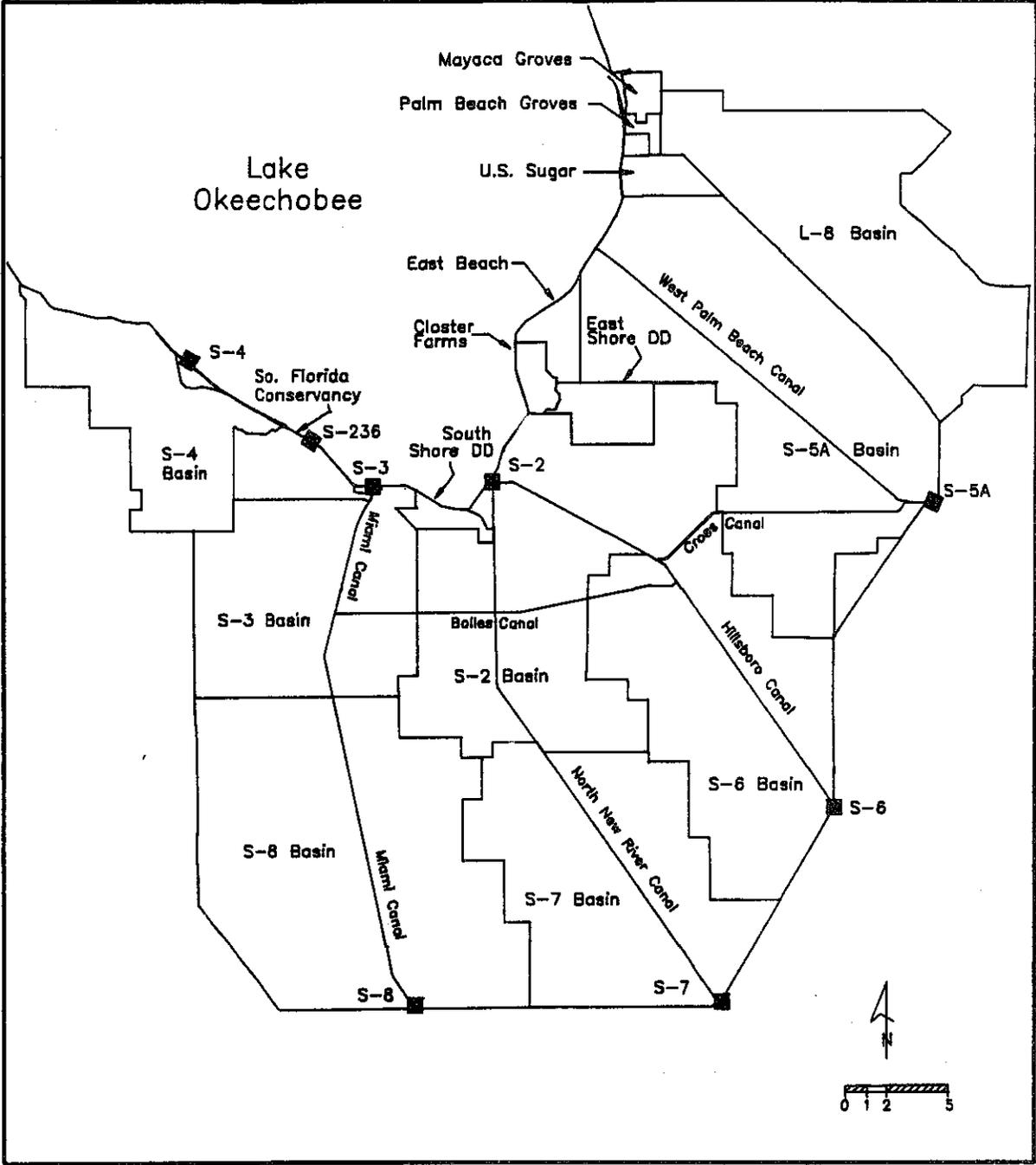
Geographic Area Designations



Lake Okeechobee Study Area



Everglades Agricultural Area



GLOSSARY

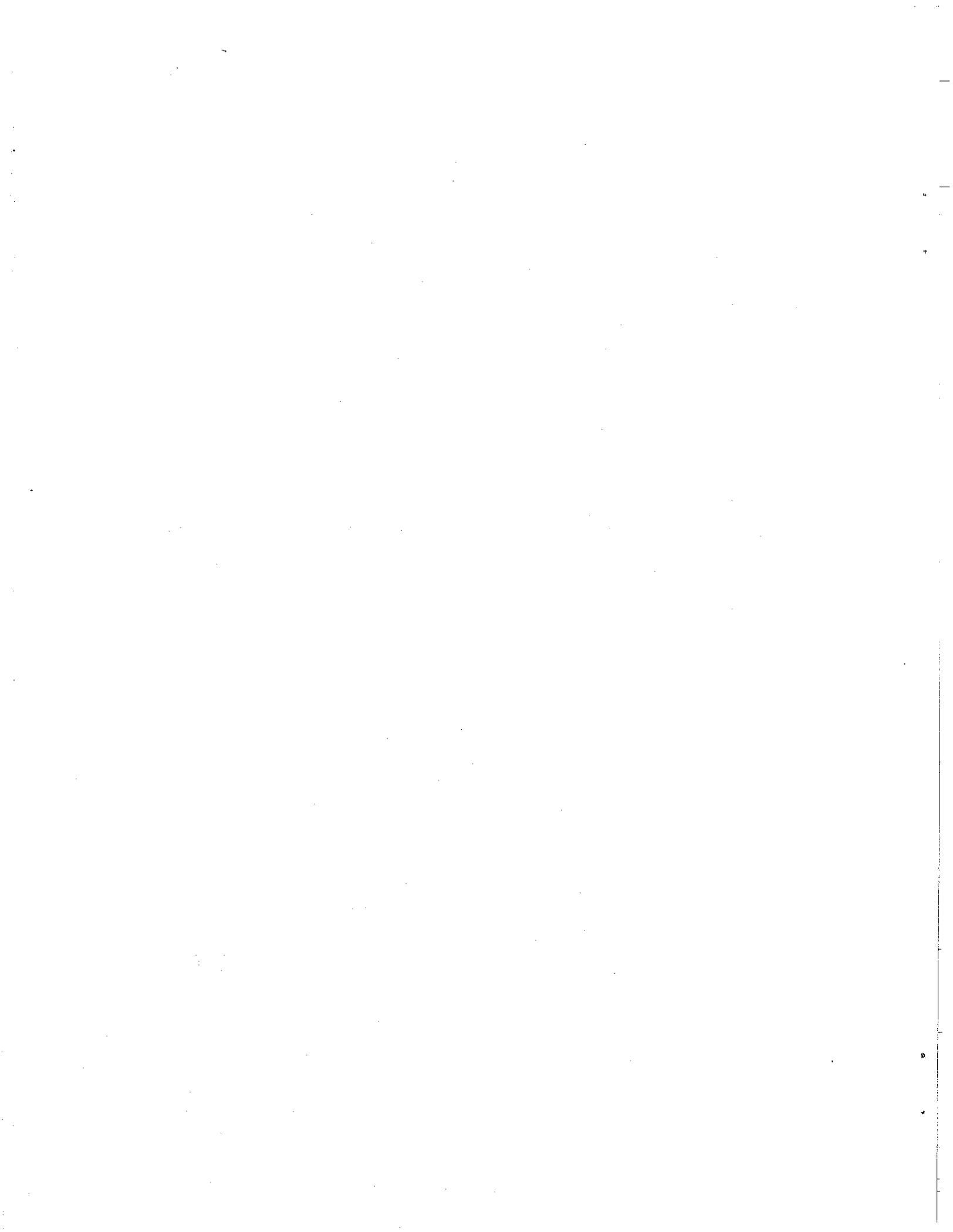


GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ARS	Agricultural Research Service, United States Department of Agriculture.
BASIS OF REVIEW	A document adopted by rule by the South Florida Water Management District containing criteria for review of permit applications.
BMP	Best Management Practices. Refers to structural or non-structural methods for control of point or non-point pollution.
COE	(United States) Corps of Engineers
DER	(Florida) Department of Environmental Regulation.
DISTRICT	South Florida Water Management District
DOT	(Florida) Department of Transportation
EAA	Everglades Agricultural Area
ENP	Everglades National Park. A Federal Park in south Florida.
EREC	Everglades Research and Education Center. A research center in south Florida, under the auspices of the Institute of Food and Agricultural Sciences, University of Florida.
FAC	Florida Administrative Code
FDER	Florida Department of Environmental Regulation
FS	Florida Statutes
FSCL	Florida Sugar Cane League. An organization of sugar cane farmers in Florida.
GDM	General Design Memorandum. A document produced by the United States Corps of Engineers for the design of engineering works.
GFC	(Florida) Game and Freshwater Fish Commission
GIS	Geographic Information System. A computerized spacial data base system.
IFAS	Institute of Food and Agricultural Sciences, University of Florida.
LKR	Lower Kissimmee River

LOTAC	Lake Okeechobee Technical Advisory Committee. A Committee established under Chapter 373, FS in connection with the implementation of the Surface Water Improvement and Management planning.
NASA	National Atmospheric and Space Administration. A Federal agency.
NOAA	National Oceanic and Atmospheric Administration. A Federal agency.
PWS	Public Water Supply
Q or Qtr	Quarter of South Florida Water Management District fiscal year which begins on October 1.
RCD	Resource Control Department. A department of the South Florida Water Management District primarily responsible for regulatory activities.
RFQ	Request for Quotations. A step in the South Florida Water Management District's procurement process for goods or services.
RPD	Resource Planning Department. A department of the South Florida Water Management District primarily responsible for data collection, assessment and planning.
SCS	Soil Conservation Service. A sub-agency of the United States Department of Agriculture.
SFRRM	South Florida Regional Routing Model. A computer Model operated by the South Florida Water Management District to model surface water flows through the system.
SFWMD	South Florida Water Management District. (See also District).
SFWMM	South Florida Water Management Model. A computer model operated by the South Florida Water Management District to model water management scenarios.
SOR	Save Our Rivers. Refers to activities carried out under, or in support of the Save our Rivers Legislation, Chapter 373.59, FS.
SWIM	Surface Water Improvement and Management. Refers to activities carried out under or in support of the Surface Water Improvement and Management Act of 1987, Chapter 373.45 FS.
UF	University of Florida, Gainesville.
USCOE	See COE

USDA	United States Department of Agriculture. A Federal agency responsible for agriculture.
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey. A Federal agency.
USWB	United States Weather Bureau. A Federal Agency.
WCA	Water Conservation Area
WMD	Water Management District. Refers to any one of the five Water Management Districts in Florida.
WUMP	Water Use Management Plans. Refers to an ongoing South Florida Water Management District initiative to develop water use and supply plans.



DISTRICT WIDE

WATER QUALITY EVALUATION OF SURFACE WATER MANAGEMENT SYSTEMS

●District Contact: Paul J. Whalen

CONTRACT REFERENCE: Agricultural (Citrus) Wet Detention Monitoring Study

1. **OBJECTIVE:** The objective of this project is to evaluate the pollutant reduction effectiveness of selected surface water management systems in support of Resource Control's Basis of Review for Surface Water Management Permit Applications.
2. **DISTRICT NEED AND USE:** There are presently thousands of permitted storm water management systems in South Florida. Water quality monitoring of these systems to ensure compliance with state standards for stormwater discharge is not seen as economically possible. Compliance with standards may be assumed, with reasonable assurance, if the systems meet a set of mandated design criteria. The District needs to evaluate these systems in order to provide evidence to support or dispute this assurance. Effective resource management may be accomplished by utilizing this information to modify and improve existing regulatory criteria.
3. **SCOPE:** This project is composed of several on going investigations of the hydrologic and water quality aspects of stormwater runoff quality and treatment.
 - a. Timbercreek study: medium density residential area with wet detention
 - b. Boynton Beach Mall study: commercial land use area with a wet detention surface water management system.
 - c. Springhill study: medium density residential area which utilizes a wet detention surface water management system.
 - d. Park Street study: mixed urban land use area with a dry detention with effluent filtration system.
 - e. Summit Avenue study: exfiltration system which receives stormwater runoff from a high traffic density roadway.
 - f. Agricultural (Citrus) Wet Detention study: citrus grove which utilizes wet detention. The wet detention system incorporates a mixture of natural and created wetlands.
4. **SCHEDULE:**
 - a. 1st Quarter FY 88-89:
 1. Continue Summit Avenue routine and storm related hydrologic and water quality monitoring.

2. Instrument agricultural (citrus) wet detention site. RPD Data Management Division is scheduled to complete instrumentation by November 1, 1988. Schedule is contingent on date of land owner access agreement.
3. Commence agricultural (citrus) wet detention data collection by contractor. Data collection start-up is conditional on completion of site instrumentation.

b. 4th Quarter FY 88-89:

1. Complete Springhill Technical Publication.
2. Complete Boynton Beach Mall Technical Publication
3. Complete Park Street Technical Publication.

c. 2nd Quarter FY 89-90:

1. Complete agricultural (citrus) wet detention data collection by contractor.
2. Conclude Summit Avenue routine and storm related hydrologic and water quality monitoring.

d. 2nd Quarter FY 89-90:

1. Complete agricultural (citrus) wet detention technical publication.
2. Complete Summit Avenue Technical Publication.

5. PROGRESS TO DATE:

- a. Technical Publication 84-11, Volume II - Evaluation of the Water Management System at a Single Family Residential Site: Water Quality Analysis for Selected Storm Events at Timbercreek Subdivision in Boca Raton, Florida.
- b. Completed data collection for The Boynton Beach Mall, Park Street, and Springhill Technical Publications.
- c. Summit Avenue study currently under way. Routine and storm water quality monitoring commenced 4th Quarter, FY 87-88.
- d. Agricultural (Citrus) Wet Detention study monitoring contract was signed, 4th Quarter, FY87-88. Commencement of monitoring is contingent on landowner agreement and site instrumentation by Data Management Division.

6. PRODUCTS:

a. 4th Quarter FY 88-89:

1. Park Street Technical Publication
2. Springhill Technical Publication.
3. Boynton Beach Mall Technical Publication

b. 4th Quarter FY 89-90:

1. Complete Agricultural (Citrus) Wet Detention Technical Publication.
2. Complete Summit Avenue Technical Publication.

DEVELOPMENT OF BASIN-WIDE WATER QUALITY CRITERIA

●District Contact: Paul J. Whalen

1. **OBJECTIVE:** The objective of this project is to develop basin-specific regulatory criteria that can be applied on an individual watershed basis for the protection of the water quality in the receiving waters.
2. **DISTRICT NEED AND USE:** This project provides customized water quality regulatory criteria to be developed for the protection of individual basins with relatively fragile ecosystems. The data and information assimilated from future Surface Water Improvement and Management priority projects (Development of Management Plans, Everglades National Park/ Florida Bay, Everglades Water Conservation Areas, Lake Tohopekaliga, and East Lake Tohopekaliga) will assist in the development of such models.
3. **SCOPE:** This project will provide support to the Resource Control Department and to the various SWIM Act projects. Support is provided in terms of technical input, review, and other related tasks. Computer modeling of selected developments and watersheds is planned to provide predictive basin-wide non-point pollution impacts on receiving water quality under assorted land use scenarios. This information will allow for a basis of water quality standards and thus design criteria alternatives on a basin by basin review.
4. **SCHEDULE:**
 - a. Support for the various projects listed above is provided as needed to each project's individual time frame.
 - b. 1st Quarter FY 89-90:
 1. Joint publication with Martin County: Design and construction of a flow-through marsh surface water management system design receiving industrial stormwater runoff.
 - c. 4th Quarter FY 89-90:
 1. Joint publication with Martin County: Evaluation of the hydrology and water quality treatment efficiency of a constructed flow-through marsh surface water management system.
5. **PROGRESS TO DATE:**
 - a. Technical Publication 88-11, An Assessment of Urban Land Use/Stormwater Runoff Quality Relationships and Treatment Efficiencies of Selected Stormwater Management Systems.
 - b. Review of the stormwater runoff and treatment aspects of the Biscayne Bay Surface Water Management Plan has been performed as requested.
 - c. Developed an RFP scope-of-work for the Hanson Grant (Manatee Pocket) stormwater runoff monitoring study in conjunction with a SWIM contract.
 - d. Participated on the RFP selection committee and providing technical input and review during the negotiation of the final contract.

- e. Provided a technical outline of the water quality benefits of the proposed Western C-51 stormwater detention area. Drafted the protocol of a long term water quality monitoring program.

6. PRODUCTS:

- a. FY 89-90: Companion Technical Publication to Urban Assessment (Technical Publication 88-9) emphasizing agricultural non-point source runoff.
- b. Completed technical review of proposed DER revisions to FAC 17-3 (water quality standards), 17-4 (permitting), 17-6 (wastewater), and 17-25 (stormwater).

ENVIRONMENTAL ASSESSMENT - SAVE OUR RIVERS

- District Contact: Peter David

1. **OBJECTIVE:** The objective of this project is to inventory environmental characteristics and develop management recommendations to enhance the resource values of property acquired in the "Save Our Rivers" (SOR) project.
2. **DISTRICT NEED AND USE:** The District will use information and recommendations from environmental assessments to plan management activities in cooperation with the Florida Game and Fresh Water Fish Commission (FGFWFC) and the Department of Natural Resources (DNR).
3. **SCOPE:** A detailed environmental assessment will be conducted using high quality maps and aerial photographs in conjunction with intensive field work to develop soil and plant community maps and a species inventory. As part of the assessment, plans will be developed for land use, habitat management and hydroperiod and wetland restoration. There will also be strict coordination with the Land Management Department to generate plans for controlled burning, cattle operations and structural needs and repairs.

Information will be compiled and used to develop, in cooperation with FGFWFC and DNR, an Operational Management Plan (OMP) for individual SOR properties.

4. **SCHEDULE:**

A. Dupuis Reserve:

- | | |
|---|------------------|
| 1. Wetland and Hydroperiod Restoration Plan - | QTR 1 - FY 88-89 |
| 2. Final vegetation maps - | QTR 2 - FY 88-89 |
| 3. Species inventory - | QTR 3 - FY 88-89 |
| 4. Environmental Assessment (first draft) - | QTR 3 - FY 88-89 |
| 5. Vegetation sampling - | QTR 4 - FY 88-89 |
| 6. Environmental Assessment (final draft) - | QTR 4 - FY 88-89 |
| 7. Breeding Bird Atlas - | QTR 4 - FY 88-89 |

B. Lake Forest Preserve:

- | | |
|---|------------------|
| 1. Preliminary environmental assessment - | QTR 2 - FY 88-89 |
|---|------------------|

C. McArthur property:

- | | |
|---|------------------|
| 2. Preliminary environmental assessment - | QTR 4 - FY 88-89 |
|---|------------------|

5. **PROGRESS TO DATE:** Soil and vegetation maps have been completed and a detailed species inventory will be continued for the Dupuis Reserve. Baseline vegetation sampling was conducted in the L-8 marsh prior to the first stage of marsh restoration initiated during FY 88. Preliminary environmental assessments were completed for the Godochik I and II properties.

6. **PRODUCTS:** The technical publication "Environmental Assessment of Dupuis Reserve" will include a detailed biological inventory and recommendations for management of the property. This report will include information from the

Wetland and Hydroperiod Restoration Plan also completed for the Dupuis Reserve.

Preliminary environmental assessments will be completed for the Lake Forest Preserve and McArthur properties.

FLOODPLAIN STORAGE ANALYSIS

●**District Contact:** Richard Tomasello/Paul Trimble

1. **OBJECTIVE:** The objective of this project is to evaluate the floodplain storage (importer/exporter) approach presented in Volume IV, Permit Information Manual.
2. **DISTRICT NEED AND USE:** To provide technical support and/or revision to the use of compensating storage design criteria in order to alleviate problems reviewers and applicants are having in the criteria application.
3. **SCOPE:** The approach presented in Volume IV for computing compensating storage requirements will be reviewed and meetings will be held with Surface Water Management permit reviewers to discuss problems they are having with the approach. Examples of projects where the approach is used and, if applicable, problems with the application will be presented. The approach will be revised as necessary.
4. **SCHEDULE:**
 - a. Review of approach, and discussion with reviewers - 4th Qtr 88-89
 - b. Present examples of application including problems - 4th Qtr 88-89
 - c. Prepare internal memorandum to discuss approach, potential problems, and recommended revisions as necessary - 4th Qtr 88-89
5. **PROGRESS TO DATE:** This is a new project
6. **PRODUCTS:** An internal memorandum to RCD for inclusion with Volume IV. Design Examples will be provided.

FREQUENCY ANALYSIS OF RAINFALL FOR SFWMD**●District Contact: Shawn Sculley/Paul Trimble**

1. **OBJECTIVE:** The objective of this project is to produce a comprehensive series of rainfall frequency maps for the District using the most recent data available. The last update was completed by the District in 1981. Predicted maximum precipitation maps for durations ranging from one day to one year will be produced for use in flood protection analysis, while predicted minimum rainfall for monthly, seasonal and annual durations will be produced for drought analysis. It should also be investigated if data exists to complete a rainfall frequency analysis for hourly periods of less than one day.
2. **DISTRICT NEED AND USE:** Results will be used for surface water management permitting purposes of Resource Control Department.
3. **SCOPE:**
 - a. Determine station rainfall gages within or near the District that include at least 20 years of daily record. Data may be obtained from the U.S. Weather Bureau, SFWMD, the Lake Worth Drainage District, and the Corps of Engineers data gages. Stations with more than 150 days of missing record were excluded. The majority of this data should already be on the SFWMD data base.
 - b. Fill in missing records using the normal ratio method.
 - c. After missing data is filled, test the significance that the estimated data has on the values to be used in the statistical analysis. Stations with extreme events derived from estimated rainfall which otherwise bias the results should be deleted from the analysis.
 - d. Determine return frequencies for maximum rainfall events ranging from one day to one year for each station available. This may entail evaluating a number of distributions to determine which one best fits the data.
 - e. Draw isohyets for maximum rainfall for the different duration periods being evaluated.
 - f. Complete similar analysis for drought conditions analyzing longer durations.
4. **SCHEDULE:**
 - Step a scheduled for completion - 1st Qtr 88-89
 - Step b scheduled for completion - 1st Qtr 88-89
 - Step c scheduled for completion - 2nd Qtr 88-89
 - Step d scheduled for completion - 2nd Qtr 88-89
 - Step e scheduled for completion - 3rd Qtr 88-89

5. PROGRESS TO DATE: New project
6. PRODUCTS: A series of isohyetal maps which will be used for surface water management permitting purposes by the Resource Control Department.

REMOTE SENSING APPLICATIONS - ENVIRONMENTAL SCIENCES DIVISION

● District Contact: Dewey Worth

1. **OBJECTIVE:** The objective of this program is to develop and refine use of remote sensing/GIS technologies to improve District capabilities in environmental monitoring and change detection. Applications are emphasized which support or complement existing projects.
2. **DISTRICT NEED AND USE:** This project is needed to provide a cost effective method to evaluate and manage natural resources. Applications of this technology will provide the District with information not available through conventional data collection techniques. Information collected and processed under this project will assist other departments in a variety of resource management issues such as permit enforcement, Save Our Rivers (SOR) evaluations and habitat management.
3. **SCOPE:** Various types of satellite (including Landsat, Spot, AVHRR and GOES) and photographic data formats will be acquired for environmental analysis. Different types of methodologies will also be evaluated for use in future extraction and processing of digital data. Specific types of data and applications may be contracted. Development work for enforcement monitoring will be continued under this project. This effort will include processing of digital satellite data each quarter to identify recent land clearing activity and comparing results with previous data.
4. **SCHEDULE:**
 - a. Complete aerial photography to support SOR acquisitions (1st Q FY88/89)
 - b. Purchase of satellite data to support enforcement monitoring effort (1st - 4th Q FY88/89)
 - c. Produce change detection maps for regulatory enforcement monitoring (2nd Q FY88/89)
 - d. Develop spatial data base for environmentally sensitive areas (4th Q FY88/89)
5. **PROGRESS TO DATE:** Remote sensing processing capabilities were acquired by the District during late 86/87. Initial efforts have been made to acquire historical satellite data for analysis. Recent efforts have concentrated on acquiring real time AVHRR satellite data for Lake Okeechobee to monitor plankton blooms (Lake Watch). A number of preliminary base maps have been produced using the SPOT satellite data.
6. **PRODUCTS:** A variety of different digital satellite and photographic data will be acquired and archived for District use. A report on use of AVHRR satellite data to monitor Lake Okeechobee algal blooms will be completed. Other products will include maps of vegetation cover and change detection.

HYDROLOGIC AND HYDRAULIC MODEL DEVELOPMENT

●District Contact: Calvin Neidrauer

1. **OBJECTIVE:** The purpose of this project is to develop and update mathematical models to solve existing and anticipated water resources analysis problems. These problems range from determining the dynamic interaction between basins and receiving canals during a flood event, to evaluating regional impacts due to water management changes and/or structural modifications. The unique character of central and southern Florida's hydrology, continuing regional development, and the complexity of the Central and Southern Florida Flood Control Project further complicates these problems.
2. **DISTRICT NEED AND USE:** The District must obtain or develop the proper tools to perform the hydrologic and hydraulic analyses that are needed to solve water resources problems, and to answer questions about the capabilities and limitations of the complex water control and drainage systems found within the District boundaries. Refer to the project documents for specific details.
3. **SCOPE:** This project is comprised of five sub-projects, details of which are given separately. These projects are:
 - 1) **Channel Routing Model** -- This project involves the modification of an existing channel routing routine to be integrated with the District's Multi-Basin Routing Model. The composite model will determine the dynamic interaction between multiple basins and their receiving canal during a flood event.
 - 2) **Predevelopment Runoff Methods** -- The commonly used methods for estimating predevelopment runoff will be assessed as to their applicability to south Florida's unique hydrology. Recommendations for their use will be made.
 - 3) **Maintenance and Improvement of Existing Models** -- This project will provide documentation of recently developed models, and models that have experienced significant modification since their original documentation. Updates for recently obtained data will also be made. Enhanced graphics capabilities will be developed for frequently used models.
 - 4) **Wetland Modeling** -- This project will provide continued hydrologic and hydraulic modeling support for the Lower Kissimmee River (LKR) Best Management Practice (BMP) Water Quality monitoring project. Modification of a hydrologic routing model and application to several basins will be made. A hydraulic wetland routing model for simulating flow through a marsh will be developed.
 - 5) **Rainfall-Runoff Modeling** -- An existing continuous rainfall-runoff model will be modified for south Florida's hydrology. This model will provide needed input to the Water Resources Division's existing continuous simulation models: South Florida Regional Routing Model (SFRRM), South Florida Water Management Model (SFWMM), and the District's Dynamic Transport

Estuary Model (DYNTRAN). A short time step, single event, rainfall-runoff model will be developed to provide input for evaluating flood studies and to provide the surface water management permit reviewers with a flexible tool for evaluating permit applications.

4. SCHEDULE:

- a. Task schedules are outlined under each sub-project.
- b. Monthly meetings between the project managers to review progress and coordinate project tasks.
- c. Quarterly reports outlining the progress of the project.

5. PROGRESS TO DATE: The first two sub-projects continue from FY 87-88 while the other three projects are new. Refer to project documents for details.

6. PRODUCTS: Some of the products provided by this project include:

- a. Updated SFRMM and SFWMM through 1987.
- b. Hydraulic channel routing capabilities for the Multi-basin Routing Model.
- c. Predevelopment Runoff Methods-Volumes I and II, technical memoranda describing the assumptions, limitations, and recommended applicability to south Florida of the commonly-used methods for estimating predevelopment runoff.
- d. Discharge estimates for several sites in the Lower Kissimmee River Basin in support of the LKR BMP Water Quality Monitoring Project.
- e. A modified, continuous rainfall-runoff model for estimating daily rainfall-runoff response of water sheds.

CHANNEL ROUTING MODEL

●District Contact: Bill Perkins

1. **OBJECTIVE:** The objective of this study is to identify and implement an appropriate one-dimensional hydraulic channel network model on the SUN computer system. In addition, a "user-friendly" preprocessing routine and computer graphics will be incorporated to enhance the model's usability.
2. **DISTRICT NEED AND USE:** Several on-going and future District projects require analysis of discharge and stage in open-channel networks. Specific projects include: Kissimmee Restoration Project, Central and Southern Florida (C&SF) Flood Control System analysis, future C&SF System channel and structure design, flood management studies, and eventually, real-time operation analysis. In most instances, a one-dimensional hydraulic channel network model is required for such discharge and stage analysis. Tools currently available are limited. A general routing model is needed which can be applied to a wide variety of situations in South Florida. This model must be able to account for gated spillway structures, gated culvert structures, lateral inflow and seepage, and irregular channel shapes. Such models exist outside the District, but need to be implemented.
3. **SCOPE:**
 - a. Review of existing channel routing models to determine their completeness and applicability to south Florida conditions.
 - b. Selection of the most appropriate model.
 - c. Implementation of the selected model on the SUN system, including obtaining source code, testing and debugging.
 - d. Development of a preprocessor and user interface.
 - e. Documentation of the model's use.

Duration 16 months.
4. **SCHEDULE:**

Review and selection of an existing model - 1st Qtr 88-89
 Complete implementation of the selected model - 3rd Qtr 89
 The development of a user interface - 4th Qtr 88-89
 Complete documentation of the model's use - 2nd Qtr 89-90
5. **PROGRESS TO DATE:** This is a new study.
6. **PRODUCTS:** A general purpose channel network routing model having the necessary capabilities for use throughout the C&SF Flood Control System.

PREDEVELOPMENT RUNOFF METHODS

●District Contact: Calvin Neidrauer

1. **OBJECTIVE:** The allowable discharge criteria applied to surface water management system designs throughout much of the District is based on the postdevelopment peak discharge rate equaling the predevelopment peak discharge rate. Often the predevelopment condition of the site and surroundings are more appropriately analyzed by one runoff methodology versus another. In some cases one runoff methodology may be more appropriate, or more readily adaptable, to the site conditions than another method. A manual to summarize the various common runoff methodologies, the meaning of their input and output variables, and their overall shortcomings and advantages in various situations would be a helpful standardization and guide to surface water permit reviewers and engineering consultants. The primary goal of this effort is to produce a manual which outlines the theory and definitions of input and output for the various runoff methods available to the Resource Control Department (RCD) permit reviewers. This manual will be published in two volumes. Volume I will cover general descriptions and list the assumptions and limitations of the commonly used predevelopment runoff methods. Volume I will also include examples to illustrate the procedure of the methods. Volume II will include a detailed comparison of the methods, an assessment of the applicability of the methods to south Florida, and recommendations for their use.
2. **DISTRICT NEED AND USE:**
 - a. Surface Water Management Division, RCD. The primary users of the Predevelopment Methods Manual will be the permit reviewers in this division.
 - b. Water Quality, Environmental Sciences, Hydrogeology, and Water Resources divisions of RPD. Engineers and hydrologists in these divisions will benefit by having an improved understanding of the applicability of the various runoff methods. The computational library of runoff method algorithms will assist in the efficient development of aggregate models for analyzing special water resources problems.
 - c. Practicing engineers/hydrologists, and other permitting agencies that work with central and southern Florida's unique hydrology will benefit from the analysis and recommendations given in the Predevelopment Runoff Methods Manual.
3. **SCOPE:**
 - a. Review hydrologic procedures and past hydrologic data collected by the District and other agencies including the USDA-ARS, SCS, USGS, and the University of Florida.
 - b. Develop runoff method algorithms to be used for analysis.
 - c. Demonstrate the applicability of the various runoff methods for the variety of hydrologic conditions within the District boundaries. The applicability of the method, advantages and disadvantages, and relative importance of the input parameters will be determined with the available data and sensitivity analysis.
 - d. Complete draft of Volume II.

4. **SCHEDULE:**
Complete review and retrieval of data - 2nd Qtr 88-89
Complete development of computational algorithms - 2nd Qtr 88-89
Perform analyses - 3rd Qtr 88-89
Write draft of Volume II - 1st Qtr 89-90
5. **PROGRESS TO DATE:** Volume I will be completed during the first quarter of FY 88-89. Some of the computational algorithms required for the Volume II analysis were completed during FY 87-88.
6. **PRODUCTS:**
 - a. Volume II of the Predevelopment Runoff Methods Manual. Volume II will document comparisons of the commonly used runoff methods, assessments of their applicability to south Florida's unique hydrology, and recommendations for their use.
 - b. A computational library of runoff method algorithms. This library will be developed in conjunction with the Rainfall-Runoff Modeling study, and will be used for the comparisons and sensitivity analysis. The algorithms can be used with other library routines for quickly assembling a component model to perform hydrologic/hydraulic analyses for other projects.

MAINTENANCE AND IMPROVEMENT OF EXISTING MODELS

●District Contact: Todd Tisdale

1. OBJECTIVE: The objective of this study is to incorporate improvements into existing District computer models used by the Water Resources Division.
2. DISTRICT NEED AND USE: This study will address the District's need for improved computational tools required to study water resources problems.
3. SCOPE: This study will consist of the following tasks:
 - a. Update documentation for and incorporate graphic capabilities into the South Florida Water Management Model.
 - b. Incorporate simplified plot options, increased user friendliness, and the ability to write specific output files into the South Florida Regional Routing Model, and implement the South Florida Regional Routing Model on a SUN workstation.
 - c. Incorporate graphics capabilities into the District's estuary hydrodynamics and salinity model (DYNTRAN).
 - d. Write documentation for the Rainfall-Runoff, Routing Spreadsheet Model.
4. SCHEDULE:
 - a. South Florida Water Management Model
 Incorporate graphics capabilities into the model - 4th Qtr 88-89
 Write documentation update - 1st Qtr 89-90
 - b. South Florida Regional Routing Model
 Incorporate simplified plot options. Increased user friendliness and ability to write specific output files into model - 4th Qtr 89-90
 Incorporate into the model the ability to write output files - 4th Qtr 89-90
 Implement model on SUN workstation 3rd Qtr 88-89
 Document improvements to the model - 1st Qtr 89-90
 - c. Rainfall, Runoff, Routing Model
 Document use of model - 4th Qtr 88-89
5. PROGRESS TO DATE: This is a new project.
6. PRODUCTS:
 - a. Updated documentation and graphics capabilities for the South Florida Water Management Model.
 - b. Simplified plot options, increased user friendliness, ability to write specific output files, and migration to the SUN workstation for the South Florida Regional Model.
 - c. Graphics capabilities for DYNTRAN
 - d. Documentation for the Rainfall-Runoff Routing Spreadsheet Model.

WETLAND MODELING

●District Contact: Calvin Neidrauer

1. OBJECTIVE: The objective of this study is to develop wetland routing models which will provide hydrologic support to environmentally sensitive projects in the District.
2. DISTRICT NEED AND USE: The models developed are needed to provide valuable information as to the annual loads of phosphorus transported by tributary watersheds in Lower Kissimmee and the effect of various agricultural practices in controlling phosphorus inputs to Lake Okeechobee.
3. SCOPE: The scope of work involves the following:
 - a. Enhance the implementation of the modified multibasin routing model for flow routing in wetland drainage systems.
 - b. Develop the detailed hydraulic routing model to route water through typical components of the drainage network.
 - c. Add capabilities to simulate water quality (primary responsibility with personnel from Water Quality Division).
 - d. Model calibration using the data to be obtained by IFAS.
 - e. Link the routing model with the field scale model to be developed by IFAS under contractual agreement.
 - f. Calibration and testing of the overall model..
4. SCHEDULE:
 - Enhance hydrologic routing model - 1st Qtr 88-89
 - Further develop hydraulic routing model - 3rd Qtr 88-89
 - Add water quality simulation - 3rd Qtr 88-89
 - Routing model calibration and testing - 3rd Qtr 89-90
 - Link with IFAS field scale model - 3rd Qtr 89-90
 - Calibration and testing of overall model - 4th Qtr 89-90
 - Model documentation completed - 1st Qtr 90-91
5. PROGRESS TO DATE: The multibasin routing model has been modified, applied and tested for the S-154 basin. A preliminary version of the hydraulic routing model is complete.
6. PRODUCTS: Hydrologic models to predict both quantity and quality of water originating in Lower Kissimmee and Taylor Creek/Nubbin Slough basins.

RAINFALL-RUNOFF MODELING

●District Contact: Calvin Neidrauer

1. **OBJECTIVE:** The objective of this study is to examine some of the more promising methods/models and modify them to apply to the rainfall-runoff response of watersheds, found within the District boundaries. One of the first steps in the analysis of many surface water resources projects is the estimation of the rainfall-runoff response of a watershed or basin. Many methods and models have been developed to make these estimates, but most have been based on data from typical watersheds not found in South Florida. Watersheds in South Florida are characterized by flat slopes, highly permeable sandy soils, and high water tables. The runoff response of these unique watersheds cannot always be adequately estimated with some of the conventional methods and models.
2. **DISTRICT NEED AND USE:** This study is needed to provide engineers, hydrologists, and permit reviewers with tools to estimate the rainfall-runoff response of South Florida's unique watersheds. The following will be adapted or developed for South Florida's hydrology:
 - a. The continuous model will be used to supply the needed basin runoff input to the existing continuous simulation models (SFRRM, SFWMM, and DYNTRAN). It will be used in conjunction with the existing models to facilitate the evaluation of structural and operational changes to the C&SF Flood Control System. Resource Planning and Resource Operations will benefit.
 - b. The single-event model will be used to provide input for the evaluation of flood studies, to provide the permit reviewers in Resource Control Department with a flexible tool for evaluating surface water management permits, and to provide input to the real-time modeling effort for Resource Operation's OASIS project
 - c. The set of computational subroutines will provide a documented resource of tested computer routines which will be used to facilitate the quick assembly of area specific models. The routines will also be used to support the analysis that is to be done for the Predevelopment Runoff Project which will provide information to the Resource Control Department surface water permit reviewers.
3. **SCOPE:** This study involves the modification of rainfall-runoff algorithms and models for application to central and southern Florida's unique hydrology. Two general purpose models are to be developed:
 - a. A long time step, continuous, rainfall-runoff model. This model will operate on a long time step (daily) and estimate the runoff response of basins to long term (multiple years) rainfall.
 - b. A short time step, single event, rainfall-runoff model. This model will operate on a short time step (minutes) and estimate the runoff response of watersheds to storm events.

4. SCHEDULE:
Review available algorithms/models - 1st Qtr 88-89
Select and modify existing algorithms/models - 4th Qtr 88-89
Calibrate and verify using actual data - 1st Qtr 89-90
Prepare documentation on changes and user instructions - 2nd Qtr 89-90
5. PROGRESS TO DATE: This is a new study for FY 89
6. PRODUCTS:
 - a. A long time step, continuous, rainfall-runoff model.
 - b. A short time step, single event, rainfall-runoff model.
 - c. A set of computational subroutines for modeling selected components of South Florida's hydrologic cycle will be developed.

SOUTH FLORIDA WATER MANAGEMENT SYSTEM ANALYSIS AND OPERATION

●District Contact: Jayantha Obeysekera

1. **OBJECTIVE:** The objective of this project is:
 - a. To make a system-wide evaluation of flood control effectiveness and water availability under both normal and drought conditions.
 - b. To develop optimal and real time operating procedures to minimize the adverse impacts of extreme water conditions.
2. **DISTRICT NEED AND USE:** This project is needed to evaluate the effectiveness of the District's water control system under both extreme conditions of shortages and floods. Also included is the development of procedures for operation of the various components of the system under extreme conditions.
3. **SCOPE:** The scope of the proposed project covers two areas:
 - a. **Flood Control Effectiveness.** This component addresses the effectiveness of the current C & SF system for flood control for extreme local and tropical storm systems. The initial work will focus on the development of a methodology for, and identification of, the problem areas within the District.
 - b. **Real Time Operation for Flood Control.** In response to the anticipated need for simulation links to the OASIS AI system which is already in the prototype development phase, a pilot study to develop a real time simulation/forecasting system is proposed. The system will be useful as a tool for making better decisions on operation of the canal system under extreme storm conditions such as those which exist during a hurricane. A pilot project to develop, test, and implement a real time simulation-forecasting model is proposed for the Upper Kissimmee basin. Primarily, this model is expected to be an extremely valuable tool for the routine operation of the Kissimmee Basin structure.
4. **SCHEDULE:**
 - a. **Flood Control Effectiveness**
 - 1) Review of the existing flood control system - 1st Qtr 89-90
 - 2) Identification of problem areas - 2nd Qtr 89-90
 - 3) Analysis of feasible solutions - 3rd Qtr 89-90
 - 4) Development of a plan of improvement - 4th Qtr 89-90
 - b. **Real Time Operation for Flood Control**
 - 1) Assembly of existing data for Upper Kissimmee Basin - 4th Qtr 88-89
 - 2) Installation of new gauges including the connection to the telemetry system - 1st Qtr 89-90
 - 3) Selection of an existing model - 2nd Qtr 89-90
 - 4) Modifications to the model - 3rd Qtr 89-90
 - 5) Model calibration - 3rd Qtr 88-89
 - 6) Implementation for real time operation - 4th Qtr 88-89
 - 7) Generalization of the forecast system - 4th Qtr 89-90
5. **PROGRESS TO DATE:** This is an effort to formalize some ongoing studies into a framework for developing an efficient system for managing the water resources of the District. A stochastic analysis of some time series data is complete.

6. PRODUCTS:
 - a. Document detailing potential problem areas in flood control and suggestions for solutions.
 - b. A real time forecasting tool for efficient operation of District structure during storm events.
 - c. A real time combined hydrologic/hydraulic routing model for providing a simulation link to the OASIS project.

DATA PROCESSING SOFTWARE SUPPORT**●District Contact: Brian Turcotte****CONTRACT REFERENCES: Data Conversion Collection/Oracle**

1. **OBJECTIVE:** The objective of this project is to provide software support for the processing, storing, and retrieving of hydrological data.

This project is a long-term comprehensive project involving research, planning, implementation, and evaluation of software development. The main components are development of software to process and archive digital, graphic, manual, solid state, and telemetry data; maintenance of data base processing systems with quality control checks and verification of data; development and testing of procedures incorporating current technology of computer systems (voice input, artificial intelligence, data base machines, etc); development of software to aid recorder maintenance and inventory; management of software tools for personnel productivity and recorder inventory/maintenance reports; flow computation algorithms incorporating data base information; communication with outside agency computers for data retrieval.

2. **DISTRICT NEED AND USE:** The SFWMD needs this project to greatly facilitate access and retrieval of hydrologic data. The conversion to an ORACLE Data Base will enable the sharing of information between data bases and provides a common platform interfacing with GIS.
3. **SCOPE:** This project consists of one short term task and eleven long term tasks. The short term task is to convert the preprocessing system to an Oracle Relational Data Base.
 - a. Preprocessing system conversion.
To manage and implement the conversion of the hydrologic preprocessing system from Control Data Corporation's CYBER to Digital Equipment Corporation's VAX machine through technical management of a contract (Data Conversion Collection/Oracle).

The nine long term tasks are as follows:

- a. General maintenance and Backup.
To provide software support for the processing, storing, and retrieving of hydrologic data and the general maintenance and backup of software and data until the new data base is established.
- b. Database interface to processing system.
To provide software support for the interface of the preprocessing system and the external agency inter-computer connection which supply input data to the hydrologic database.
- c. Graphic interface to processing system.
To provide graphic routines to interactively display hydrologic data, and provide color plots.
- d. Solid state production environment.
To provide support and software for full production scale processing of solid state hydrologic recording instrumentation.

- e. Telemetry rainfall.
To process and archive daily rainfall data collected from Resource Operations Telemetry System.
 - f. USWB hourly data.
To archive weather data from the United States Weather Bureau
 - g. Recorder maintenance/inventory interface to processing.
To interface recorder maintenance/inventory data base to processing system.
 - h. Flow equations.
To provide flow equations and algorithms in a general interval value generator routine
 - i. Daily water readings production system.
To produce an automated system to archive Resource Operation's Daily/Water Readings.
4. SCHEDULE:
- a. Software support is a continuing process.
 - b. Commence conversion of preprocessing system - 1st Q FY 88-89
 - c. Complete conversion, testing and implementation - 4th Q FY 88-89
5. PROGRESS TO DATE:
- a. Negotiation is in process with Oracle Corporation for the conversion of the Preprocessing System.
6. PRODUCTS: The major products of this project are:
- a. Enhanced data processing system
 - b. Converted Relational Data Base Preprocessing System

DATA BASE

●District Contact: Trevor Campbell

1. **OBJECTIVE:** The main objectives of this project are twofold;(a) to maintain and enhance the existing hydrologic data base (DBHYDRO) and (b) to convert the existing DBHYDRO to an Oracle Relational Data Base.

Accomplishment of the main objectives will be realized through the provision of comprehensive and efficient linkage mechanisms demanded by sophisticated users of hydrological data, and incorporating and integrating all hydrologic data collected in South Florida by all collecting agencies. Provision to allow implementation of sophisticated data quality assurance procedures and state-of-the-art flow computation algorithms will be specifically incorporated. This is a very large data base requiring sophisticated methods of organization, storage, and retrieval. End user assistance in the form of documentation,software, and training will be provided on a continuing basis.
2. **DISTRICT NEED AND USE:** This project will greatly enhance access and retrieval techniques to facilitate both the casual and sophisticated end user. The conversion to an Oracle Relational Data Base will facilitate the sharing of information between data bases on different machines and provide a platform to interface with GIS.
3. **SCOPE:** The project is comprised primarily of three tasks:
 - a. Maintain the current data base.To make minor changes as required to keep system operational until a new data base is implemented.
 - b. Improve structure information in current data base.To verify the exact location of all sites and entering parameters such as structure design characteristics, basin linkages, upstream/downstream linkages, etc.
 - c. Continue development of Oracle Relational Data Base. To modernize the hydrologic data base incorporating the sophistication and tools of relational technology.
4. **SCHEDULE:**
 - a. 3.a and 3.b are continuing efforts.
 - b. Design and develop entity relationship diagrams new data base - 1st Q FY 88-89
 - c. Commence coding - 2nd Q FY 88-89
 - d. Complete coding - 1st Q FY 89-90
 - e. Test code - 2nd Q FY 89-90
 - f. Implement - 3rd Q FY 89-90
5. **PROGRESS TO DATE:** The design of the new data base is being discussed.
6. **PRODUCTS:** A relational hydrologic data base providing linkages with other relational data bases and serving as a subsystem to GIS.

GENERAL NETWORK HYDROLOGIC DATA ACQUISITION AND DOCUMENTATION OF HYDROLOGIC DATA COLLECTION IN SUPPORT OF OTHER PROJECTS

●District Contact: Robb Startzmann

PROJECTS SUPPORTED:

SOR Land Use Management
Loxahatchee River
Upper Kissimmee River Valley
Resource Control Support
General Hydrologic Network
Lake Worth
Fisheating Creek
Upper Kissimmee Lakes
Big Cypress Basin
Biscayne Bay
Indian River
Water Conservation Areas
Everglades Agricultural Area
Taylor Creek/Nubbin Slough
Lower Kissimmee Valley
Lake Okeechobee
Everglades National Park
Caloosahatchee River / Six Mile Slough & Corkscrew Wildlife Preserve
Indian Prairie/Harney Pond/Lake Istopoga

CONTRACT REFERENCES:

USGS GW DATA COLLECTION (MIAMI)
USGS SW DATA COLLECTION (MIAMI)
USGS GW DATA COLLECTION (ORLANDO)
USGS SW DATA COLLECTION (ORLANDO)
USGS (MIAMI) COMPUTER LEASE LINE

1. **OBJECTIVE:** Data acquisition and documentation is carried out through a number of projects which are identified by geographic areas. The purpose of these projects is to collect hydrologic and meteorologic data from various recording devices, maintain existing recorders, install or remove recorders, process and computer archive this data. These tasks are completed for the basic data network and for these specific projects listed above.
2. **DISTRICT NEED AND USE:** Efficient and accurate collection and processing of hydrologic data is needed in order to meet legal requirements, provide a technical base for water resources decisions, monitor changes in water quality loadings and to provide a basis for enforcement, document the operation of project systems, and provide a base for future modeling and research. Specific uses include:
 - Land Management Department - Hydrologic information for management of SOR lands.
 - Resource Control Department - Criteria development, alternate water supply.
 - Resource Planning Department - Wellfield water conditions report, Water Supply Plans, model calibration and verification, rainfall reports, flood studies, storm reports.
 - Resource Operations Department - Telemetry and structure operations feedback,

documentation of structure operations, water conditions report, structure problem reporting, installation of Telemark gauges.

DER - Flow for water quality loading, historical water fluctuations, rainfall.

Orange County - Cooperative data collection effort (share recorders and data).

USGS - Cooperative data collection, Water Resources Report, quality control.

Corps of Engineers - Navigation lockages, water budgets, Water Supply Plan, Structure Operations Report, Shingle Creek

DOT - Maximum water levels and flows for bridge and highway design.

Local Governments and Utilities - Rainfall, water supply, groundwater levels, flows, comprehensive plan.

Local Agricultural Interests - Rainfall, water levels, permitting.

3. **SCOPE:** Hydrologic data collection and processing is completed both for a basic network that covers the whole District and to support the specific requirements of individual projects. Hydrologic network design and optimization is an integral part of this project to ensure cost-effective, multipurpose utilization of resources. Parameters processed include primarily surface water levels, rainfall, flow, groundwater levels and structure operations. Some water quality and meteorologic information is also collected. This is a cooperative effort between Data Management Division, USGS, Resource Operations Department, NASA, NOAA, Orange County, Everglades National Park, Game & Fish Commission, Environmental Science Division, Water Quality Division, and Water Resources Division. A summary of the hydrologic data acquisition scope and budget for all projects receiving this support is presented below.

This project provides for a basic hydrologic network which is designed for general utility. Its scope includes the entire District. Most stations have long observation periods which are required for frequency analysis, and documenting changes in hydrology due to management, structural changes or climatic changes. A minimal effort is also expended in acquiring data which is not currently utilized but which may be invaluable at a later time due to improvements in technology or a better understanding of basic processes.

The scope of this project is expected to experience continual growth. Current trends in water management and hydrologic modeling require finer time steps to provide the detail necessary to resolve crucial issues. Finer time resolution requires an exponential growth in the density of the basic network on a spatial basis and tighter controls on allowable errors. Thirty years ago most analysis was done on a yearly basis. The next 2 decades saw a transition to monthly time scales. Current modeling is almost entirely on daily or finer time steps. The growth in the density of the hydrologic network has not kept pace with this effort. Current network density is sufficient to meet the needs of monthly time scales but in most cases is barely sufficient and, in some of the more remote areas, totally inadequate. Time scales as short as 1 hour can only be supported for a handful of special project areas and are not generally included in the BASIC NETWORK.

4. **SCHEDULE:** See the detailed descriptions of tasks below regarding scheduling for each of the projects supported.
5. **PROGRESS TO DATE:** This is a continuing project.
 - a. Backlog - Completed 770 parameter years in FY87-88; projected was 600.
 - b. Recorder Installation - 170 parameters at 50 sites in FY87-88, primarily for dairy

monitoring in the areas of Kissimmee River and Taylor Creek/Nubbin Slough, POET, S-4 Diversion, Kissimmee River Demonstration Project, and Lake Okeechobee Circulation Study.

c. Network Reduction - 2 recorders eliminated; 3 parameters identified for removal; 164 parameters relegated to backup status.

6. **PRODUCTS:** Products provided by this project will include:

GENERAL

a. All data available on data base system within two weeks of collection.

b. Process telemetry data within one week and other Data Management recorders within two weeks from collection; USGS data two months from collection.

c. Monthly data collection trips.

d. Recorders installed and running.

e. Legal documentation of the operation of District structures.

SPECIFIC

a. Backlog - 775 parameter years by fourth quarter FY88-89. This is 20% of the remaining backlog.

b. Recorder Installation - 260 parameters at 69 sites (20 additional recorders for flow-way monitoring), primarily additional dairy monitoring and environmental monitoring.

Hydrologic Data Collection and Support - SOR Land Use Management

This project encompasses hydrologic monitoring, data collection and processing for special studies throughout the District to support and facilitate land use management decisions for the SOR initiative by Land Management, Resource Assistance, Natural Resource Management, Water Quality, and Environmental Sciences. The magnitude of the effort by Data Management has not yet been completely identified for SOR land use management. However, installation of some staff gauges on the White Belt Ranch has been identified and the costs are shown below

Hydrologic Data Collection and Support for Loxahatchee River Basin

This program covers hydrologic data monitoring for the area tributary to the Loxahatchee River and the estuary system which it feeds. Hydrologic monitoring in this areas is a highly coordinated effort between Data Management Division, Water Resources Division, Environmental Sciences Division, Resource Operations Department, and the USGS. Environmental Sciences Division provides most data collection functions in the tributary regions as a part of their environmental monitoring function, Water Resources Division provides data collection and some processing in the estuary areas, Data Management Division provides recorder installation, maintenance, processing, and archive function on all data collected, Resource Operations Department operates and maintains the telemetry data acquisition systems. The USGS provides groundwater information and some detailed information for calibration of estuary modeling.

Current instrumentation consists of:

Flow		5	parameters
Surface water	Recorders	21	parameters (USGS 5)
Gates		4	parameters
Rainfall	Recording	4	parameters
Wells	Recording	6	parameters (USGS 2)

There has been a large volume of hydrologic data of an exploratory nature collected over the last ten years. This data formed the basis of understanding the nature and extent of environmental and water quality changes occurring in the basin and provided criteria on which to base a management plan for restoration efforts. The old network has largely been abandoned in favor of a more systematic network design to support engineering and environmental analysis within the restoration project including basin modeling and estuary dynamics modeling. The current hydrologic network will also support operational requirements of the basin management plan. Flows computed under this project are required to compute water quality loading.

Hydrologic monitoring efforts will see moderate increases during FY89. Two additional recorders will be installed to support water management efforts in the tributary regions. The USGS will continue to collect detailed data to support estuary modeling in a cooperative cost sharing agreement. These funds are included in the BASIC NETWORK program.

Backlog is substantially complete in this area except for updating archives with data collected at 5 sites by Water Resource Division

There are two structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data to serve the estuary modeling portion of this project.

Hydrologic Data Collection and Support - Upper Kissimmee River Valley

The Upper Kissimmee River monitoring project covers the area draining to C-38 and the Kissimmee river from S-65 to S-65C.

Current instrumentation consists of:

Flow		9	parameters (USGS 1)
Surface water	Recorders	26	parameters (USGS 2)
	Manual	2	parameters
Gates		16	parameters
Rainfall		20	parameters
Evaporation		2	parameters
Weather Station	Recording	10	parameters
Wells	Recording	12	parameters (USGS 3)
	Manual	15	parameters (USGS all)

Substantial increases in hydrologic monitoring will continue during FY89 in support of Kissimmee River Restoration efforts. Additional monitoring will concentrate on defining the flow characteristics of the oxbows, the auxiliary structures designed to increase flow to the oxbows, and overland flow resistance characteristics through marsh vegetation. Twelve new recorders have been allocated to support the additional monitoring. Site selection for these additional sites has not been finalized and it is likely that several units may be diverted to cover unanticipated

needs in other areas. Five of the units will be temporarily installed in Boney Marsh to support a coordinated effort to quantify overland flow resistance through marsh vegetation. They will be removed prior to the end of FY89.

Detailed hydrologic map characteristics were digitized in AutoCad allowing correction of location information on the hydrologic data base. The USGS installed their satellite monitoring instrumentation on S-65 during FY88. This system is working with moderate success and now allows near real time data acquisition at this key station.

The manual wells by the USGS are monitored twice per year to document changes in the Floridan Aquifer. Additional well information is available from the USGS for which SFWMD does not contribute funding nor exert control over network characteristics.

There are nine structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data under their estuary modeling project.

A small amount of backlog processing for shallow groundwater wells is still outstanding and will be completed in FY89

Hydrologic Data Collection and Support - Resource Control Support

This project encompasses hydrologic monitoring for special studies which are currently an agricultural runoff study in the Caloosahatchee River Area, an exfiltration study at the main post office in West Palm Beach, and 2 wells near J.D. State Park.

Current instrumentation consists of:

Flow		1	parameter
Surface water	Recorders	3	parameters
Gates		1	parameter
Rainfall	Recording	1	parameter
Wells	Recording	9	parameters

The scope of this project will increase this year to include the agricultural runoff study. Additional effort is expected at the POET (Post Office Exfiltration Trench) study in support of hydrologic and water quality work. Considerable manpower will be expended in field testing of new instrumentation and monitoring techniques on these projects, particularly the West Palm Beach site. The ag runoff project will need a large coordination effort due to contracting portions of the study.

There is no backlog associated with this project.

Hydrologic Data Collection and Support - Lake Worth

This project encompasses hydrologic monitoring for the area tributary to the Lake Worth Estuary. Generally this is the portion of Palm Beach and Broward Counties east of the Conservation Areas, south of the Loxahatchee River Basin, and north of the Biscayne Bay drainage areas.

Current instrumentation consists of:

Flow		16	parameters (USGS 3)
Surface water	Recorders	36	parameters (USGS 15)
Gates and pump rpm		30	parameters (7 manual)
Rainfall		37	parameters (NOAA 6)
Evaporation		1	parameter
Wells	Recording	52	parameters (USGS 45)
	Manual	25	parameters (USGS all)
Water Quality	Recording	5	parameters (telemetry)
	Surface	19	sites (USGS)
	Wells	60	sites (USGS)

The scope of this project is expected to remain relatively constant. Some unanticipated instrumentation costs may be associated with monitoring operation on the new G-57 structure originally slated for telemetry control.

The water quality sites in this area are established primarily to document and provide advance warning of salinity intrusion problems.

There are nine structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

Most of the surface water data in this area is collected through our telemetry system in cooperation with Resource Operations Department, with backup at these critical control structures through existing graphic recorders which are not normally processed.

A small amount of backlog remains in this area, but it is not scheduled to be worked on until FY90.

Hydrologic Data Collection and Support - Fisheating Creek

This project encompasses hydrologic monitoring for the area tributary to Fisheating Creek. This area contributes flow to Lake Okeechobee from the west.

Current instrumentation consists of:

Flow		1	parameter
Surface water	Recorders	1	parameter
Rainfall		2	parameters (FFS 1)
Wells	Recording	1	parameter (USGS 1)
	Manual	6	parameters (USGS 6)

The scope of this project is expected to remain relatively constant. Two additional recorders are budgeted to provide support for water quality monitoring near Lake Okeechobee. It will be very difficult to provide the type of control necessary at these locations due to local site conditions thus it is probable that this instrumentation will not be installed during FY89.

The District exerts very little control of the hydrologic network in this area. The hydrologic monitoring for flow and water levels at the Palmdale gauge are paid for by the Corps of Engineers and performed by the USGS. One of the rain gauges is operated by the Forest Service under an informal data sharing project. We contribute funding on a cost-share basis to 5 of the bi-annual well readings on Floridan water levels. No backlog exists in this area.

Hydrologic Data Collection and Support - Upper Chain of Lakes

This project encompasses hydrologic monitoring for the area north of S-65. Generally this is the portion of Polk, Osceola, and Orange Counties within District boundaries bounded by Lake Kissimmee on the south.

Current instrumentation consists of:

Flow		16	parameters (USGS 6)
Surface water	Recorders	46	parameters (USGS 13)
	Manual	2	parameters (USGS 2)
Gates		8	parameters
Rainfall		29	parameters (NOAA 8, ORNG 2)
Evaporation		2	parameters (NOAA 1)
Wells	Recording	20	parameters (USGS 7)
	Manual	45	parameters (USGS 45)

The scope of this project is expected to remain relatively constant. The District expects to join NASA in a cooperative venture to establish additional rain gauges for calibration of radar rainfall. Under this agreement, the instrumentation will be furnished by NASA with some assistance in collection and processing by the District.

Resource Operations Department contributes greatly to the data collection effort by changing charts and keeping manual operation logs on most of the District structures in this area.

The manual wells by the USGS are monitored twice per year to document changes in the Floridan Aquifer.

There are 10 structures in this area for which there is a legal as well as hydrologic reason for maintaining detailed records.

There is a substantial amount of additional stage, well, flow, surface water quality, and ground water quality available from the USGS which is useful and is archived in our hydrologic data base. For example, the USGS computes flow at 19 sites in this area but the District contributes to only 6 of these. The remaining data is accessible to us but we exert no control over the non-contributory network.

There is a substantial amount of backlog associated with District structures in this area. This work is tentatively scheduled for FY90.

Hydrologic Data Collection and Support - Big Cypress Basin

The Big Cypress Basin covers the area west of Conservation Area 3A south of the area draining to the Caloosahatchee River and north of Everglades National Park.

Current instrumentation consists of:

Flow		3	parameters (USGS 2)
Surface water	Recorders	39	parameters (USGS 3)
Rainfall		20	parameters (FFS 4) (NOAA 4)
Wells	Recording	33	parameters (USGS 32)
	Manual	99	parameters (USGS all)
Water Quality	Manual	81	well sites (USGS all)

The magnitude of the effort by Data Management is expected to be less than during FY88. This is due to the Big Cypress Field Station assuming primary responsibility for recorder installation, collection, and field swaps for malfunctioning recorders. Data Management's role will be primarily processing data collected by the Field station, an annual trip for routine preventative maintenance and checking of new recorder installations. A stock of functioning recorders will be kept at the field station to replace malfunctioning equipment and will be repaired as bench type operations in West Palm Beach. Data collection responsibilities will remain with the Big Cypress personnel.

Five recorders were budgeted by Big Cypress Basin for FY89. Installation will be by Big Cypress Staff with final installation checks by Data Management.

The surface water and rainfall stations are established and maintained to document extreme hydrologic events, to provide the basis for operating control structures within the basin, and to establish the foundation for a basin water management plan. Flow is currently computed at only one gauging station. A moderate stream gauging effort is in progress to calibrate additional structures. The groundwater monitoring program is utilized to trigger water shortage plans, evaluate water supply potential of the ground water resource, and provide warning of potential salinity intrusion and groundwater contamination.

Hydrologic Data Collection and Support - Biscayne Bay

This project encompasses hydrologic monitoring for the area tributary to Biscayne Bay. Generally this is the portion of Dade County east of Conservation Area 3B and L-31N bounded on the south by the C-111 basin.

Current instrumentation consists of:

Flow		26	parameters	(USGS 2)
Surface water	Recorders	48	parameters	(USGS 7)
	Manual	23	parameters	
Gates and pump rpm		73	parameters	
Rainfall		10	parameters	(NOAA 5)
Evaporation		1	parameter	(NOAA 1)
Wells	Recording	72	parameters	(USGS 69)
Manual		6	parameters	(USGS 6)
Water Quality	Recording	11	parameters	(telemetry)
	Manual SW	4	sites	(USGS all)
	Manual GW	12	sites	(USGS all)

The scope of this project is expected to remain relatively constant. A moderate amount of additional effort is expected in the S-27 basin to help facilitate developing procedures to protect manatees. Some unanticipated instrumentation costs may be associated with monitoring operations on the new G-97 structure originally slated for telemetry control.

The water quality sites are established primarily to monitor and provide early warning of salinity intrusion problems and to a lesser extent to detect contamination from landfill areas and other pollutant sources.

There are 24 structures in this area for which there is a legal as well as hydrologic reason for maintaining detailed records.

Most of the surface water data in this area is collected through our telemetry system in cooperation with Resource Operations Department. With backup at these critical control structures through existing graphic recorders which are not normally processed.

There is a substantial amount of backlog associated with District structures in the South Dade coastal area. This work is tentatively scheduled for FY90.

Hydrologic Data Collection and Support - Indian River

This project encompasses hydrologic monitoring for the area tributary to the Indian River. Generally this is the portion of St. Lucie and Martin Counties which drains to the east. It includes portions of the St. Lucie Canal, all of the project works within St. Lucie County, and the areas associated with the St. Lucie Estuary and Indian River Lagoon.

Current instrumentation consists of:

Flow		5	parameters (USGS 1)
Surface water	Recorders	29	parameters (USGS 1)
	Manual	6	parameters
Gates		17	parameters
Rainfall		11	parameters (FFS 2, NOAA 2)
Evaporation		2	parameters
Wells	Recording	14	parameters (USGS 4)
	Manual	36	parameters (USGS 36)

The scope of this project is expected to remain relatively constant.

There are five structures in this area for which there is a legal as well as hydrologic reason for maintaining detailed records. The manual well data is semi-annual readings in the Floridian Aquifer to determine long term changes. The District asserts no control over the networks established by NOAA and the Forest Service nor does it contribute funding.

Critical backlog in this area is substantially complete except for transfer of estuary data at 20 sites previously collected by Water Resource Division for modeling purposes to our archive system. Some additional data from graphic recorders for special projects and auxiliary gauges has not been processed and is tentatively scheduled for FY91.

Hydrologic Data Collection and Support - Water Conservation Areas

This project encompasses hydrologic monitoring in Conservation Areas 1, 2A, 2B, 3A, and 3B and the area to the west that drains into CA 3A through L-1, L-2, L-3, and L-28.

Current instrumentation consists of:

Flow		40	parameters (USGS 8)
Surface water	Recorders	58	parameters (USGS 8)
	Manual	25	parameters

Gates and pump rpm		117	parameters (71 manual)
Rainfall		15	parameters
Evaporation		1	parameters
Weather Station	Recording	2	parameters
Wells	Recording	23	parameters
Water Quality	Recording	1	parameters (telemetry)

The scope of this project is expected to remain relatively constant. The interior of this area is relatively inaccessible resulting in high unit costs for data collection and instrumentation. For this reason, monitoring is held to the absolute minimum required to support environmental, modeling, and legal requirements. The number of gauges is large because all inflow and outflow structures are included as well as the interior gauges. There are 12 interior gauges which are generally set up to monitor surface, groundwater, and rainfall concurrently and 2 interior structures for which access is a real problem. The possibility of doing data collection by contract for these interior gauges is being considered.

There are 34 structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

There is a moderate amount of backlog associated with inflow stations which will be completed in FY89.

Hydrologic Data Collection and Support - Everglades Agricultural Area

This project encompasses hydrologic monitoring in the Everglades Agricultural Area. This is the portion of Palm Beach and Hendry Counties south of Lake Okeechobee and north of Water Conservation Areas 1 and 3A, which contains the rich muck lands prized for agricultural purposes.

Current instrumentation consists of:

Flow		1	parameter
Surface water		13	parameters (USGS 5)
Gates		6	parameters
Rainfall		17	parameters (NOAA 2)
Wells	Recording	3	parameters

Substantial increases in scope are envisioned for this area in FY89 due to implementation of the Holey Land and SN Knight Area restoration projects. Four recorders are budgeted for the Holey Land Area. A substantial number will be required for the SN Knight Area but were not budgeted due to uncertainty in scope during budget development. Current scope seems unnaturally small due to the inclusion of structures at the north end in the Lake Okeechobee Area and the structures at the south end in the Conservation Area.

There is one structure for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

Hydrologic Data Collection and Support - Taylor Creek / Nubbin Slough

This project encompasses hydrologic monitoring in the Taylor Creek/Nubbin Slough Basin. This is the portion of Okeechobee, Martin, and St. Lucie Counties northeast of Lake Okeechobee which drain to Lake Okeechobee through S-191. A large number of dairies are concentrated in this area contributing to water quality problems in Lake Okeechobee.

Current instrumentation consists of:

Flow		4	parameters (USGS 3)
Surface water	Recorders	62	parameters (USGS 3)
Velocity		27	parameters
Gates		6	parameters
Rainfall		9	parameters (NOAA 1, FFS 1)
Wells	Recording	3	parameters
	Manual	7	parameters (USGS 7)
Water Quality	Recording	16	parameters

A substantial increase in scope was realized for this area in FY88 to support water quality monitoring of the dairies. Instrumentation for this project was purchased in FY88 but installation will continue through the first quarter of FY89.

The USGS has had calibration problems with the three flow monitoring sites for which they receive cooperative funding and have not been able to supply data in 1988. The District is considering taking over these stations or abandoning them. There is one structure, S-191, for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

Backlog processing of hydrologic data for this area was completed in FY88.

Hydrologic Data Collection and Support - Lower Kissimmee Valley

This project encompasses hydrologic monitoring in the Kissimmee River Basin below S-65C. This is the portion of Okeechobee, Highlands and Glades Counties north of Lake Okeechobee which drain to Lake Okeechobee through S-65E and S-154. A large number of dairies are concentrated in this area contributing to water quality problems in Lake Okeechobee.

Current instrumentation consists of:

Flow		10	parameters (USGS 1)
Surface water	Recorders	57	parameters (USGS 2)
Velocity	Recorders	21	parameters
Gates and pump rpm		25	parameters (5 manual)
Rainfall		30	parameters
Evaporation		1	parameter
Weather Station	Recording	10	parameters
Wells	Recording	1	parameter
	Manual	10	parameters (USGS 10)
Water Quality	Recording	44	parameters

A substantial increase in scope was realized for this area in FY87 and FY88 to support water quality monitoring of the dairies. Instrumentation for this project was

installed in FY88. Relocation of some of the instrumentation sites will be required due to changes resulting from implementation of BMP projects.

Manual well stations by the USGS are bi-annual readings to monitor long-term changes in the Floridian Aquifer. Additional information on well water levels is available from the USGS on our hydrologic data base. The District does not contribute funding for these additional stations and does not exert control over the network. There are eight structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

Backlog processing of hydrologic data for this area was completed in FY88.

Hydrologic Data Collection and Support - Lake Okeechobee

This project encompasses hydrologic monitoring in Lake Okeechobee and the major pump stations which pump to the Lake. A large number of dairies are concentrated in this area contributing to water quality problems in Lake Okeechobee.

Current instrumentation consists of:

Flow		24	parameters (USGS 4)
Surface water	Recorders	34	parameters (USGS 7)
	Manual	2	parameters
Gates and pump rpm		56	parameters
Rainfall		19	parameters
Evaporation		2	parameters
Weather Station	Recording	18	parameters
Water Quality	Recording	6	parameters

A substantial increase in scope is envisioned for this area in FY89. This includes budgeted instrumentation for 5 sites related to dairy runoff at S-4, S-135 and Henry Creek Lock. Additional monitoring will be established within the Lake itself in a cooperative effort with the University of Florida in their lake circulation study.

There are 15 structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

A substantial amount of backlog remains in this area which will be completed in FY89.

Hydrologic Data Collection and Support - Everglades National Park

This project encompasses hydrologic monitoring in Everglades National Park, the East Everglades Area in Dade County and the C-111 Basin. Everglades National Park operates, maintains, and processes data collected within the park boundaries and furnishes data summaries on a routine basis.

Current instrumentation consists of:

Flow		9	parameters (USGS 4)
Surface water	Recorders	34	parameters (USGS 13, ENP 9)
	Manual	6	parameters
Gates and pump rpm		17	parameters
Rainfall		20	parameters (NOAA 5, USGS 1, PARK 8)

Evaporation		1 parameter
Wells	Recording	11 parameters (USGS 5)
Water Quality	Recording	2 parameters (telemetry)
	Manual GW	4 sites (USGS)
	Manual SW	1 site (USGS)

The scope of hydrologic monitoring will remain constant in this area during FY89. Resource operations maintains the telemetry network at selected stations and furnishes manual pump logs. Data Management maintains and processes the remainder of the information in cooperation with the USGS in the East Everglades, L-31N, and C-111 areas. Additional information is supplied to our database from Everglades National Park at no charge.

There are 15 structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data. The water quality sites are established primarily to monitor and provide early warning of salinity intrusion problems.

Hydrologic Data Collection and Support - Caloosahatchee River Basin / Six Mile Slough & Corkscrew Wildlife Preserve

The Caloosahatchee Basin covers the area west of Lake Okeechobee which drains to C-43, and the Caloosahatchee River including the estuary formed by Estero Bay, the Caloosahatchee River, and Charlotte Harbor.

Current instrumentation consists of:

Flow		4 parameters (USGS 3)
Surface water	Recorders	21 parameters (USGS 15)
	Manual	1 parameter
Gates		5 parameters
Rainfall	Recording	25 parameters (FFS 5, NOAA 4)
Evaporation		1 parameter
Wells	Recording	35 parameters (USGS all)
	Manual	128 parameters (USGS all)
Water Quality	USGS SW	2 sites (USGS)
	USGS GW	11 sites (USGS)

The magnitude of the effort by Data Management is expected to increase substantially due to instrumentation requirements in Six Mile Slough and Corkscrew Wildlife Preserve. Four recorder installations were budgeted for Six Mile Slough and two recorder installations in Corkscrew Marsh. Both sets of instrumentation are primarily for environmental efforts. Surface and groundwater information is handled by the USGS with cooperative funding between the USGS, SFWMD, and the Corps of Engineers.

The surface water and rainfall stations are established and maintained to document extreme hydrologic events, to provide the basis for operating control structures within the basin, and to establish the foundation for a basin water management plan. The groundwater monitoring project is utilized to trigger water shortage plans, evaluate water supply potential of the ground water resource, and provide warning of potential salinity intrusion and groundwater contamination.

There are four structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

Hydrologic Data Collection and Support - Indian Prairie/Harney Pond/Lake Istokpoga

This project encompasses hydrologic monitoring within the area draining to Lake Istokpoga and the outlets from Lake Istokpoga to Lake Okeechobee. This covers a major portion of Highlands County and portions of Glades and Polk counties.

Current instrumentation consists of:

Flow		10	parameters (USGS 5)
Surface water	Recorders	21	parameters (USGS 8)
	Manual	1	parameters (USGS 1)
Gates		25	parameters
Rainfall		13	parameters (NOAA 4, FFS 3)
Wells	Recording	4	parameters (USGS 2)
	Manual	41	parameters (USGS 4)

The magnitude of the effort by Data Management is expected to increase during FY89 due to new monitoring of dairies in the Arbuckle Creek area. Six complex installations are planned for this purpose.

The surface water and rainfall stations are established and maintained to document extreme hydrologic events, to provide the basis for operating control structures within the basin, and to monitor water deliveries to the Brighton Seminole Indian Reservation. Flow is currently computed by both the USGS and by Data Management at 4 stations. The reliability of both estimates is being evaluated with the possibility of SFWMD assuming total control of these stations in FY90. A moderate stream gauging effort is in progress to improve flow estimates within the area. The groundwater monitoring project is primarily the base network established to document hydrologic status of the Floridan Aquifer.

There is a substantial additional stage, well, flow, and ground water quality data available from the USGS which is useful and is archived in our hydrologic data base. This data is accessible to us but we contribute no funds nor exert control over the non-contributory network. There are eight structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data.

A significant amount of backlog data at the structures below Lake Istokpoga was completed in FY88. The remainder will be completed in FY89.

INSTRUMENT EVALUATION

●**District Contact:** **Brian Turcotte**

1. **OBJECTIVE:** Evaluate applicability of new instrumentation and sensors to District specific needs and environment, and evaluate the marketplace for acceptable vendors to identify potential sources for instrumentation.
2. **DISTRICT NEED AND USE:** Improved efficiency and accuracy of hydrologic data collection and processing is required.
3. **SCOPE:** This program encompasses all aspects of instrumentation and data logging. Information on new equipment is accumulated and evaluated as to the suitability for District use. Proposed sites are evaluated, designed and planned to test and implement state-of-the-art instruments and data loggers. Equipment is fabricated and installed on site. Operation and accuracy are verified. Other divisions/departments and agencies are advised as to appropriate instrumentation. Instruments are designed, developed and/or modified for special requirements where needed. Facilities are maintained for testing, maintenance and repair of instruments and recording equipment. Equipment is obtained and modified if necessary for detail testing. Publications are researched for developments in state-of-the-art instrumentation; particularly electronic sensors. Conferences are attended which showcase new developments in instrumentation, and made contacts with promising vendors to gather information. Vendors may be invited for demonstrations as appropriate to better evaluate their equipment. Monthly meetings are conducted with the Division Director to review progress and coordinate special tasks. Quarterly reports are prepared outlining the project progress.
4. **SCHEDULE:**
 1. Conduct market survey or RFQ in first quarter to give all potential vendors an opportunity to make their products and services known and to allow the division to issue bid requests in second quarter for equipment best suited for its goals.
 2. Purchase recorders, sensors, and auxiliary equipment through the RFB process in the second quarter.
5. **PROGRESS TO DATE:** This is a continuing project. Request for bids issued fourth quarter FY 87-88. (1) Campbell Scientific has developed promising solid state recording/reporting system. This instrumentation will be evaluated under local conditions to determine suitability for competitive source of basic system components. (2) Uniloc Division of Beckman Industrial offers a promising conductivity sensor at considerable cost savings compared to our current method. (3) Attended recent international symposium on fiber optic sensors. State-of-the-art knowledge was acquired. Fiber optic and infrared sensors are being considered for further investigation. Campbell Scientific Inc. CR10 Measurement and Control Modules were purchased in 4th quarter FY 87-88 for rigorous evaluation in FY 88-89.

6. **PRODUCTS:** Information gathered through this program is disseminated to the following groups as outlined:
1. **Resource Control Department** - New techniques and hardware for compliance monitoring.
 2. **Resource Operations Department** - Telemetry applications for sensing and control.
 3. **Resource Planning Department** - New methods for controlling automatic water samples; innovative techniques for rainfall, runoff, infiltration monitoring; development of techniques for measuring water quality parameters such as conductivity, pH, ORP; monitoring meteorological parameters effectively; more cost effective instrumentation.
 4. **USGS** - Assistance with satellite telemetry operations.
 5. **ARS** - Weather station.
 6. **Miscellaneous users of electronic recording media** - National interest in our extensive experience.
 7. **Agricultural interests** - Improved meteorological instrumentation, weather stations
 8. Provide advice on procurement and utilization of experimental instrumentation, and assistance to cooperating agencies such as USGS, other WMDs, ARS, U of F, Orange County, on installation of electronic recording instruments.
 9. Evaluation of alternative instrumentation identified in 1987-88. (2)
Continued market search through 1st quarter, 1988-89.

STREAM GAUGING

●District Contact: Art Nelson

1. OBJECTIVE: The three main objectives of the Stream Gauging project are: (1) to provide verification of old rating curves, (2) to establish discharge data for unrated structures, and (3) to check flow at points where neither structures nor recording instruments are present.
2. DISTRICT NEED AND USE: Justification for this project is found in both the increased efficiency and accuracy of hydrologic data collection and processing.
3. SCOPE: Execution of this project is limited by hydrologic conditions. Verification of rating curves at structures in the Kissimmee chain will continue. Additional measurements of the Indian Prairie-Harney Pond structures are planned along with routine and periodic measurements in the Loxahatchee and Naples areas. High water measurements in the C-51, Hillsboro and Loxahatchee Basins, and measurements in the East Everglades will be made as the need arises. Measurements will be made on an as needed basis at any other site meeting the criteria cited in the project objectives. This project consists of five task types:

Routine Measurements
 Special Measurements for Other Programs
 Rate District Structures
 Storm Event Monitoring
 Flow Measurements to Data Base

4. SCHEDULE: Scheduling is dependent on water conditions. Structure ratings will continue in the Indian Prairie-Harney Pond area. High water measurements will be made in the C-51, Hillsboro and Loxahatchee Basins as the need arises. Hydrologic conditions permitting, other measurements will occur as needed.
5. PROGRESS TO DATE: This is a continuing project. In April, at the request of the Big Cypress Basin, two days of low water measurements were made in the Naples area. During the month of October, high water measurements were made in the same area over a two-day period. Repetition of these measurements on an annual basis is considered probable. A week of intensive measurements for the Kissimmee Demonstration Project (130+ meas.) occurred in February. Structure rating measurements were made at S-151. Rating measurements were made at the S-8 spillway on two separate occasions. Measurements were made at S-83 in February. In an attempt to check the calibration of the Marsh-McBirney velocity meter, flow measurements were made at two dairy sites. Continued training of technicians in the field on stream gauging is an ongoing process.
6. PRODUCTS:
 - a. Flow data.
 - b. Rating curves.

HYDROGEOLOGIC DATA BASE DEVELOPMENT

●District Contact: Barbara Dickey

1. **OBJECTIVE:** The objective of this project is the development and collection of the Hydrogeology Division's computer programs and data sets.
2. **DISTRICT NEED AND USE:** The models and pre and post processors developed by the Hydrogeology Division will be available for use by District personnel. Currently, the Upper East Coast 2-D model and pre and post processors are being used by the Resource Control Department as an aid for water use allocations.
3. **SCOPE:** During the next fiscal year emphasis will be placed on coordinating with the District's GIS efforts. Also, the following models will be incorporated into the data base upon completion: Collier County Management Model, Lee County Management Model, and the Palm Beach County Model.
4. **SCHEDULE:**
Quarter 1, FY 88-89: Software needed to integrate the various elements of the Collier County Management Model will be completed.

Quarter 2, FY 88-89: Completion of software ancillary to the permanent utilization of the Palm Beach County model.

Quarter 3, FY 88-89: Completion of software for utilization of the Lee County model in a cumulative impact format.
5. **PROGRESS TO DATE:** The following programs and documentation have been developed for the hydrogeologic data base, Upper East Coast Floridan Model (UECFMOD), pump test data reduction and analysis system, Palm Beach County Macros, Compaq Computer Modem Setups, and USGS Comi programs for Collier and Lee Counties.
6. **PRODUCTS:** This is an ongoing project. Products achieved from this project are documented user-friendly pre and post processors to the models and data sets developed by the Hydrogeology Division.

USGS COOPERATIVE STUDIES COORDINATION

●District Contact: Sharon Trost

1. OBJECTIVE: The objective of this project is to provide funding, manpower and services and management oversight to complete all USGS-SFWMD cooperative studies which involve ground water investigations. This project will monitor the performance of the cooperator and will assure that the District is fully informed on their progress and results of the studies.
2. DISTRICT NEED, USE: The District does not have the manpower available to perform all of the monitoring and applied research studies necessary to enable us to make prudent water management decisions. The USGS has the expertise and experience to perform this work. The District and the USGS have cooperated in mutually beneficial studies for over 33 years.
3. SCOPE: This project will involve coordination of all technical aspects of current USGS-SFWMD cooperative ground water studies through periodic reviews, meetings, correspondence, and other contacts with the cooperator. All ground water and surface water data collection are coordinated through Data Management Division. The cooperative studies for FY 88-89 include:
 - a. ASR, Cape Coral: Determine the feasibility of ASR as a water management tool in Cape Coral, Lee County.
 - b. Potentiometric Maps, Palm Beach, Martin, St. Lucie Counties: Data collection and contour maps of wet and dry season water tables in the Upper East Coast Planning Area counties.
 - c. Osceola County Ground Water Reconnaissance: Evaluation of the ground water resources of Osceola County; the District will provide drilling and aquifer testing services associated with this study.
 - d. Surface Water Investigations, Northern Kissimmee River Basin: The possible causes of rising lake levels will be defined and instrumentation will be installed for monitoring purposes.
 - e. Salt Water Intrusion Monitoring in Broward County: The location, nature, and movement of the salt water front will be more accurately defined.
 - f. Canal-Aquifer Interaction: The interdependent relationships of surface and subsurface hydrologies will be investigated.
 - g. Assessment of Ground Water Resources, Southern Broward County: Development of a 3-Dimensional Ground Water Flow Model (MODFLOW) for southern Broward County.
 - h. Simulation of Surface Water/ Ground Water Interaction: A computer model which includes the dynamic components of surface water hydrology along with those for ground water is developed.

- i. Water Resources Investigation, Okeechobee County: Evaluation of the ground water resources of Okeechobee County; the SFWMD will provide drilling and aquifer testing services associated with this study.
 - j. Water Resources Investigation, Orlando Metropolitan Area: An update of the 1963 water resource study in the Orlando Metropolitan area, exploring water quality changes and establishing a monitor network. Identify future problem areas.
 - k. Assessment of the Lake Worth Drainage District: The effects of surface water hydrology of the system on the regional ground water regime are investigated.
 - l. Geographic Information Systems (GIS): Explore the use of a GIS which will include hydrogeologic data for ground water resource assesment and wellfield protection applications.
4. **SCHEDULE:** A quarterly in-house review of all status reports submitted by the cooperator will be carried out. In addition, all final reports or deliverables will be reviewed and commented on as necessary.
- a. ASR, Cape Coral (3rd of 3 yrs)
 - b. Potentiometric Maps, Palm Beach, Martin, St. Lucie Counties (ongoing)
 - c. Osceola County Ground Water Reconnaissance (final year)
 - d. Surface Water Investigation, Northern Kissimmee River Basin (1st of 3 yrs)
 - e. Salt Water Intrusion Monitoring in Broward County (1st of 2.5 yrs)
 - f. Canal-Aquifer Interaction (2nd of 2 yrs)
 - g. Assessment of Ground Water Resources, Southern Broward County (1st of 2 yrs)
 - h. Simulation of Surface Water/ Ground Water Interaction (1st of 3 yrs)
 - i. Water Resources Investigation, Okeechobee County (1st of 2.5 yrs)
 - j. Water Resources Investigation, Orlando Metropolitan Area (1st of 3 yrs)
 - k. Assessment of the Lake Worth Drainage District (1st of 2 yrs)
 - l. Geographic Information Systems (GIS) (Continuing)
5. **PROGRESS TO DATE:** Several studies have been underway for some time. A meeting will be held in the second quarter of FY 88-89 with the USGS to review progress and make suggestions on the conduct of the studies.
6. **PRODUCTS:** Products include: Technical reports summarizing the results of ground water studies; raw data which is transmitted electronically each month

to the SFWMD hydrologic data base; and maps, charts or other interpretation of raw data submitted on a periodic basis.

WELL DRILLING, GEOPHYSICS, HYDROGEOLOGIC FIELD SUPPORT

●District Contact: Martin Braun

**CONTRACT REFERENCES: St. Lucie Floridan Drilling (New)
Broward Shallow Drilling (New)
Martin/St. Lucie Shallow Drilling (New)**

1. **OBJECTIVE:** The objective of this project is to provide well drilling, geophysical logging, pump testing, contract administration support, and all other related ground water field support services to the Hydrogeology Division.
2. **DISTRICT NEED AND USE:** Ground water data obtained via field investigations is utilized by project managers in writing technical reports and making decisions as to the reasonable and beneficial use of ground water throughout the District.
3. **SCOPE:** This project is designed to support Hydrogeology Division's major ground water field investigations. Well drilling rigs, geophysical logging units, and hydrogeologic analysis systems are operated, calibrated, and maintained by Division field/technical and well drilling personnel; administrative and technical support of contracts for drilling services is provided by the project manager. During FY 88-89, the following major accomplishments are scheduled:
 - a. Martin Co. Three-Dimensional Model: 25 wells will be drilled at 15 sites; 3 Aquifer Performance Tests (APT'S) will be performed.
 - b. St. Lucie County Reconnaissance: Ten monitor wells and two APT sites will be completed.
 - c. Osceola County Reconnaissance: Seven Floridan aquifer sites comprising three wells each and one Surficial aquifer site of two wells will be completed.
 - d. St. Lucie County Floridan Aquifer: Two Floridan aquifer sites each comprising five wells will be completed, and APT'S performed.
 - e. Broward County Biscayne Aquifer: Five APT sites comprising four wells each will be completed and APT's performed.
 - f. Aquifer Storage and Recovery (ASR) Demonstration: Assistance, testing, and monitoring during injection/recovery cycles will be performed.
4. **SCHEDULE:** Because of the great number of variables associated with scheduling under this project, developing a quarterly schedule of accomplishment is unrealistic and impractical. Refer to scope for anticipated accomplishments during the fiscal year.
5. **PROGRESS TO DATE:** Multi-year studies are supported by this project simultaneously, summary of FY 87/88 highlights are as follows:
 - a. Palm Beach County Field Investigation: Complete
 - b. Hendry County Field Investigation: Complete
 - c. Martin County Drilling: 30% Complete
 - d. ASR Well Drilling: Completed Contract
 - e. Water Quality Division Field/Contract Support: Continuing
 - f. Seismic Drilling/Logging: Complete
 - g. Osceola County Reconnaissance: 15% Complete

6. **PRODUCTS:** Ground water data obtained from test/monitor well sites is utilized by Hydrogeology Division project managers in writing technical reports and developing ground water models (continuing).

WATER USE MANAGEMENT AND PLANNING

●District Contact: Wm. Scott Burns

CONTRACT REFERENCES: Multi-Objective Evaluation Methodology (MOEM) Framework Development

1. **OBJECTIVE:** The objective of this project is to develop the framework for the Water Use Management and Planning Initiative. Work associated with this project includes the development of the District Water Use Management Plan (DWUMP), revisions of the Basis of Review, development of the framework of the Section Water Use Management Plan (SWUMP) and the implementation of the SWUMPs.
2. **DISTRICT NEED AND USE:** Florida law (Chapter 373, F.A.C.) places a clear responsibility for the development of regional water use management plans on the water management districts. This requirement is reiterated in State Water Policy (Chapter 17-40). The WUMP initiative is the District's attempt to meet this directive through the incorporation of its mission statement in District-wide plans, basin specific plans, and water use permitting regulations.
3. **SCOPE:** This project is a District-wide effort which will be ongoing for the next five years. The project consists of two major phases. Phase I, which will last for two years, is directed to: 1) the development of resource assessment tools (surface and ground water models, environmental resource data base, water demand forecast models and economic impact models), 2) the drafting and approval of the DWUMP and 3) completion of the revision of the Basis of Review. Several efforts needed to determine the overall evaluation framework for the Water Use Management Plans and the role of economic impact evaluations within that framework are being conducted under this project in FY 88-89. A multi-objective evaluation framework is being developed under contract to assist the District in factoring its goals into its decision-making criteria by evaluating the economic, environmental, social and financial impacts of plan alternatives. The applicability of economic impact measures and the feasibility of particular methods are being evaluated by in-house research supplemented by contractual services.

Phase II of the project will begin in FY 1991 and continue through FY 1993. The work elements associated with this phase include the development of eight SWUMPs. The SWUMPs will be based on the incorporation of the resource assessment tools with the demand forecast (from District and local comprehensive plans) utilizing the goals set forth in the DWUMP.

A total of 12 projects are associated with the WUMP initiative District-wide. The time incorporated into this project consists of administrative and developmental time associated with drafting of the DWUMP Basis of Review and SWUMP framework.

4. **SCHEDULE:**
 - a. Drafting of the DWUMP. 3rd Quarter FY 1989
 - b. Editorial review of DWUMP by Exec. Council & Gov. Board 1st Quarter FY 1990

- | | | |
|----|---|---------------------|
| c. | Rule-making for DWUMP | 3rd Quarter FY 1990 |
| d. | Draft of the revised Basis of Review | 2nd Quarter FY 1989 |
| e. | Editorial review of Basis of Review | 3rd Quarter FY 1989 |
| f. | Rule-making for Basis of Review | 4th Quarter FY 1989 |
| g. | Resource assessments (see indiv. project documents) | |
| h. | Develop framework for SWUMP | 3rd Quarter FY 1989 |
| i. | Approval of SWUMP framework | 1ST Quarter FY 1990 |
5. PROGRESS TO DATE: This project expands upon and replaces the Water Use Allocation and Management project for FY 88. Work completed on this project through FY 88 includes: 1) revision and redefinition of the scope of the WUMP initiative, 2) determination of the work elements and resources required to complete the initiative, and 3) initial work in development of the DWUMP, revised Basis of Review and the scope of work for the MOEM contract.
6. PRODUCTS:
- a. District Water Use Management Plan
 - b. Revised Basis of Review for Water Use Permits
 - c. Eight Sector Water Use Management Plans (SWUMPs)
 - d. Multi-Objective Evaluation Framework

INORGANIC LAB CHARGES

●District Contact: Mary Lou Daniel

1. **OBJECTIVE:** This project provides analytical chemistry support for the District's water quality monitoring projects. This project is used to collect the costs (personnel and commodities) associated with the projects listed under the SCOPE. These costs are distributed to the projects based on the percentage of workload on a monthly basis.
2. **DISTRICT NEED AND USE:** This project supports the monitoring of the impacts of water management decisions and practices on water quality in the District. The data produced by the project are used to evaluate the effectiveness of BMP's, to inform the governing board and public about the quality of water within the District and to provide an historical basis for comparing water quality changes.
3. **SCOPE:** This project covers 36 routine analytical tests. The eight nutrient tests for nitrogen and phosphorus compounds, account for approximately 60% of the laboratory workload. The predicted workload for FY 88-89 is 175,000 analyses for "routine" monitoring projects and 20,000 analyses for storm event monitoring. Support is also provided to field sampling personnel. This project provides support for the following projects:
 - Local Government Assistance (Wellfield Protection)
 - RPD Support (Hydrogeology)
 - RCD Support (Stormwater Monitoring and Enforcement)
 - Loxahatchee River Restoration
 - Chemistry Laboratory Overhead (Quality Control)
 - Surface Water Quality Monitoring Network
 - Lake Okeechobee Management
 - Chemical Treatment Technology Demonstration
 - Caloosahatchee Estuarine Studies
 - St. Lucie Estuarine Studies
 - WCA Impacts/Monitoring
 - Boney Marsh Management Technique Evaluation
 - TCNS BMP Data Acquisition
 - Kissimmee Valley BMP Data Acquisition
 - Lake Okeechobee Data Acquisition
 - L-8 Backpumping Data Acquisition
 - ENP Data Acquisition
 - Caloosahatchee River Data Acquisition
 - Upper Kissimmee Chain of Lakes Data Acquisition
 - Arbuckle Creek BMP Data Acquisition
 - Lake Istokpoga Data Acquisition
4. **SCHEDULE:** The anticipated load for FY 88-89 is 195,000 analyses. All tests for nutrients, cations, anions, and physical parameters are completed within five working days of sample submission.

All trace metal analyses are completed within thirty calendar days of sample submission.

5. **PROGRESS TO DATE:** This is a continuing project. During FY 87-88, approximately 146,000 analyses were performed. This was a 40% increase over the total for FY 86-87.

A second shift of 4 persons was added to the laboratory staff in February 1988. Independent operation of the second shift commenced in March 1988.

6. **PRODUCTS:** The products of this project are the analytical results stored in the laboratory computer database and support for the field sampling effort (cleaning of bottles and filter holders).

CHEMISTRY LAB DATA BASE

●District Contact: Thomas Raishe

CONTRACT REFERENCES: LIMS Maintenance/Perkin Elmer

1. **OBJECTIVE:** This project provides support for the division's Laboratory Information Management System (LIMS).
2. **DISTRICT NEED AND USE:** This data base contains both historical and current water quality data and is used by project managers to make operational decisions and to formulate recommendations based on water quality considerations. LIMS provides essential sample tracking, data acquisition and processing support for the analytical laboratory.
3. **SCOPE:** The primary functions of this project are:
 - a. To collect, process, archive and disseminate all computerized water quality information within RPD and
 - b. To provide complete support, operation and maintenance, for LIMS.
4. **SCHEDULE:**
 - a. Daily system maintenance and manual data entry.
 - b. Weekly distribution of results to project managers.
 - c. Respond as appropriate to meet the needs of the LIMS users for data output and programming.
5. **PROGRESS TO DATE:** The LIMS has processed over 179,000 results to date.
6. **PRODUCTS:** Analytical data reports and machine readable data are provided to project managers and external requesters.

WET/DRY PRECIPITATION COLLECTION

●District Contact: Larry V. Grosser

1. **OBJECTIVE:** The objective of this project is to collect water quality data from wet and dry precipitation samples from representative locations throughout the District. This will allow the determination of the spacial and temporal variance associated with rainfall water quality (nutrients and physical parameters) and will establish a database that will enable the District to estimate the impact upon the receiving lands or waters from direct precipitation.
2. **DISTRICT NEED AND USE:** The primary use of this project is to provide cooperative data to the Florida Sugar Cane League and Everglades National Park and for District Planning and Operations Department research and operational programs. Of particular interest is the determination of rainfall pollutant mass loading contributed to the Kissimmee-Okeechobee-Everglades system.
3. **SCOPE:** The monitoring program consists of four refrigerated automatic wet/ dry precipitation collectors located at the ENP Research Center, Clewiston Field Station, Okeechobee Field Station, and at District Headquarters (B50).
4. **SCHEDULE:**
 - a. The B50 station is collected weekly (two samples).
 - b. Outlying stations are collected bi-weekly (6 samples)
 - c. 1st Quarter FY 88-89:
 1. Automatic precipitation collectors will be installed at S80 and S65A.
 2. Water Chemistry Lab to begin analysis of samples submitted from Florida Sugar Cane League.
5. **PROGRESS TO DATE:**
 - a. The B50 station commenced operation in February, 1987.
 - b. The ENP, Clewiston, and Okeechobee stations commenced operation in November, 1987.
6. **PRODUCTS:**
 - a. 3rd Quarter FY 88-89:
 1. Develop quality control procedures for rainfall collection.
 - b. 3rd Quarter FY 88-89:
 1. Develop the rainfall collection quality assurance plan.
 - c. 4th Quarter FY 88-89:
 1. Conduct rainfall collection quality assurance systems audit.

PESTICIDE WATER QUALITY MONITORING NETWORK

●District Contact: Richard J. Pfeuffer

1. **OBJECTIVE:** The objective of this project is to collect pesticide monitoring data as required by permit or agreement and evaluate the information collected. In addition, pesticide data are collected throughout the District at locations selected to determine water quality conditions at the major water control points.
2. **DISTRICT NEED AND USE:** This monitoring, which began in 1984, provides an evaluation of pesticide contamination within the District. Data collected will provide District staff and management improved understanding of the fate of pesticides in the environment. Data collection is required under the Department of Environmental Regulation's Lake Okeechobee Operating Permit, Miccosukee Tribe Memorandum of Agreement, and the Everglades National Park Memorandum of Agreement. The project provides District managers data needed to assess potential environmental impacts of surface water management decisions.
3. **SCOPE:** The monitoring network consists of 30 stations located at Lake Okeechobee and Water Conservation Area inflow and outflow structures and at Caloosahatchee River, and Everglades National Park inflow and watershed points. Both surface water and sediment samples are collected on a quarterly basis and analyzed for 65 pesticide, herbicides, and degradation products. This set of compounds includes chemicals currently utilized in the agricultural areas as well as compounds presently banned or currently restricted to non-crop areas. The list of compounds analyzed is periodically reevaluated so as to include contemporary compounds.
4. **SCHEDULE:** Major tasks and schedules are as follows:
 - a. 1st Quarter FY 88-89:
 1. Coordinate and conduct First Quarter Sampling (November). Compose data summary memorandum and Water Conditions Report section (January).
 - b. 2nd Quarter FY 88-89:
 1. Coordinate and conduct Second Quarter Sampling (January). Compose data summary memorandum and Water Conditions Report section (March).
 - c. 3rd Quarter FY 88-89:
 1. Coordinate and conduct Third Quarter Sampling (June). Compose data summary memorandum and Water Conditions Report section (June).
 2. Compose pesticide section of Technical Memorandum "Lake Okeechobee Water Quality 1987-1988 Annual Report".
 - d. 4th Quarter FY 88-89:
 1. Coordinate and conduct Fourth Quarter Sampling (August). Compose data summary memorandum and Water Conditions Report section (October).
 2. Complete Technical Publication summarizing data from 1984 to 1988.
 - e. As Needed Basis:

1. Occasional special investigations are performed on selected pesticides as required.
 2. Follow-up sampling is conducted if pesticides are detected.
5. **PROGRESS TO DATE:** Fiscal Year 87-88 was the third year of this formal routine monitoring network. Quarterly sampling, data summary memorandums, and Water Conditions Report sections were written during the year, and the pesticide section of the Technical Memorandum "Lake Okeechobee Water Quality 1986-1987 Annual Report" was completed. Prior to the establishment of the routine network, Technical Publication 85-2 "Pesticide Residue Monitoring in Sediment and Surface Water Bodies within the SFWMD" was written to evaluate historic data and delineate data gaps. This is anticipated to be a continuing project.
6. **PRODUCTS:**
- a. Quarterly data summary memorandums.
 - b. Quarterly Water Conditions Report section.
 - c. 4th Quarter FY 88-89:
 1. Technical Publication entitled "Pesticide Residue Monitoring in Sediment and Surface Water" which will summarize 1984-1988 results.
 - d. 3rd Quarter FY 88-89:
 1. Pesticide section for Lake Okeechobee Water Quality Annual Report 1987-88.

TRACE METALS MONITORING PROGRAM**District Contact: Richard J. Pfeuffer**

1. **OBJECTIVE:** The objective of this project is to provide baseline information on trace metal contamination in the soil and sediment.
2. **DISTRICT NEED AND USE:** The District has routinely analyzed water samples for metals. However, the data generated from water samples reflects only a snapshot or brief period of time while sediment data identifies the long term or historical information. This and the recent identification of a potential mercury contamination problem in fish, has resulted in a need to determine the possible origin and extent of trace metal contamination throughout the District. Information obtained will be utilized by District, Department of Environmental Regulation, and Florida Game and Fresh Water Fish commission managers to evaluate the extent of trace metal contamination in south Florida.
3. **SCOPE:** Representative samples will be obtained throughout the District to evaluate the extent and origins of heavy metal contamination. The first round of sampling will initially cover over one hundred sites. Triplicate sediment samples will be collected at each site. Triplicate analysis may be reduced if acceptable levels of variability among samples are encountered. Metals to be analyzed include: aluminum (Al), antimony (Sb), arsenic (As), beryllium (Be), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), silver (Ag), thallium (Tl), and zinc (Zn). Each sediment sample will also have particle size (percent silt and clay), total organic carbon, and calcium carbonate analysis performed. Standards obtained from the National Bureau of Standards will be utilized to verify the quality of analysis. The project is intended to be dynamic, with changes based upon sample variabilities and results. The data obtained will be used to establish relationships between concentrations of metals and sediment composition. This will be used to provide a basis for determining the origin and a means of comparing the data from the different areas. A second round of follow-up sampling will be conducted based on the interpretation of the data from the first round.
4. **SCHEDULE:** Major tasks and schedules are as follows:
 - a: 3rd Quarter FY 88-89
 1. Negotiate contract for laboratory analysis
 - b: 4th Quarter FY 88-89
 1. Start sample collection
 2. Compose data summary as information is available
5. **PROGRESS TO DATE:** Evaluation of laboratories responding to work proposals has been completed.
6. **PRODUCTS:** Data summary as information is available from contract laboratory.

WATER QUALITY INFORMATION SYSTEMS AND SUPPORT

●District Contact: Kevin A. Rodberg

1. **OBJECTIVE:** The objective of this project is to continue the development, maintenance, and support for a comprehensive water quality information system and database.
2. **DISTRICT NEED AND USE:** The water quality information systems used by the District are essential in the daily management of the state's water and environmental resources. The project assures that there is an accurate and efficient system for projects to examine, review, and make projections of the water quality on a historical and contemporary basis. A flagging routine will provide immediate notification of potential water quality problems or violations. As part of the Lake Okeechobee Operating permit, the DER will be provided with direct computer access to the database in order to expedite the flow of water quality data.
3. **SCOPE:** This project is an ongoing effort that includes archiving data from several internal and external sources, development of retrieval and analysis projects for review and maintenance of this data, and centralization and standardization of the District's water quality databases.

On a routine basis, data is transferred into the Chemical Analysis Archive System (CAAS) from several sources including: Laboratory Information Management System (LIMS), Ambient Ground Water Quality Monitoring Network data from Dade, Broward, and Collier Counties, and external laboratories.

A flagging system will be developed that will allow project managers to set limits for data values that need to be emphasized. Routine data reporting systems will also be designed to include mass balance calculations, statistics, and other applications.

4. **SCHEDULE:** Major tasks and schedule are as follows:
 - a. 1st Qtr FY 88-89: Implement Flagging Standards Definition System (FSDS) for LIMS and CAAS.
 - b. 2nd Qtr FY 88-89: Develop routines to interface with the FSDS and the data reporting system to include mass balance calcs and statistical routines.
 - c. 3rd Qtr FY 88-89: Incorporate detailed station information into the CAAS system.
 - d. 4th Qtr FY 88-89: Document results of the conversion evaluation.
5. **PROGRESS TO DATE:** The CAAS system has been implemented with documentation and user training has been provided. The FSDS has been defined, developed, and is under review prior to its implementation.
6. **PRODUCTS:**
 - a. 2nd Qtr FY 88-89: Provide a full featured FSDS integrated with the CAAS system.

- b. 3rd Qtr FY 88-89: Provide an upgraded database incorporating detailed station information with the CAAS system.
- c. 4th Qtr FY 88-89: Provide the results of the evaluation of the conversion to Oracle as a Technical Memorandum.

ECONOMIC ANALYSIS OF WATER DEMAND AND COSTS

●District Contact: Richard March

1. **OBJECTIVE:** The objective of this project is to utilize the results of past District contract research with IFAS to improve the District consumptive use permitting by improving the estimations of reasonable need for irrigation water.

2. **DISTRICT NEED AND USE:** The District is currently in the process of revising the Water Use Basis of Review. The results from this research project will provide useful technical information and recommendations to RCD staff and management in evaluating alternatives for incorporation into the Basis of Review. In addition, the results of the research can be used in evaluating alternative drought management (and perhaps flood management strategies) for agriculture. The results of this project will also support the Water Use Management Plan.

3. **SCOPE:** The project entails three tasks. These tasks represent extensions of research begun in previous fiscal years.

1. Evaluation and utilization of the AGWATER model to assess the economic impact of alternative water management strategies on South Florida agriculture. Particular attention is being paid to the evaluation of the sugarcane yield response component of the model. A draft evaluation report was begun in FY 87-88. The evaluation report will be edited and extended in FY 88-89.

2. Evaluation and utilization of the AFSIRS model- In FY 87-88, a draft report evaluating the AFSIRS model and making recommendations for areas of future research and implementation issues was completed. This report is being edited and revised. SWFWMD has issued a research proposal for IFAS (or other qualified contractor) to extend the AFSIRS model. One of the objectives of the model is "To prepare a plan and timetable for activities necessary to bring the model to full utilization." A portion of this task will entail cooperation with SWFWMD in its effort.

3. Evaluation and utilization of the ACUPIS model- IFAS developed a computer model to assess the economic consequences of alternative permit conditions (permit duration and drought frequency). This task will involve completing a report summarizing the results of model runs, evaluating the model and applying results to evaluate alternative policy options for revising the Water Use Basis of Review.

4. SCHEDULE-

- | | |
|---------|--|
| Task 1: | Complete AGWATER runs. Begin writing completion report - 1st Qtr
Finish completion report - 2nd Qtr
Ongoing utilization of product - 3rd and 4th Qtr |
| Task 2: | Complete AFSIRS completion report - 1st Qtr
Ongoing utilization of product - 2nd, 3rd and 4th Qtr |
| Task 3: | Make ACUPIS runs. Evaluate usefulness of ACUPIS model - 1st Qtr.
Write completion report - 2nd Qtr
Ongoing utilization - 3rd and 4th Qtr |

5. PROGRESS TO DATE-

Task 1- Numerous runs of the AGWATER model have been made and the major strengths and weaknesses of the model have been identified. A draft completion report has been begun.

Task 2- A draft completion report has been completed and circulated. On the basis of comments received from SWFWMD officials, additional model runs are being made, which will be incorporated in the final completion report.

Task 3- Preliminary runs of the ACUPIS model have been made and strengths and weaknesses of the model identified. Work with the model will continue parallel to RCD revisions of the Water Use Basis of Review.

6. PRODUCTS- **Task 1-** The major product of this task will be a report summarizing the workings of the AGWATER model, District experience with using the model, strengths and weaknesses of the model, implications for District water management projects, and areas for future research.

Task 2- The major product of this task will be a report summarizing the workings of the AFSIRS model, results of making runs with the model, strengths and weaknesses of the model, recommendations regarding District use of the model, and areas for future research.

Task 3- The major product of Task 3 will be a report summarizing the workings of the ACUPIS model and making recommendations on methods for incorporating economic considerations into District consumptive use permitting.

WATER USE MANAGEMENT PLAN-DEMAND PROJECTIONS

●District Contact: David Gilpin-Hudson

1. OBJECTIVES: The objective of this project is to develop water use demand estimates and projections throughout the District for use in developing water use management plans and water allocation policies as part of the Water Use Management and Planning Initiative.

2. DISTRICT NEED AND USE: Growing water resource demands have produced areas where needs equal or exceed supply resulting in saltwater intrusion, ground water mining, and adverse environmental impacts. District water use plans are needed to maximize safe development of water resources while maintaining environmental goals.

3. SCOPE:

Develop methodology - A methodology will be developed to insure that the demand projections made will fulfill the needs of the groundwater and surface water modeling process, District permitting needs, and the requirements of the objectives of the multi-objective evaluative methodology (MOEM) model.

Data Collection - Collect land use and water use data from the District permit files, local governments, agricultural and industrial sources, etc. Format the information (mapping, floppy disks, etc.)

Develop the Base Case - A detailed documentation of existing land and water use will be generated. Land uses will be broken down into urban, agricultural, golf and recreational, residential, and industrial components. Water uses will include surface and groundwater demands.

Make Demand Projections - Base case land and water uses will be projected into the future using the developed methodologies. Future land and water uses will be described in terms of ranges.

4. SCHEDULE: The following schedule is proposed for FY 88-89:

Methodology	3rd Qtr 88/89		
Projections			
Area:	<u>Data Collection</u>	<u>Analysis</u>	<u>Projections</u>
EAA	2nd Qtr 88/89	3rd Qtr 88/89	4th Qtr 88/89
West Central	2nd Qtr 88/89	3rd Qtr 88/89	4th Qtr 88/89
Lower West Coast	4th Qtr 88/89	1st Qtr 89/90	2nd Qtr 89/90
Lower East Coast	4th Qtr 88/89	1st Qtr 89/90	2nd Qtr 89/90
Upper East Coast	2nd Qtr 89/90	3rd Qtr 89/90	4th Qtr 89/90
Kissimmee Basin	2nd Qtr 89/90	3rd Qtr 89/90	4th Qtr 89/90

5. PROGRESS TO DATE: Data collection for the EAA and West Central areas has been completed and the data are being analyzed. Projection methodology is presently being developed.

6. PRODUCTS:

- A. Demand Projections for the EAA
- B. Demand projections for the West Central area
- C. Demand Projections for the Lower West Coast area
- D. Demand Projections for the Lower East Coast area
- E. Demand Projections for the Upper East Coast area
- F. Demand Projections for the Kissimmee Basin

WETLAND RESOURCE/WATER REQUIREMENTS

●District Contact: Dewey Worth

1. **OBJECTIVE:** The objective of this project is to evaluate existing wetland resources and determine type, quantity, water requirements and current ecological condition. This data will be used in conjunction with ground and surface water models to establish water requirements for maintenance of wetlands.
2. **DISTRICT NEED AND USE:** This project is needed to provide information used in preparation of the Water Use Management Plan (WUMP) for the District. A requirement of this plan includes an assessment of wetland resources and water demands needed to maintain these natural systems. Development of new well fields or other water resource management scenarios must consider the potential impacts of drawdown on surrounding wetlands and their water use requirements. A detailed wetland map and other quality/quantity data are also needed by RCD to identify important wetlands and facilitate the permitting process.
3. **SCOPE:** Map data and other important habitat or hydrologic data pertaining to wetlands will be compiled from District and other agency sources. This information may be supplemented with remotely sensed satellite or photographic data to produce wetland classification maps using representative spectral signatures. Wetlands will be classified to the lowest possible level that best describes the ecological value of a particular wetland. Classified wetlands will be ground truthed to verify accuracy and interpretation. Water requirements for specific community types will be evaluated using available hydrologic data and based on a literature survey.
4. **TASK SCHEDULE:** Tasks to be completed in FY88/89:
 - a. Recruit one professional, (1st Q FY88/89)
 - b. Recruit one technician, (3rd Q)
 - c. Complete RFP for Remote Sensing data collection (3rd Q FY88/89)
 - d. Contract for digitization of National Wetlands Inventory maps (3rd Q FY88/89)
 - e. Begin ground inventory of wetlands (3rd - 4th Q FY88/89)

Tasks to be completed in FY89/90:

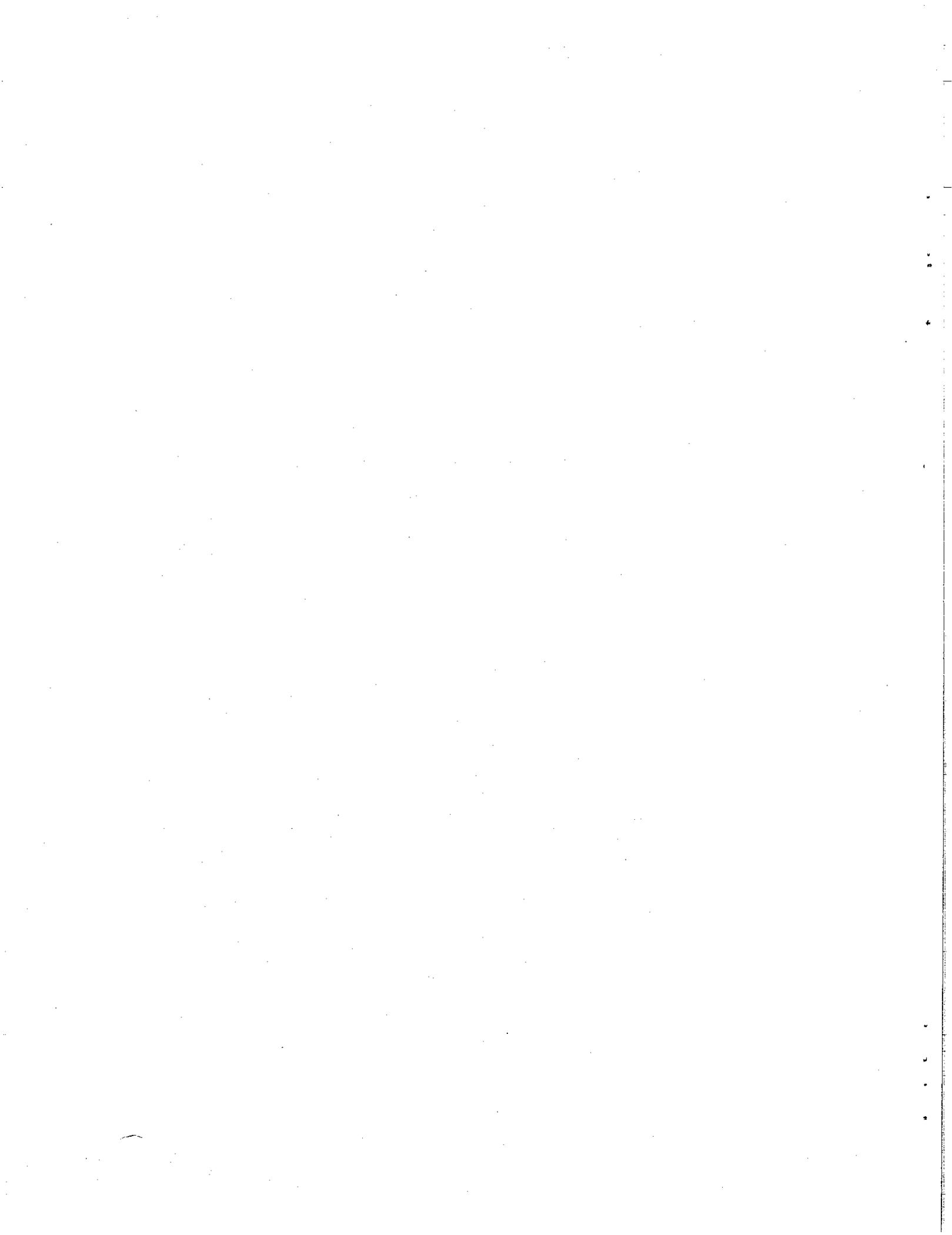
 1. Combine/classify ground truth data with Remote Sensing data (1st Q FY89/90)
 2. Complete literature review of water requirements (2nd Q FY88/89)
 3. Complete composite maps for wetland types and water needs for West Central, Lower West Coast and Upper East Coast (4th Q FY89-90)
5. **PROGRESS TO DATE:** This is a new project.
6. **PRODUCTS:** Major products will include a spatial database of wetland classifications including type, acreage, and other descriptive geographic data. A variety of digital and photographic data will also be acquired for District use together with a database of local wetland water requirements.

SWIM MANAGEMENT PLANS--IDENTIFICATION OF OTHER PRIORITY WATER BODIES

●District Contact: Joel A. VanArman

1. **OBJECTIVE:** The primary objective of this project is to prepare an annual update of the report entitled, "Identification of Priority Water Bodies within the South Florida Water Management District." Efforts within this project will be directed toward the development of appropriate methods for classification and prioritization of lakes, estuaries, and wetlands. Following this, a prioritized listing of water bodies for the development of management plans will be determined.
2. **DISTRICT NEED AND USE:** This project is required to meet the intentions of the Surface Water Improvement and Management (SWIM) legislation and to identify SWIM priority planning areas in cooperation with other agencies and local governments.
3. **SCOPE:** In the past year a method was developed for ranking lakes, wetlands, and estuaries, based on statistical procedures and a scoring process. However, this method had a number of limitations due to the subjective nature of the scoring and the limited number of water bodies on the list. The District will attempt to improve upon the present method this year, based on a consensus among agency staff, concerned citizens and technical experts. Priorities shall be assigned based on consideration of factors as defined in Ch 17-43 F.A.C.
4. **SCHEDULE:** This is the second year of a continuing project. The report will be evaluated and updated in FY 89-90.
5. **PROGRESS TO DATE:** This is a continuing project, building on previous work and reports by the District and research and assistance provided by other agencies, local governments and consultants. The first year's research and final report were adopted by the Governing Board in February 1988 and were sent to the FDER by March 1, 1988.
6. **PRODUCTS:**
 - a. 2nd Quarter FY 88-89:
 1. A final report will be presented to the Governing Board and sent to the FDER.

LAKE OKEECHOBEE



PHOSPHORUS DYNAMICS AND CIRCULATION STUDY

●District Contact: Bradley L. Jones

CONTRACT REFERENCE: Lake Okeechobee Phosphorus Dynamics Study

1. **OBJECTIVE:** The objective of this project is to determine the ability of the lake to assimilate phosphorus, the role of lake stage and sediment interactions in internal phosphorus loading, and the response time of the lake to reductions in external phosphorus loading. This will be done through detailed field and laboratory investigations of phosphorus cycling in the lake and complex modeling efforts including hydrodynamic modeling.
2. **DISTRICT NEED AND USE:** This research project was recommended by the Lake Okeechobee Technical Advisory Committee I. It will be used to determine the degree of improvement in lake water quality that can be expected after phosphorus loading reductions are made and to estimate how long it will take to achieve these improvements. It will also be used to estimate how much time is available to implement the needed load reductions before the lake can no longer assimilate phosphorus and becomes hypereutrophic.
3. **SCOPE:** The scope of work includes the following work elements:
 - a. Characterize and map sediment types in the lake.
 - b. Determine the capacity of different types of sediments to assimilate phosphorus.
 - c. Compare recent and geologic phosphorus sedimentation rates.
 - d. Assess the influence of major inflows on phosphorus assimilation rates in the sediments.
 - e. Quantify the internal loading process, including the role of lake stage.
 - f. Develop a model to predict the effect of external phosphorus loading reductions on in-lake concentrations.
 - g. The total duration of the project is over three fiscal years.
4. **SCHEDULE:** Quarterly progress reports are due December 1, March 1, June 1, and September 1 of each fiscal year.
 - a. 3rd Quarter FY 87-88:
 1. Evaluate sediment mapping methodologies.
 - b. 3rd Quarter FY 88-89:
 1. Complete sediment mapping and physical characterization.
 - c. 2nd Quarter FY 89-90:
 1. Determine the capacity of different types of Lake Okeechobee sediments to assimilate phosphorus from the water.

2. Determine phosphorus accumulation rates in the sediments and compare them to accumulation rates in the geologic past.
 3. Quantitatively determine the annual phosphorus loading to the lake from sediments, including the influence of sediment type and lake stage on phosphorus cycling.
 4. Assess the role of aquatic macrophytes as a source or sink in phosphorus exchanges between the littoral and open water zones in Lake Okeechobee.
- d. 3rd Quarter FY 89-90:
1. Evaluate the influence of major lake inflows on phosphorus assimilation and accumulation rates in the sediments.
 2. Quantitatively determine the impact of external phosphorus loading reductions on ambient lake phosphorus concentrations.
 3. Complete final report for the project, integrating all tasks listed above.
- e. 4th Quarter FY 89-90:
1. Provide documentation and training to SFWMD personnel for all models developed as part of this research.
5. PROGRESS TO DATE: The contract was executed on February 12, 1988 and work commenced on March 1. During the second and third quarters, equipment was procured, initial reconnaissance and sampling was completed, and decisions were made on the methodologies to be used in the sediment mapping and physical characterization study (item (a1) above). A progress report was submitted in June 1988. During the fourth quarter, the sediment mapping (b1) was initiated, sediment sampling for chemical analysis (c1) was completed, and the first field survey for items (c3) and (c4) were begun. The principal investigators presented the results to date to District staff in August and a second progress report was due to be submitted in September.
6. PRODUCTS:
- a. 3rd Quarter FY 88-89:
 1. Sediment characterization and distribution maps.
 - b. 3rd Quarter FY 89-90:
 1. Final Report.
 2. Maps of the assimilative capacity of the lake sediments.
 - c. 4th Quarter FY 89-90:
 1. Predictive model for in-lake phosphorus concentrations based upon external and internal loadings.

LAKE ECOSYSTEM STUDY

●District Contact: Michael J. Maceina

CONTRACT REFERENCES: Lake Okeechobee Ecosystem

1. **OBJECTIVE:** The objective of this project is to determine the specific ecological relationships between the littoral and pelagic (open-water) zones of Lake Okeechobee. In addition, this study will delineate the impacts of nutrient loading and lake stage management on the biological resources of the lake.
2. **DISTRICT NEED AND USE:** Completion of this project will permit the District to describe the ecological status of the lower trophic, fish, and wildlife resources in Lake Okeechobee. Monitoring of various biota components will provide a benchmark to assess nutrient loads and/or lake stage impacts on these resources. This information will assist the District in proposing management strategies to maintain or improve the ecological integrity of the lake. Many aspects of this study were recommended by LOTAC I and LOTAC II.
3. **SCOPE:** This is a five year multi-disciplinary field research project now in its second year (FY 89) being completed under contract by the University of Florida (UF) and the U. S. Fish and Wildlife (F&W) Cooperative Research Unit in cooperation with the Florida Game and Freshwater Fish Commission (GFC). A Memorandum of Understanding was signed between the GFC and the District which stipulates the GFC will collect macroinvertebrate and fishery data to augment this contract and current District research efforts on the lake. Scientists from the UF will be collecting weather, water chemistry, aquatic macrophyte, phytoplankton, periphyton, zooplankton, wading bird larval and juvenile fish data.

Specific tasks for this project to be completed during FY 88-89 include:

- a. Compile and catalog existing scientific literature pertinent to this research project.
- b. Complete a habitat inventory map of Lake Okeechobee.

Specific tasks for this project to be partially completed during FY 88-89 include:

- a. Determine population structure and biomass at various trophic levels (i.e. aquatic macrophytes, phytoplankton, periphyton, zooplankton, macro-invertebrates, fish, and wading birds).
- b. Determine the nutrient content of certain aquatic macrophytes and their role in nutrient recycling in the lake.
- c. Examine the historical relationship between lake stage level and nutrient inputs to the lake and the emergent macrophyte community.
- d. Determine the mechanisms accounting for episodic algae blooms on the lake, and examine the impact and toxicity of these blooms.
- e. Determine zooplankton population dynamics.
- e. Develop a model of trophic interactions, analyze data, and write annual report.

4. SCHEDULE:

- a. Complete scientific literature review completed - 1st Q FY 88-89
- b. Complete habitat inventory - 1st Q FY 88-89 to 4th Q FY 91-92
- c. Monitor algal blooms events - 1st Q FY 88-89 to 3 Q FY 91-92 or until causative factors are delineated
- d. Complete evaluation of factors regulating the abundance of larval and juvenile fish - 4th Q FY 89-90 to 3rd Q FY 91-92
- e. Complete trophic community analysis - 4th Q FY 88-89 to 4th Q FY 92-93
- f. Develop models, analyze data, and write final report - 1st Q 92-93 to 4th Q 92-93.

5. PROGRESS TO DATE:

- a. completion of the scope of work (1st year) by the program manager - 2nd Q FY 87-88
- b. contract implementation - 3rd Q FY 87-88
- c. complete a Memorandum of Understanding (MOU) between the District and the GFC - 3rd Q FY 87-88
- d. Sampling locations were selected and field studies began in the 3rd Q FY 87-88.
- e. Quarterly reports were received in August and November 1988, and in February 1989.

6. PRODUCTS (FY 88-89)

a. Information collected from this study will provide an extensive computer data base on the ecological relationships among trophic components in Lake Okeechobee. This data base will be provided to the District.

b. Quarterly, semi-annual, and annual reports will be submitted during this FY. Reports to be submitted to the District during FY 88-89 include:

Semi-annual report with a computerized bibliographic data base and current GIS information provided: 1st Q FY 88-89

Third quarterly report: 3rd Q FY 88-89

Annual Report (first-year): 4th Q FY 88-89

First quarterly report (second-year): 4th Q FY 88-89

For future FY's, reports will be received on the same annual cycle. A Final Five-Year Report is due on July 1, 1993.

SURFACE WATER USE PLAN FOR THE LAKE OKEECHOBEE SERVICE AREA

●District Contact: Shawn Sculley

1. **OBJECTIVE:** This project is part of the District's larger initiative to develop water use management plans for all basins in the District. This project deals specifically with surface water availability in the The Lake Okeechobee service area. Hydrologic basins to be studied within this service area include the St. Lucie Canal, EAA, East and West Caloosahatchee River, S-4 basin, and Lake Okeechobee perimeter basins. It has two objectives: (a) To estimate the surface water available in the Lake Okeechobee service area under a variety of rainfall conditions. These estimates will be used to improve the basis of review for water use permitting. (b) To evaluate various alternatives for augmenting water supply to the Lake Okeechobee service area.
2. **DISTRICT NEED AND USE:** The District needs this project to develop improved permitting and allocation criteria. The results of this project will directly benefit the residents, growers, and industries of the The Lake Okeechobee service area by providing a basis for an equitable distribution of limited surface water resources, and by identifying the best alternatives for augmenting surface water supply to the basins within this service area.
3. **SCOPE:**
 - a. Assess available hydrologic data.
 - b. Develop a methodology to determine surface water availability in the basins.
 - c. Estimate and analyze the surface water available for various rainfall conditions under current management practice: (1) Estimate the surface water availability in the basins in the years of normal, 1-in-5 below normal rainfall, and other drought conditions. (2) Quantify water shortages and their frequency. (3) Develop criteria for defining water shortage conditions.
 - d. Evaluate various water augmentation alternatives. Alternatives may include: (1) A change in management of the system. (2) An increase in canal conveyance. (3) Storage reservoirs within the basins.
 - e. Document the results of the estimations and evaluations detailed above.
4. **SCHEDULE:** This project began last fiscal year and is scheduled to be completed in October 1989. This schedule is consistent with the District's objectives of having a draft basis of review by January 1990 and rule making by July 1990.
 - a. Establish methodology for determining surface water availability in the basins - 3rd Qtr 87-88
 - b. Complete estimation of the surface water available for various rainfall conditions in EAA Basins - 1st Qtr 88-89
 - c. Evaluation of water supply augmentation alternatives - 3rd Qtr 88-89
 - d. Criteria for defining water shortage conditions in the basins - 4th Qtr 88-89
5. **PROGRESS TO DATE:** Available hydrologic data have been assessed. Hydrologic models (Creams-WT and Seasonal Water Balance Model) for determining surface water availability in the basins and water budget methods are being investigated and implemented. Requests for information about land and water use in the basins have been submitted.

6. **PRODUCTS:** Documentation of the following: (a) Estimates and analysis of the surface water available in the Lake Okeechobee service area for various rainfall conditions. (b) Evaluations of various water augmentation alternatives.

LAKE OKEECHOBEE MONITORING AND HYDROLOGIC DATA COLLECTION

●District Contact: David M. Soballe and Ron Mierau

1. **OBJECTIVE:** The objectives of this project are to collect hydrologic and meteorologic data in support of the following objectives:
 - a. To understand the effects of material inputs, hydroperiod, and weather in Lake Okeechobee on the water quality and trophic state of the lake.
 - b. To maintain a long-term limnetic and littoral zone monitoring program to detect changes in the water quality and lake trophic state.
 - c. To monitor the development of algal blooms and potential algal toxicity on Lake Okeechobee.
2. **DISTRICT NEED AND USE:** This project is needed to:
 - a. Fulfill specific conditions of the DER operating permit (No. 50-0679349), which requires the preparation of an annual report summarizing water quality of the lake and its tributaries and nutrient loadings from major inflows.
 - b. Provide the data base required to provide District managers information needed to make necessary decisions on restoration or corrective actions related to eutrophication of Lake Okeechobee.
3. **SCOPE:** This is a long-term research and monitoring project that provides data to address specific cause-effect relationships among material fluxes, meteorological forcing, water quality, and trophic response. Hydrologic parameters measured are stage, wind speed and direction, solar radiation, photosynthetically active radiation (P.A.R.), relative humidity, air and water temperature, rainfall, flow, and structure operations.

Hydrologic and meteorologic data are being collected and processed to support this program. Complete descriptions of the scope and budget of these hydrologic data support efforts are contained in the documentation for the project "Central Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects".

4. **TASK SCHEDULE:**
 - a. A technical publication summarizing 15 years of data collection will be completed in the 1st quarter of FY 89-90. In-lake littoral zone and limnetic zone monitoring and sampling of the lake's inflows and outflows will be conducted every two weeks.
 - c. Algal toxicity monitoring. During bloom conditions, algal samples are evaluated weekly for toxicity (mouse bioassay).
 - d. Primary Productivity-Phytoplankton dynamics studies. Pilot studies commencing 4th quarter FY 88-89. Aspects of this task will eventually be merged into littoral and limnetic zone monitoring.

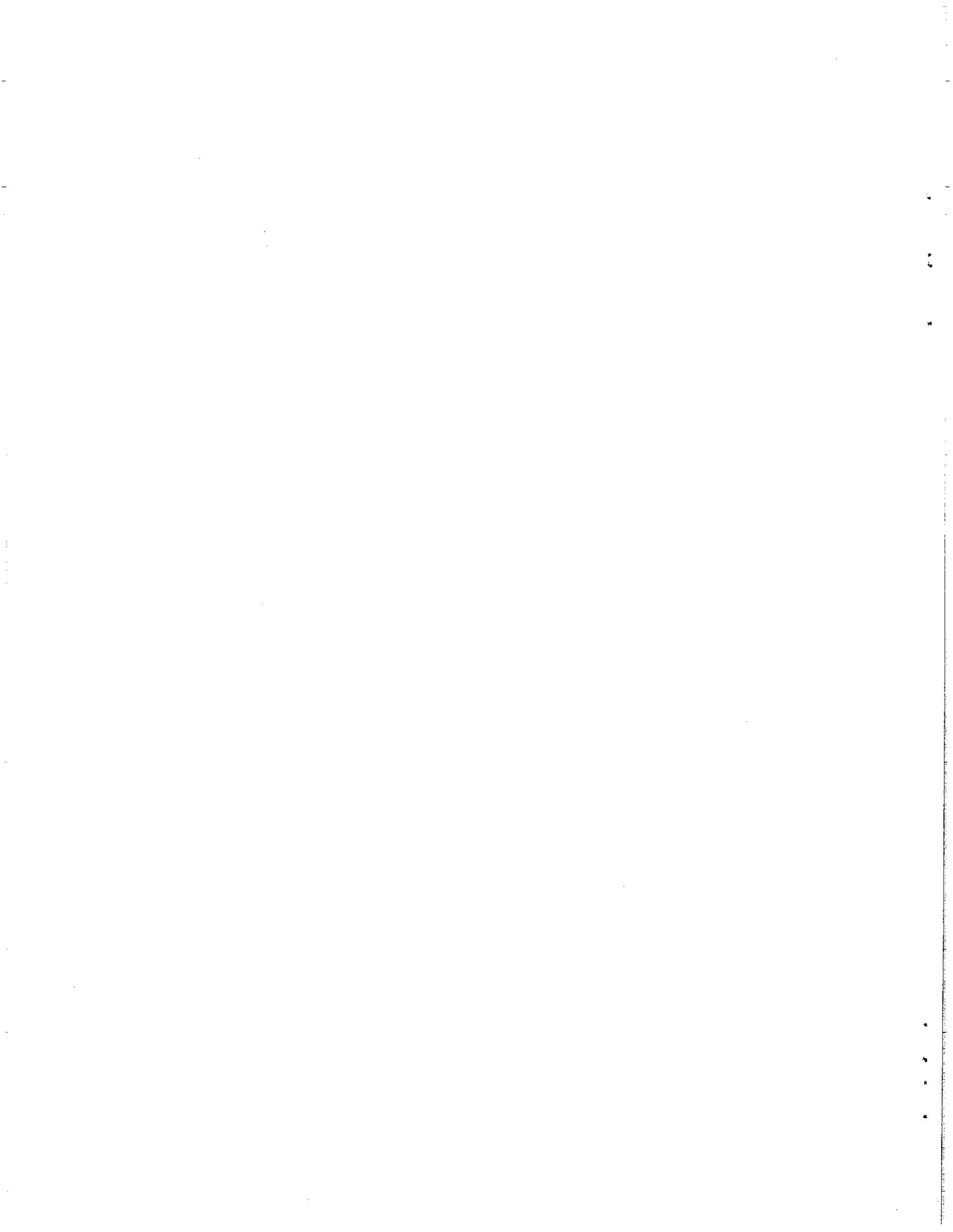
- e. Hydrologic Data Processing conducted by Data Management Division.
5. **PROGRESS TO DATE:** Data collection and processing are ongoing. Major equipment (liquid scintillation counter, field fluorometer, data loggers, LORAN receiver, light meters) for phytoplankton primary productivity studies have been purchased and placed into operation, and a radioactive materials license has been obtained. Preliminary field work has commenced, with complete pilot studies scheduled for the 4th quarter of FY 88-89. Three in-lake weather and stage monitoring stations have been established and are being maintained.
6. **PRODUCTS:**
- a. Monthly updates for the Governing Board on water quality and nutrient loadings to Lake Okeechobee.
 - b. Hydrologic data available on data base system. Telemetry data within one week, other Data Management recorders within two weeks from collection, USGS data within two months of collection.
 - c. Legal documentation of project structure operations.
 - d. 1st Quarter FY 89-90:
 - 1. Lake Okeechobee Water Quality and Eutrophication report for the period 1973-1987.
 - e. 3rd Quarter FY 88-89:
 - 2. Lake Okeechobee Water Quality Monitoring Project - annual report, year five, October 1987-September 1988.

WATER QUALITY EVALUATION OF HERBICIDE SPRAY PROGRAM

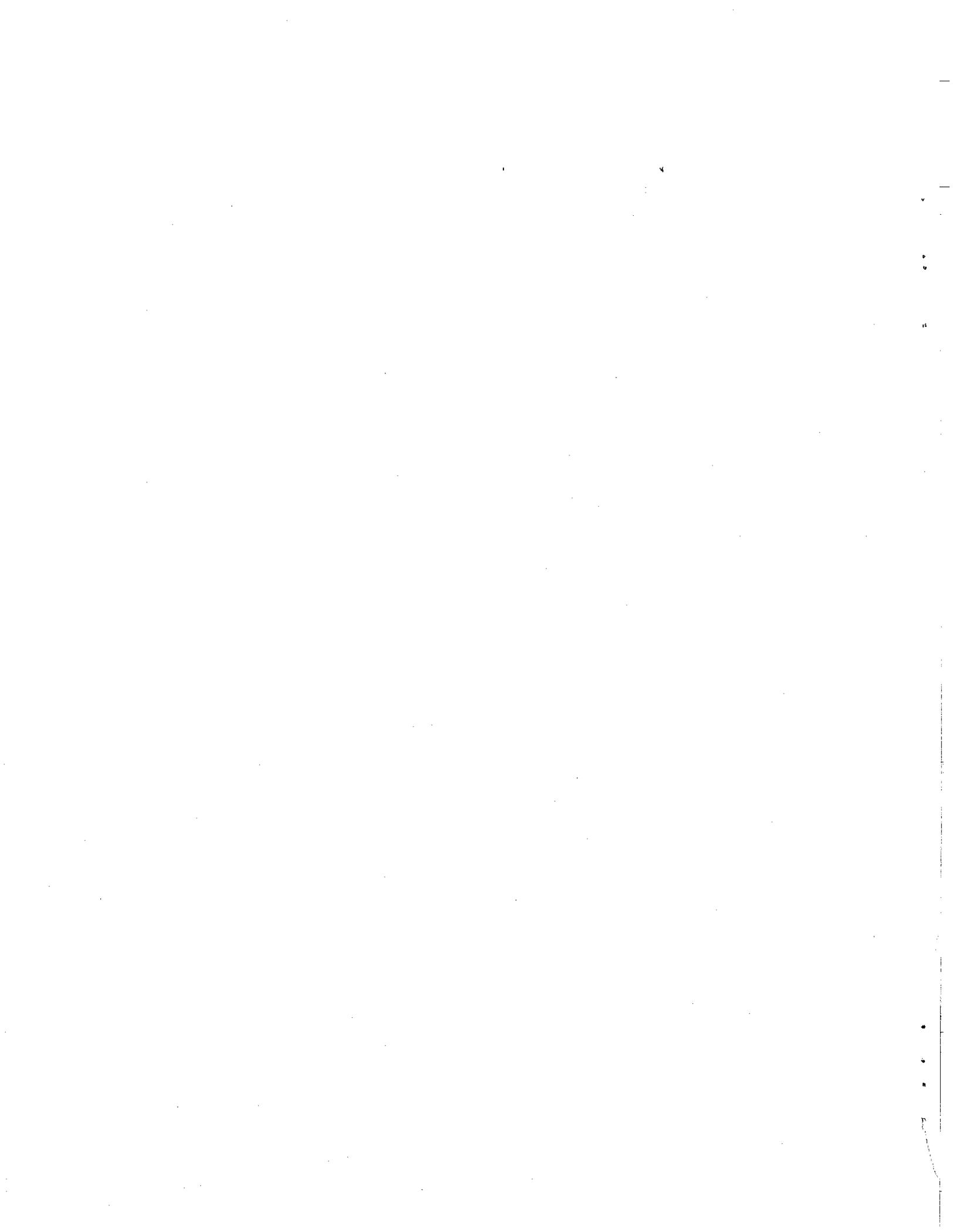
●District Contact: Richard J. Pfeuffer

1. **OBJECTIVE:** The objective of this project is to determine the concentration and persistence of herbicides applied by the District as part of its aquatic weed management program within and surrounding the areas of application in the water and sediments. An evaluation will be made of the potential water quality and environmental impacts from using the targeted herbicide. This will allow District managers to assess potential environmental impacts caused through aquatic weed control projects.
2. **DISTRICT NEED AND USE:** The District utilizes significant quantities of herbicides, most of which have not been studied in the south Florida environment. This program will evaluate any dissipation anomalies specific for this area. Dissipation anomalies can include degradation products, chemical movement or potential water quality changes for example. The results of these studies will be utilized to determine any impacts of the spray project.
3. **SCOPE:** This project is mostly concerned with research on District utilized herbicides applied in Lake Okeechobee, although some studies have been expanded to other lakes or areas. As topics of research are identified, an appropriate monitoring project is developed to answer the questions or areas of concern. This project requires coordination with Resource Operations and the appropriate field station personnel. Studies will continue at the request of the Resource Operations Department, or if new herbicides are utilized.
4. **SCHEDULE:** Major tasks and schedules are as follows:
 - a. 4th Quarter FY 88-89:
 1. Complete Technical Publication Herbicide Monitoring Program for Fluridone and N-Methylformamide.
 2. Develop monitoring program(s) for FY 89-90.
 - b. 2nd Quarter FY 89-90:
 1. Complete Technical Publication Herbicide Monitoring Program for 2,4-D and 2,4-dichlorophenol.
5. **PROGRESS TO DATE:** This project is in its third year. Technical Publication 88-1, Herbicide Monitoring Program for the Active Ingredient Glyphosate received Governing Board approval in February (2nd Quarter FY 87-88). Technical Publication 88-8, Herbicide Monitoring Program for the Active Ingredient Fluridone [Sonar(R)] received Governing Board approval in July (4th Quarter FY 87-88). Field work for the fluridone/NMF and 2,4-D monitoring has been completed (4th Quarter FY 87-88).
6. **PRODUCTS:**
 - a. 4th Quarter FY 88-89:
 1. Technical Publication Herbicide Monitoring Program for Fluridone and N-Methylformamide.

- b. 2nd Quarter FY 89-90:
 - 1. Technical Publication Herbicide Monitoring Program for 2,4-D and 2,4-dichlorophenol.



LAKE OKEECHOBEE TRIBUTARY BASIN



L-8 BACKPUMPING DATA ACQUISITION

●District Contact: Larry V. Grosser

1. **OBJECTIVE:** The objective of this project is to collect water quality data when the L-8 canal is being used to convey large amounts of water southward due to pumpage or gravity flow from the surrounding lands in the L-8 basin.
2. **DISTRICT NEED AND USE:** This water quality evaluation is needed to help determine the environmental impact of placing a proposed pumping station at the western end of the L-8 drainage basin that would be designed to backpump stormwater runoff into Lake Okeechobee.
3. **SCOPE:** There are 11 water quality sampling stations located along the L-8 canal from State Road 80 northwest to Lake Okeechobee. Sampling stations are located at major tributary inflows chosen to best represent the various land uses. Each station is sampled following significant rainfall events when culvert 10A is closed and S-5AS is not discharging into L-8. This allows for the collection of samples representative of the runoff from adjacent lands. The stations near Lake Okeechobee represent pumpage from sugar cane fields. Areas to the north of the canal are pine, cypress domes, and wet prairie, with some intensified agricultural use, such as formerly occurred on the White Belt property. Areas to the south are a mixture of sugar cane and grazing. This project generates 816 laboratory analyses annually.
4. **SCHEDULE:**
 - a. Sampling began in June 1983 and continued for one year.
 - b. Project was re-initiated at the request of the U.S. Army Corps of Engineers in March 1986 and continues to date.
 - c. Sampling is performed on an irregular schedule following major rain events several times a year.
5. **PROGRESS TO DATE:** There were two water quality sampling events on this project during fiscal year 87-88.
6. **PRODUCTS:**
 - a. 4th Quarter FY 88-89:
 1. Technical Memorandum L-8 Water Quality Monitoring.

AQUIFER STORAGE AND RECOVERY (ASR) DEMONSTRATION PROJECT

●District Contact: Sharon Trost

1. **OBJECTIVE:** The objective of this project is to construct a well and ancillary facilities and perform testing to determine the effectiveness of ASR as a means of controlling and reducing nutrient inflow to Lake Okeechobee.
2. **DISTRICT NEED AND USE:** This project is needed to determine if nutrient inflows to the Lake may be reduced if a portion of storm runoff from Taylor Creek and Nubbin Slough basins could be diverted to aquifer storage, then later recovered and released to the Lake with a possible improvement in water quality. Studies have determined that a significant amount of the nutrient loading in Lake Okeechobee originates in these basins.
3. **SCOPE:** To accomplish the project, it will be necessary to design, construct and test the well and facilities, obtain permits or exemptions required for the facility, then perform both short and long duration injection and recovery cycle tests. Upon completion of these tests, the feasibility of the technology can then be evaluated.

This project is being implemented through three major contracts which total over \$1.5 million dollars. There are two construction contracts for the wells and surface facilities and one contract for professional engineering services.

4. **SCHEDULE:**
FY 86-87: Develop scope of work and execute engineering services contract and apply for various permits.

FY 87-88: Develop scope of work and execute construction contracts for wells and surface facilities construction; monitor and administer the three contracts associated with the project. Prepare special presentations for Governing Board and LOTAC councils.

FY 88-89:

Quarter 2: Complete construction, under contract, of the surface injection and chlorination facilities.

Quarter 2: Obtain an aquifer exemption from FDER/USEPA for an unchlorinated injection/recovery cycle test.

Quarter 3, 4: Conduct short and long duration injection/recovery cycle tests.

Quarter 4: Complete draft report on well testing and ASR feasibility for surface water quality enhancement.

FY 89-90: Present results to SFWMD Governing Board.

5. **PROGRESS TO DATE:** Thus far, the determination of background surface water quality was made; chlorination jar tests were conducted; the wells and surface facilities were designed and construction contracts let; permit applications were

made to FDER; the wells were constructed and pump tests were run; and construction of the surface facilities began.

6. PRODUCTS: The final products are the completed ASR well and facilities; a report on the testing of the well in determining the feasibility of ASR as a means of reducing nutrient inflow to Lake Okeechobee; and the results of studies which simulate the ASR process via a computer model, and studies which analyze the costs of the ASR technology which will follow the evaluation report on this facility.

DEMONSTRATION AND EVALUATION OF BIOLOGICAL TREATMENT TECHNOLOGIES FOR PHOSPHORUS CONTROL ON DAIRIES

●District Contact: Kim M. O'Dell and Alan L. Goldstein

CONTRACT REFERENCES: On-Farm Demonstration of Water Hyacinths for Nutrient Removal from Dairy Wastewater

Optimization of the Vegetative Uptake of Phosphorus from Dairy Wastewater

1. **OBJECTIVE:** The objective of this project is to demonstrate and evaluate the potential of biological treatment Best Management Practices (BMPs) as practical, reliable, and cost-effective methods of reducing nutrients from milking barn and intensive use area runoff at dairies. The first phase of the project will demonstrate the technological feasibility and cost-effectiveness of nutrient removal from dairy wastewater using water hyacinths. The second phase will compare and evaluate the effectiveness of utilizing emergent, submersed and floating macrophytes, as well as terrestrial grasses for nutrient uptake.
2. **DISTRICT NEED AND USE:** The District is providing research and demonstration support to identify BMPs which can limit the load of nutrients (phosphorus) reaching Lake Okeechobee. The reductions in nutrient loads to Lake Okeechobee are required under the operating permit the District has received from DER. BMPs are being, or have been, implemented on dairy farms in areas tributary to Lake Okeechobee under cooperative or regulatory programs. However, it is not clear if these measures will achieve the needed reduction in nutrient loads. The results will be used to determine if biological treatment is a viable method of further reducing nutrient loadings. The District has followed a recommendation of the Lake Okeechobee Technical Advisory Committee by evaluating biological treatment as one possible advanced nutrient reduction alternative to determine its technological feasibility and cost-effectiveness. Should this prove to be an effective nutrient removal process, the District might accept utilization of this technology in issuing or administering future agricultural surface water management permits.
3. **SCOPE:** This project is being conducted through contractual agreements; two contracts are underway. The project duration is 2 1/2 years starting with Fiscal Year 87-88 and ending by the second quarter of Fiscal Year 89-90. The major resource commitment is the contract funding and management. The specific work to be completed under each contract is as follows:
 - a. **Phase I:** The effectiveness of water hyacinths as a biological treatment technology is being investigated in a pilot scale demonstration that utilizes runoff from an existing dairy waste storage pond. The District has committed \$497,000 for contractual services for this study.
 - b. **Phase II:** A comparison and evaluation of the performance of a variety of vegetative treatment systems including aquatic (floating, submersed and emergent macrophytes) and terrestrial vegetation will be completed. Investigations are being conducted on a small experimental scale in the field utilizing combined dairy barn washwater and intensive management area runoff from a participating dairy. The District has committed \$250,000 for contractual services for this study.

4. SCHEDULE:

a. Phase I:

1. 2nd Quarter FY 87-88:
 - a. Complete contract procurement and begin work.
2. 1st Quarter FY 88-89:
 - a. Complete installation of treatment system and begin testing.
3. 3rd Quarter FY 89-90:
 - a. Complete contract and final report.

b. Phase II:

1. 2nd Quarter FY 87-88:
 - a. Complete contract procurement and begin work.
2. 1st Quarter FY 88-89:
 - a. Complete small tank tests and select plants for more detailed evaluation.
3. 2nd Quarter FY 88-89:
 - a. Begin experiments in larger scale tanks.
4. 1st Quarter FY 89-90:
 - a. Complete contract and final report.

5. PROGRESS TO DATE:

- a. Phase I: Contract signed February 23, 1988. Preliminary Engineering Plan and Design specs completed. Construction of site facilities scheduled to start in October 1988. Demonstration project commenced January 1, 1989.
- b. Phase II: Contract signed March 8, 1988. Large scale studies have begun on the most favorable plants. Contractor has submitted bimonthly status reports and a literature review.

6. PRODUCTS: Completion reports will be produced for each of the contracts.

a. 4th Quarter FY 87-88:

1. Bench scale study results that identify vegetative species and conditions that provide maximum uptake of nutrients.

b. 1st Quarter FY 88-89:

1. Operational turn-key pilot scale demonstration plant for nutrient removal with water hyacinth.

c. 1st Quarter FY 89-90:

1. The report on Phase II will summarize the methods and results of the experiments on the selected macrophytes and grasses. It will also make recommendations as to the optimal species combinations and the chemical and physical parameter combinations which would result in maximum nutrient removal utilizing vegetative uptake.

d. 3rd Quarter FY 89-90:

1. The report on Phase I will provide descriptive information on the quality of water treated, the start-up, operation and maintenance procedures and costs; and the nutrient removal performance of water hyacinths. It will also include evaluations and recommendations regarding the technical and economic feasibility of full-scale implementation.

Details on these final products as well as intermediate products such as the construction of each treatment facility and the completion of interim progress reports are specified in the contracts.

CHEMICAL TREATMENT DEMONSTRATION TECHNOLOGY

●District Contact: Kim M. O'Dell

**CONTRACT REFERENCES: Chemical Treatment Technology Demonstration for
Phosphorus Removal from Dairy Wastewater and
Stormwater Lagoons**

1. **OBJECTIVE:** The objective of the demonstration project at Dry Lake Dairy #2 is to determine the feasibility of chemical treatment as an alternative method of phosphorus removal for effluent leaving commercial dairy operations. Eliminating excess nutrients in runoff from dairy operations in the Lake Okeechobee basin is necessary in order to meet basin load allocations. The demonstration project is the outgrowth of a Lake Okeechobee Technical Advisory Committee recommendation.
2. **DISTRICT NEED AND USE:** The District is providing research and demonstration support to identify Best Management Practices (BMPs) which can limit the load of nutrients (phosphorus) reaching Lake Okeechobee in order to prevent its further eutrophication. BMPs are being, or have been, implemented on all dairy farms in areas tributary to Lake Okeechobee under cooperative or regulatory programs. Chemical treatment may be an option should the BMP program fail to attain necessary load reduction. The results of this project will be used by the District to determine if chemical treatment is a reliable, cost-effective, additional method of reducing phosphorus loads in the basin. Should this prove to be an effective process, the District might accept utilization of this technology in issuing or administering surface water management permits for agricultural systems.
3. **SCOPE:** The project has been organized into four phases that include a basic engineering report on the project feasibility, efficiency, and cost effectiveness, to actual construction and operation of a demonstration pilot plant on an existing 500 acre, 700 head dairy operation. This contract will span three fiscal years, beginning Fiscal Year 86-87. The demonstration facility has been designed to treat an average daily flow of 50,000 gallons per day. The objective is to reduce total phosphorus concentrations in the combined dairy wastewater and stormwater effluent to 0.1 mg/L, as cited in the Lake Okeechobee Technical Advisory Committee recommendations.

The District has secured the consulting firm of Briley, Wild and Associates, Inc. (BWA) of Ormond Beach, Florida, through a competitive RFP process, to provide the engineering services and construction supervision of the demonstration plant. A subsidiary of BWA, Professional Plant Operations (PPO), is operating and maintaining the treatment facility for one year.

The treatment facility currently operates as a no discharge, total reuse system whereby all treated effluent is stored on-site for reuse in dairy operations as for irrigation on adjacent pastures.

4. **SCHEDULE:**
 - a. 4th Quarter FY 86-87:
 1. Treatment evaluation and facility design. BWA recommended in their Phase I report to the District the chemical process which they believed

would achieve the desired goal of an effluent total phosphorus concentration of 0.1 mg/L. Through jar testing influent dairy waste samples, it was determined that the combination of treating the influent with lime and a synthetic polymer would effectively achieve the desired results with a minimum of handling, ease of operation, and with the possibility of reusing all or part of the generated sludge solids on-site as soil conditions or phosphorus fertilizers.

- b. 2nd Quarter FY 87-88:
 - 1. Construction of Treatment Plant Completed and operation commences.
 - c. 2nd Quarter FY 88-89:
 - 1. Cessation of plant operations and decommissioning.
 - d. 3rd Quarter FY 88-89:
 - 1. Final report due.
5. PROGRESS TO DATE: The facility was in operation through January 1989. The desired average effluent concentration of 0.1 mg/L was achieved on a consistent basis since June 1, 1988, which equates to a greater than 99 percent removal efficiency for the plant process. Phase I report, which included the treatment facility process and design recommendations, was completed 4th Quarter FY 86-87.
6. PRODUCTS:
- a. 2nd Quarter FY 87-88:
 - 1. Operational turnkey chemical treatment facility on an existing dairy.
 - b. 2nd Quarter FY 87-88 through 2nd Quarter FY 88-89:
 - 1. Operation and maintenance of the chemical treatment facility for one year with monthly operating reports.
 - c. 3rd Quarter FY 88-89:
 - 1. Final report summarizing pilot scale and full scale operational feasibility and efficiency. Plant decommission and site restoration as required.

CONFINEMENT DAIRY DEMONSTRATION

●District Contact: Alan L. Goldstein

CONTRACT REFERENCES: Confinement Dairy Demonstration Study

1. **OBJECTIVE:** The purpose of the Confinement Dairy Demonstration project is to determine the feasibility of permanent confinement of dairy cattle for the purposes of eliminating stormwater runoff from intensive holding areas and controlling waste management problems by catching all waste products and reducing liquid volume that must be handled.
2. **DISTRICT NEED AND USE:** The District is providing research and demonstration support to identify Best Management Practices (BMPs) which can limit the load of nutrients (phosphorus) reaching Lake Okeechobee. The results of this program will be used by the District and the Department of Environmental Regulation (DER) to determine if reductions in nutrient runoff can be achieved by dairy operations in the basins tributary to Lake Okeechobee by confining dairy cattle, thus eliminating the presently occurring non-point source phosphorus contributions from lounging pastures adjacent to milking barns. Reductions in nutrient loads to Lake Okeechobee are required by the operating permit the District has received from DER. BMPs are being, or have been, implemented on all dairy farms in areas tributary to Lake Okeechobee under cooperative or regulatory programs. However, it is not clear that these measures will achieve the needed reduction in nutrient loads. The District has been guided by the recommendations of the LOTAC committee to continue to evaluate a variety of BMPs for effectiveness to reduce pollutant loads and for economic feasibility. Should this prove to be an effective nutrient control process, the District might consider use of this technology in issuing or administering surface water management permits for dairies.
3. **SCOPE:** A contract has been negotiated and signed with Davie Dairy, Inc. of Okeechobee, Florida, to cost-share on a 50 percent basis the construction of a confinement facility for housing approximately 900 milking cows. In addition, the District is providing 100 percent of the support for the engineering design for the waste management system. This is consistent with the District's present program to contract for private engineering services to assist the dairy industry to meet the deadlines mandated by the DER's Dairy Rule. The dairy owner/contractor is responsible for providing the remainder of the funds for construction of the housing facility. The state of Florida will cost-share with the landowner for the waste management system in a manner consistent with that allowed for all dairies in the Lake Okeechobee basin subject to compliance with the Dairy Rule. The contracted owner will supply all livestock and will operate and maintain the facility for a period of at least three years. All information on livestock health and milk production during that time will be made available to the District as well as other members of the dairy production community. This project began with advertisement of a RFP for cooperating dairymen during 2nd quarter FY 87-88. This project will end March 1991.

4. SCHEDULE:

- a. 1st Quarter FY 88-89:
 - 1. Begin construction.
- b. 2nd Quarter FY 88-89:
 - 1. First housing unit complete.
 - 2. Begin construction on second housing unit.
- c. 3rd Quarter FY 88-89:
 - 1. Complete second housing unit.
- d. Through 3rd Quarter 1990/91:
 - 1. Data reporting on milk production and herd health.

5. PROGRESS TO DATE: This project is proceeding as outlined in the above schedule.

- a. 3rd Quarter FY 87-88:
 - 1. Contract negotiated and signed April 1988.
 - 2. Engineering design for housing facility.
- b. 4th Quarter FY 87-88:
 - 1. Waste management system Summer 1988.
 - 2. DER permit applied for August 1988.
 - 3. DER permit issued September 1988.
 - 4. Bids for construction September 1988.

6. PRODUCTS:

- a. 2nd Quarter FY 88-89:
 - 1. Completion of two animal housing facilities on an existing dairy, each with a capacity of approximately 450 cows.
 - 2. Copies of all engineering designs and blueprints.
- b. 3rd Quarter FY 88-89:
 - 1. A detailed accounting of all construction costs.
- c. Periodic and routine updates of milk production, herd health and any other information that relates to the success or failure of the project from an economic standpoint - monthly through DHI information and biannual reports.

S-4 BASIN NUTRIENT REDUCTION PLAN

●District Contact: Richard Tomasello

CONTRACT REFERENCE: S4 Basin Nutrient Reduction/Briley Wild

1. **OBJECTIVE:** The objective of this project is to manage the completion of the S-4 Basin Nutrient Reduction Plan and to review the contract's engineering work products. The plan's objective is to reduce the total phosphorus loading from the S-4 basin into Lake Okeechobee to, or below, its allowable limit.
2. **DISTRICT NEED AND USE:** The District will use the information provided by the consultant in deciding how to implement the LOTAC recommendation of the S-4 basin runoff diversion from Lake Okeechobee, and will procure a construction contract, if necessary.
3. **SCOPE:** The District has let a contract for the evaluation of nutrient reduction alternative for the S-4 basin. The contract consists of three phases:
 - Phase I
 - a. A review of existing basin data (soils, flow, and water quality); coordination meeting with regulatory agencies; literature review; field investigation of land uses.
 - b. Preparation of land use maps; determination of quantities and methods of fertilizer application.
 - c. Field flow measurements; additional water quality sampling throughout the basin.
 - Phase II
 - Feasibility assessment of alternatives including no-action, revisions to present agricultural management practices, chemical treatment, and structural methods (drainage diversion); preliminary permit application with regulatory agencies.
 - Note: This is a potential stop point of the contract if the no-action alternative is selected.
 - Phase III
 - Develop basin design criteria; prepare preliminary design layouts and develop preliminary capital- and operating-cost estimates; obtain concurrence of regulatory agencies.
4. **SCHEDULE:**
 - Phase I completed 4th qtr 87-88
 - Phase II scheduled for completion 3rd Qtr 88-89
 - Phase III scheduled for completion 4th Qtr 88-89
5. **PROGRESS TO DATE:** This is a continuing project. Phase I has been completed and work has commenced on Phase II.
6. **PRODUCTS:**
 - Phase Ia, Ib: Report on data findings
 - Phase Ic: Report on recommendations
 - Phase Id: Progress report and milestone meeting
 - Phase II: Progress report and meeting
 - Phase III: Final report and meeting

BIOGEOCHEMICAL BEHAVIOR AND TRANSPORT OF PHOSPHORUS IN THE LAKE OKEECHOBEE BASIN

●District Contact: Eric G. Flaig

CONTRACT REFERENCES: Biogeochemical Behavior and Transport of Phosphorus in the Lake Okeechobee Basin

1. **OBJECTIVE:** The objective of this project is to quantify the behavior of phosphorus in the inorganic soils surrounding Lake Okeechobee and the transport of phosphorus from deposition to discharge to the lake. In particular, there are five major objectives. The first objective is to describe and determine short-term and long-term phosphorus sorption and release phenomena as a function of major soil types, drainage patterns, and land uses. The second objective is to characterize the soil chemistry influencing phosphorus retention and movement. A third objective is to determine phosphorus movement pathways for common soil profiles and drainage patterns. The proceeding information will be used as part of the fourth objective, which is to determine the change in phosphorus budgets for alternative land and water management practices. Finally, a phosphorus budget based on consumption and production of materials will be developed for the major drainage basins of Lake Okeechobee to determine the potential impact of alternative management practices.
2. **DISTRICT NEED AND USE:** The objectives of the investigation of phosphorus behavior stem from the recommendations of the Lake Okeechobee Technical Advisory Committee to Florida Department of Environmental Regulation. Specific recommendations for monitoring and research called for additional research and monitoring of phosphorus storage in soil, phosphorus transport in sandy/ organic soils, efficacy of wetlands as long-term phosphorus sinks, and a detailed inventory of phosphorus sources for all lake basins. Similarly, chemical phosphorus removal is to be evaluated as soil amendments affect phosphorus retention and potential transport to the lake.

Information obtained from this study will provide staff and managers a body of information concerning phosphorus sources and uses in the basin. An estimate of the annual storage of phosphorus in the basin, and identify the causes and manners in which phosphorus moves through the basin.

3. **SCOPE:** The work under this project will be completed by a contractor (the University of Florida has been selected). The major tasks are:
 - a. Describe and determine short-term and long-term phosphorus sorption and release phenomena as a function of major soil types, drainage patterns, and land uses. Determine the impact of soil sorption on loads delivered to Lake Okeechobee.
 - b. Characterize the soil chemistry influencing phosphorus retention and movement.
 - c. Determine phosphorus movement pathways for common soil profiles and drainage patterns.
 - d. Determine the change in phosphorus budgets for alternative land and water management practices.

- e. Develop a phosphorus budget for the major drainage basins of Lake Okeechobee.
4. **SCHEDULE:** This project is a three year contract with the University of Florida, IFAS. The contract is beginning the second year. The contract is highly task-deliverable oriented. The schedule can be determined from the deliverable list given below under PRODUCTS. The first year was primarily concerned with site selection, baseline analysis, and sample collection. The second and third years will consist of intensive data collection and analysis. In the final year further analysis and interpretation will be conducted.
5. **PROGRESS TO DATE:** The first year of the three year contract has been completed. All sites have been selected for field experimentation, which will quantify the flowpaths of phosphorus transport in typical soils. Most of the initial sampling has been completed and the results will be presented in October. The field experiments are being installed, and intensive data collection will begin this fall. Preliminary data collection for determining phosphorus budgets is nearing completion. Some task completion has been delayed by inability of IFAS contractors to secure sufficient support staff.
6. **PRODUCTS:**
- a. 1st Quarter FY88-89:
 1. Soil phosphorus analyses for dairies and pastures.
 2. Soil chemical and physical analyses for dairies and pastures.
 3. Two-dimensional phosphorus transport model.
 4. Inventory of basin characteristics.
 - b. 2nd Quarter FY88-89:
 1. Manure and sediment analysis report.
 2. Report on infiltration-runoff behavior of selected field sites.
 3. Stage-discharge curves for selected sites.
 - c. 3rd Quarter FY88-89:
 1. Dry Lake soil and sediment report.
 2. Field-scale phosphorus transport model.
 3. Comprehensive report of phosphorus flows by economic activity.
 4. Report on infiltration-runoff behavior of selected field sites.
 5. Manure and sediment analysis report.
 6. Two-dimensional phosphorus transport model.

DEVELOPMENT OF FERTILIZATION PRACTICES FOR BEEF CATTLE PASTURES TO MINIMIZE NUTRIENT LOSS IN RUNOFF

●District Contact: Eric G. Flaig

CONTRACT REFERENCES: Optimum Phosphorus Fertilization Levels of Beef Cattle Pastures

1. **OBJECTIVE:** The objective of this project is to identify the optimum method of phosphorus fertilization of forage crops on sandy, high-water table soils. The optimum method is defined as the loading rate of phosphorus and timing of application that minimizes the phosphorus load in runoff and provides acceptable forage crop yield and crop quality.
2. **DISTRICT NEED AND USE:** Improved pastures have been identified as a potential source of phosphorus in the Lake Okeechobee basin. This project will provide necessary information for selecting phosphorus fertilization rates which will result in considerable reduction in phosphorus discharged from pastures. The program results will be used by IFAS to improve bahia grass pasture fertilization recommendations.
3. **SCOPE:** The project consists of a projected three year contract with IFAS, University of Florida for developing replicated demonstration plots to show area ranchers the potential for reducing phosphorus fertilization. The contract contains three main activities:
 - a. Conduct a review of current fertilization practices and identify viable alternative practices for demonstration. Develop a physically and statistically valid experimental design for identifying the optimum fertilization method.
 - b. Establishment of fertilization treatment plots in the designated area. Construct plots such that each treatment is hydrologically isolated by sufficient buffer strips and surface drainage.
 - c. Monitor the movement and uptake of fertilizer nutrients, particularly phosphorus, for a period of three years. The field results should quantify the volume of runoff from each plot, quantify the phosphorus concentrations in runoff, quantify the mass loss of phosphorus in runoff, and determine the mass uptake of phosphorus in forage. This information will be used to determine the phosphorus budget for each plot considering runoff loss, plant uptake, and soil retention. The data report will include the quality assurance/quality control procedures and results.
4. **SCHEDULE:**
 - a. Literature review and project design were submitted in March, 1987.
 - b. The experimental plots were established at Williamson Ranch in May, 1987.
 - c. Periodic collection of runoff water, ground water, and, soil and forage samples began in May 1987. Summaries of field activities and interim data sets have been submitted quarterly.
 - d. A final report for the first year was accepted in May 1988.
 - e. The final report for the second year will be submitted in December 1988.
 - f. The final report for the last year of the project will be submitted in December 1989.

5. **PROGRESS TO DATE:** This project is the third year of an ongoing contract with the University of Florida, IFAS. The program was originally designed for three years. However the first year fertilization treatments were delayed due to poor weather. The field plots have been established and fertilized. Surface discharge and ground water samples have been collected for two seasons and analyzed. Similarly soil and forage samples have been collected and analyzed. Based on the first year of results additional ground water samples are being collected.

6. **PRODUCTS:**

a. Quarterly:

1. Interim reports of field and laboratory data.

b. First Quarter FY 88-89:

1. A final report for the second year with appropriate data analysis and interpretation.

c. Fourth quarter FY 88-89:

1. A field day to show results to area ranchers and dairymen.

d. First Quarter FY 89-90:

1. A final report for the last year of the project with complete data analysis and interpretation.

PHOSPHORUS FEED REDUCTION

●District Contact: Kim M. O'Dell

CONTRACT REFERENCES: The Relationship of Variable Levels of Phosphorus Intake to Livestock Needs and Excretion

1. **OBJECTIVE:** The objective of this study is to determine if lowering the phosphorus content in feed rations can significantly reduce the phosphorus content of dairy waste and to determine the effect on milk production and herd health of a reduced phosphorus content feed ration.
2. **DISTRICT NEED AND USE:** The District is providing research and demonstration support to identify Best Management Practices (BMPs) which can limit the load of nutrients (phosphorus) reaching Lake Okeechobee in order to prevent its further eutrophication. Phosphorus in dairy feed rations are a major source of phosphorus importation into the Lake Okeechobee basin. Should reduction of phosphorus in dairy rations be feasible, then District permittees require a reduction in feed as part of permitting conditions for new or existing dairy farms.
3. **SCOPE:** It is known that feed rations currently used by Okeechobee dairymen as usually formulated contain amounts of phosphorus in excess of recommended levels. These rations may contain higher levels of phosphorus than needed to maintain high milk production. Thus, the excess phosphorus may be contributing to the high phosphorus concentrations in dairy farm runoff. This study will evaluate the historical and current feeding practices and determine the quantity of phosphorus excreted by dairy cows. In addition, feed studies using minimum adequate levels of phosphorus in the rations will be conducted to demonstrate the effect on milk production, herd health, and excretion of phosphorus.

Two cooperating dairies have agreed to participate in the nine month field trial; McArthur Farms and Dry Lake Dairy. A phosphorus metabolism study will be conducted at the University of Florida Dairy Research Unit to measure the impact of phosphorus intake levels on phosphorus excretion concentrations.

This project consists of the following three tasks:

Task I: Evaluate the composition of fractions, mineral mixtures, liquid supplements, and forages being fed to dairy cattle in Okeechobee County and relate to livestock intake and needs.

Task II: Conduct a field trial with cooperating dairies in the basin using minimum but adequate levels of phosphorus in the rations. The field trial will be conducted over a period of one year, and levels of nutrients in formulated diets will be calculated from book values from the National Research Council. Manure and urine from the selected dairies will be evaluated for phosphorus content.

Task III: Conduct a phosphorus metabolism study at the University Dairy Research Unit to further measure the impact of phosphorus intake levels on phosphorus excretion levels in feces, milk, and urine, and evaluate milk production.

The preparation and dissemination of an Extension Service Fact Sheet will be provided to advise farmers and dairymen of study results.

A contract extension, was awarded 4th quarter FY 87-88 (Task IV) to provide an additional year of data collection. The objective of the extension is to further evaluate the effects of variable phosphorus levels in feed rations on milk production, and feed intake.

4. SCHEDULE:

Tasks I through IV are complete. The contract amendment was approved to provide IFAS researchers with an additional year to collect data and prepare a final report and feeding recommendations. The final report is due in the 3rd Quarter of FY 88-89.

5. PROGRESS TO DATE: A report containing an evaluation and analyses of the project was submitted at the end of FY 87-88. All data analyses are complete within Tasks I, II, and III, and IV. Work on the tasks agreed to in the contract amendment commenced October 1, 1988.

6. PRODUCTS:In addition to Quarterly Status Reports and an Interim Data Reduction Summary, the following deliverables will be provided by IFAS in conjunction with the study:

a. 2nd Quarter FY 86-87:

1. Literature Review on historical and current feeding practices for dairy cattle in Florida, with emphasis on the Okeechobee basin.

b. 4th Quarter FY 87-88:

1. Final Report due on Tasks I through III. Report submitted September 30th.

c. 3rd Quarter FY 88-89:

1. Final Report on of the contract amendment tasks is due.
2. Extension Service Fact Sheet will be provided by IFAS to advise farmers and dairymen of study results.

Details on the intermediate and final products are specified in the agreement.

S-236

●**District Contact:** Michael Cullum

**CONTRACT REFERENCES: Inter-Local Agreement/South Florida Conservancy
Assessment of Alternative Strategies**

1. **OBJECTIVE:** The objective of this project is to collect surface water quality data as required by Department of Environmental Regulation's Temporary Operating Permit (TOP) and to evaluate alternatives for reducing the nutrient loading from S-236 to Lake Okeechobee. Data collection and alternatives evaluation are conducted through two contracts.
2. **DISTRICT NEED AND USE:** The District holds a permit for discharging into Lake Okeechobee via the S-236 pump station. The permit expired in September, 1988, but an extension has been requested according to the Special Conditions set forth in the original permit. The District needs this project to support efforts to obtain either an extension of the old permit, or to apply for a new permit.
3. **SCOPE:** This project is concerned with the monitoring and alternatives evaluation for the S-236 pump station (South Florida Conservancy District).
4. **SCHEDULE:** Continue water quality monitoring through contract as required in modifications to be made to the TOP. Modify draft of alternative strategies report through contract after formal comments are received by DER.
5. **PROGRESS TO DATE:** The first year of water quality data collection was completed in March 1988. The monitoring contract was renewed for additional data collection at that time. Draft report entitled Analysis of Control Strategies for Reduction of Phosphorus Loads to Lake Okeechobee from the Special 298 Drainage Districts was delivered to DER in October, 1987. Draft is presently under review by DER.
6. **PRODUCTS:** Monthly water quality data collected during storm events, as weather conditions dictate. Final report on alternative strategies.

DESIGN OF BMPs - TAYLOR CREEK NUBBIN SLOUGH

●District Contact: Alan L. Goldstein

CONTRACT REFERENCES: TCNS BMP Design USDA SCS Support

1. **OBJECTIVE:** The purpose of this project is to provide the USDA - Soil Conservation Service (SCS) with financial support for staffing in Okeechobee and Highlands Counties above normal service levels for the purpose of developing BMP plans on individual dairies that provide for the catchment and treatment of runoff on individual farms in such a manner as to comply with the DER's "Dairy Rule" by the deadline date of June 1989 on the completion of the designs. It also provides support for continued staffing to provide construction oversight services by SCS for the designs that they have produced.
2. **DISTRICT NEED AND USE:** The District has established a policy of providing assistance to the Dairy industry in the Lake Okeechobee basin to design, install, and implement the BMPs that are required in the DER's "Dairy Rule" by the deadline dates established by the rule. This project provides support for technical assistance to produce the plans. The goal is to design BMPs that address phosphorus removal from stormwater runoff thus reducing phosphorus loads from dairy land uses to Lake Okeechobee.
3. **SCOPE:** The DER has passed a rule that requires all dairy operations in the Lake Okeechobee basins to catch and treat runoff from intensive animal holding areas on the individual farms. This will require amending existing water quality management plans to incorporate this management practice into existing operations. The District has provided the SCS financial support in past BMP design efforts in order to keep enough staff on hand to implement the projects in a timely fashion. This is a continuation of this support.
4. **SCHEDULE:**
 - a. 1st Quarter FY 88-89:
 1. One half of the 29 dairies covered by the contract will have plans produced, approved and signed by the SCS State Engineer. Failure to achieve this milestone will result in a reevaluation of the contract and shift of financial support for this project to private Engineering firms.
 - b. 2nd Quarter FY 88-89:
 1. Continuation of plan production and approval.
 - c. 3rd Quarter FY 88-89:
 1. Completion of all 29 dairy designs by June 3, 1989.
 - d. Through 2nd Quarter 1990-91:
 1. Oversight and certification of construction to specifications.
5. **PROGRESS TO DATE:** This project is proceeding as outlined in the above schedule.

SWIM MANAGEMENT PLANS--LAKE OKEECHOBEE

●District Contact: Joel A. VanArman

1. **OBJECTIVE:** The objective of this project is to develop an Interim Surface Water Improvement and Management (SWIM) Plan for Lake Okeechobee as mandated in the SWIM legislation and in order to protect the natural resources of the lake. An update of the Interim plan will also be required this year. An additional objective is to provide technical support as needed to develop budgetary requirements for FY 90-91 SWIM projects.
2. **DISTRICT NEED AND USE:** This project is required to meet the mandates of the SWIM legislation. In addition, subsequent versions of this plan will be developed periodically to address new and emerging resource management issues for Lake Okeechobee.
3. **SCOPE:** The Interim SWIM plan for Lake Okeechobee will be completed during FY 88-89. This plan will identify a number of ongoing projects that will continue within the lake. The SWIM plan for Lake Okeechobee will be updated annually, based on new data or changes in policy that occur during the planning process and will reflect any new projects, management strategies and priorities that are identified for Lake Okeechobee. This project will provide technical support for updating the management plan and identifying new projects for the FY 90-91 SWIM budget and beyond.
4. **SCHEDULE:** This is the second year of a continuing project. The SWIM plan for Lake Okeechobee will be updated on an annual basis according to the following schedule for FY 88-89.
 - a. 2nd Quarter FY 88-89:
 1. Governing Board Approved Water Quality and Public Information portions of SWIM Plan in February 1989.
 - b. 4th Quarter FY 88-89:
 1. The water supply and environmental components of the plan will be completed in Fall 1989, including a revised budget for FY 90-91 SWIM projects.
5. **PROGRESS TO DATE:** A draft plan for Lake Okeechobee was completed in September, 1988. Completion of the final draft is currently underway. A number of contractual and research investigations are currently underway that are included under other projects.
6. **PRODUCTS:**
 - a. 1st Quarter FY 88-89:
 1. An Interim SWIM plan for Lake Okeechobee which will be presented to the Governing Board in December and sent to the Florida FDER.

TAYLOR CREEK NUBBIN SLOUGH BMP MONITORING

●District Contact: Gary J. Ritter

1. **OBJECTIVE:** The objective of this project is to determine the effectiveness of Best Management Practices (BMPs) implementation at the dairy, sub-tributary, tributary, and watershed level in improving water quality and consequently improving inflow water quality to Lake Okeechobee. This project will also provide nutrient loading information from each individual dairy.
2. **DISTRICT NEED AND USE:** This information will be used to evaluate operation and maintenance of the Department of Environmental Regulation's (DER) Dairy Rule and other BMPs designed for the S191 basin on a farm by farm basis. The results of this project will be used by the District and DER to determine if additional practices will be needed to achieve further reductions in phosphorus loads to the lake at S191. The District also needs to assess the nutrient contributions from non-dairy related land use activities to determine if strategies for controlling non-point source runoff from these areas need to be developed. The project will provide District management the ability to assess the effectiveness of current and future basin management progress for water quality protection. It will also provide a database and monitoring network to ensure continued utilization of BMPs and compliance with required programs.
3. **SCOPE:** Three levels of activity have been developed to support this project:
 - Level I. Water quality assessment and inventory at each dairy and selected non-dairy land use activities.
 - Level II. Phosphorus loading modeling, assessment and forecasting.
 - Level III. Evaluation of specific BMP components.

This is a multiyear intensive monitoring project utilizing automatic samplers at approximately 34 sampling stations located at the outfalls of individual dairy operations to Taylor Creek/ Nubbin Slough and its tributary channels.

The Data Management Division will install hydrologic monitoring at approximately 34 sites in the Taylor Creek area. Electronic data loggers will be used to facilitate data processing and control of water quality samplers. In situ parameters sampled will be surface water levels, conductivity, velocity, pH, ORP, and rainfall. The project will generate approximately 13,000 lab analyses annually. Initial processing and archiving of the additional data is included, although engineering analysis and detailed error screening will be the responsibility of Water Quality and Water Resources Divisions. No processing personnel were budgeted because the full impact of the additional load will not be realized until late in the fiscal year, the electronic recording media minimizes processing time, additional processing equipment required to make the data available on our computer system has been requested this fiscal year, and the night crew will provide a buffering capacity to handle surges in processing requirements.

Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for "General Network Hydrologic

Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects".

4. SCHEDULE:
 - a. Ongoing data collection on a routine basis.
 - b. Implementation of intensive sampling network utilizing automated devices by end of 1988.
 - c. Annual data analysis for inclusion in Rural Clean Waters Program annual report (1st Quarter FY 88-89).
5. PROGRESS TO DATE: A watershed monitoring project designed to collect water quality at 26 locations was initiated in 1973. This project has expanded to 50 monitoring locations to include all dairy operations and non-dairy land use activities. Six of 34 continuous sampling stations have been implemented. Weekly implementation meetings are conducted and status reports prepared.
6. PRODUCTS:
 - a. Ongoing:
 1. Monthly water quality input for Water Condition Reports to Governing Board.
 2. Identify "hot spots" and non compliance as input to regulatory program.
 - b. 1st Quarter FY 88-89:
 1. Annual reporting for Rural Clean Waters Program.

LOWER KISSIMMEE RIVER WATER QUALITY MONITORING PROGRAM

●District Contact: Eric G. Flaig

1. **OBJECTIVE:** The objectives of this project are to determine the phosphorus and nitrogen loads contributed by each major tributary in the basin, to identify source areas, to monitor nutrient contributions from individual dairies in the basin, and to evaluate the effectiveness of DER mandated Best Management Practices (BMP) on dairies to reduce phosphorus loads to Lake Okeechobee.
2. **DISTRICT NEED AND USE:** This project is needed to assist in developing suitable, scientifically valid criteria by which to make management recommendations. The primary goal is to evaluate the input of various land uses to phosphorus loads. This requires a water quality inventory of surface waters. In particular, it is necessary to determine the effectiveness of prescribed BMPs. This project will provide District management the ability to assess the effectiveness of current and future basin management projects for water quality protection. It will also provide a database and monitoring network to ensure continued utilization of BMPs and compliance with required projects.
3. **SCOPE:** A water quality monitoring project has been developed to satisfy various objectives for monitoring discharge water quality from agriculture. A three level program using weekly grab samples, automated samplers, and intensive short-term studies is designed to provide an inventory of water quality in the basin and quantify phosphorus loads from dairies and tributaries. Several specific practices will be evaluated as will basin scale impacts. Finally, a phosphorus dynamics and transport model will be developed to forecast the impact of alternative management strategies. Thus, a goal is to develop sufficient, process-oriented data for model verification and calibration. Flows from each site will be measured or estimated through modeling activities. Loads from each individual dairy will be determined.

Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.

4. SCHEDULE:

- a. 1st Quarter FY 88-89:
 1. Completion of installation of instrumentation.
- b. 3rd Quarter FY 88-89:
 1. Development of computer model for estimating loads.
 2. Draft data analysis report for Rural Clean Waters Program.
5. **PROGRESS TO DATE:** Installation of the equipment and instrumentation for the Lower Kissimmee River BMP monitoring project is nearing completion. Weekly grab samples have been collected at 52 stations for the last year. This data has been used to evaluate dairy discharge phosphorus concentrations. Autosampler stations have been constructed at representative outfalls for each dairy and major tributaries and structures. The composite water samplers have been

deployed at each site. The final corrections for electronic data collection will be completed during the next few weeks. The final construction activities for the intensively monitored pasture and spray fields will be completed soon.

Although the monitoring project has been deployed, the BMP implementation program is not complete. With the construction of the Dairy Rule BMPs on each dairy, the primary dairy discharge locations will be moved. At the completion of each plan, the discharge locations will be reevaluated and the monitoring stations may be moved as necessary.

6. PRODUCTS:

- a. Monthly Governing Board updates in Water Conditions report (ongoing).
- b. Identification and evaluation of causes for episodic high load discharge events (as needed).
- c. Input into regulatory programs (monthly or as required).

DAIRY MONITORING ST. LUCIE CANAL BASIN

●District Contact: Alan L. Goldstein

1. **OBJECTIVE:** The objective of this project is to determine the effectiveness of Best Management Practices (BMPs) implemented on individual dairies in the St. Lucie Canal drainage basin. This project will provide nutrient loading from each individual dairy. It will also be used to evaluate operation and maintenance of the Department of Environmental Regulation's (DER) Dairy Rule design on a farm by farm basis.
2. **DISTRICT NEED AND USE:** Dairies that discharge into the St. Lucie Canal Basin have been determined to be subject to the DER's Dairy Rule since, under some circumstances, the basin is a contributor of nutrient loads to Lake Okeechobee. The monitoring effort is needed to determine the effectiveness of DER mandated BMPs in reducing the phosphorus loads entering Lake Okeechobee from the St. Lucie Canal. The results of this project will be used by the District and the DER to determine if additional practices or regulatory enforcement actions will be needed to achieve necessary reductions in phosphorus loads to the lake.
3. **SCOPE:** This is a multi-year intensive water quality monitoring project utilizing automatic samplers at two sampling stations located at the outfalls of individual dairy operations in the basin.

Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.

4. **SCHEDULE:**
 - a. 1st Quarter FY 88-89:
 1. Begin baseline monitoring.
 - b. 2nd Quarter FY 88-89:
 1. Instrumentation installation.
5. **PROGRESS TO DATE:** This is a new project.
6. **PRODUCTS:** Water Quality data to be included in monthly Water Conditions and Regulatory Compliance Reports.

DAIRY MONITORING S-4 BASIN

●District Contact: Alan L. Goldstein

1. **OBJECTIVE:** The objective of this project is to determine the effectiveness of Best Management Practices (BMPs) implemented on individual dairies in the S-4 drainage basin. This project will provide nutrient loading from each individual dairy. It will also be used to evaluate operation and maintenance of the Department of Environmental Regulation's (DER) Dairy Rule design on a farm by farm basis.
2. **DISTRICT NEED AND USE:** Dairies that discharge into the S-4 basin have been determined to be subject to the DER's Dairy Rule since, under some circumstances, the basin is a contributor of nutrient loads to Lake Okeechobee. The monitoring effort is needed to determine the effectiveness of DER mandated BMPs in reducing the phosphorus loads entering Lake Okeechobee at S-4. The results of this project will be used by the District and the DER to determine if additional practices or regulatory enforcement actions will be needed to achieve further reductions in phosphorus loads to the lake.
3. **SCOPE:** This is a multi-year intensive monitoring project utilizing automatic samplers at one sampling station located at the outfalls of individual dairy operations in the basin.

Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.

4. **SCHEDULE:**
 - a. 2nd Quarter FY 88-89:
 1. Begin baseline monitoring.
 - b. 4th Quarter FY 88-89
 1. Instrumentation installation.
5. **PROGRESS TO DATE:** This is a new project.
6. **PRODUCTS:** Water Quality data to be included in monthly Conditions and Regulatory compliance Reports.

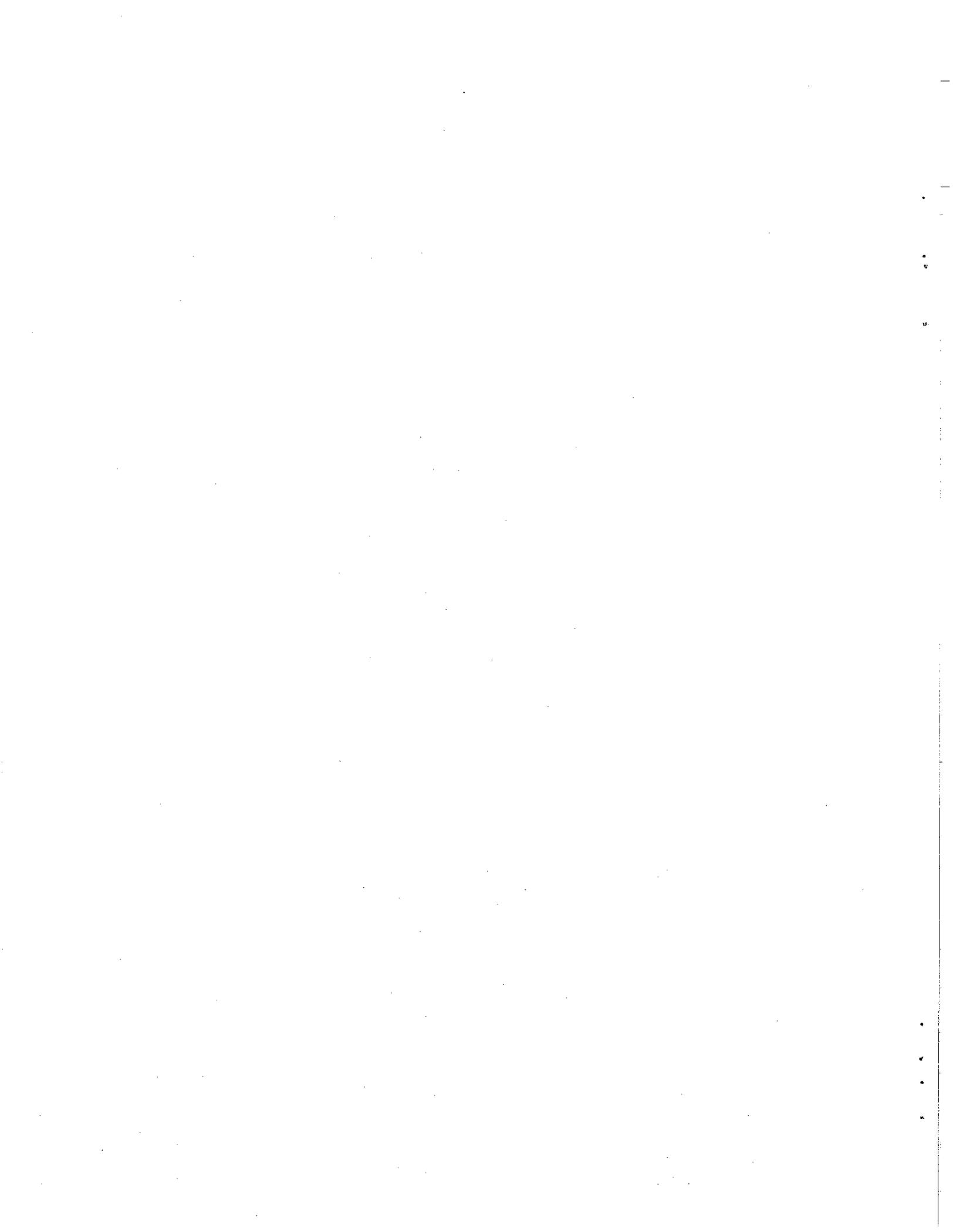
DAIRY MONITORING ARBUCKLE CREEK

●District Contact: Alan L. Goldstein

1. OBJECTIVE: The objective of this project is to determine the effectiveness of Best Management Practices (BMPs) implemented on individual dairies in the Arbutckle Creek drainage basin. This project will provide nutrient loading from each individual dairy. It will also be used to evaluate operation and maintenance of the Department of Environmental Regulation's (DER) Dairy Rule design on a farm by farm basis.
2. DISTRICT NEED AND USE: Dairies that discharge into the Arbutckle Creek basin have been determined to be subject to the DER's Dairy Rule since drainage from this basin ultimately finds its way to Lake Okeechobee. The monitoring effort is needed to determine the effectiveness of DER mandated BMPs in reducing the phosphorus loads entering the Lake Okeechobee basin from Arbutckle Creek. The results of this project will be used by the District and the DER to determine if additional practices or regulatory enforcement will be needed to achieve necessary reductions in phosphorus loads to the lake.
3. SCOPE: This is a multi-year intensive monitoring project utilizing automatic samplers at four sampling stations located at the outfalls of individual dairy operations in the basin.

Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.

4. SCHEDULE:
 - a. 2nd Quarter FY 88-89:
 1. Begin baseline monitoring.
 - b. 3rd Quarter FY 88-89:
 1. Instrumentation installation.
5. PROGRESS TO DATE: This is a new project.
6. PRODUCTS: Water Quality data to be included in monthly Conditions and Regulatory compliance Reports.



KISSIMMEE RIVER

FLOODPLAIN RESTORATION PROJECTS IN THE KICCO WILDLIFE MANAGEMENT AREA

•District Contact: Lou Toth

1. **OBJECTIVE:** The objective of this project is to plan, design and obtain permits for floodplain restoration projects on the KICCO Wildlife Management Area Property acquired by the District in Pool A and northern Pool B of the Kissimmee River, compatible with other Kissimmee River Restoration strategies and District's SOR Land Management strategy.
2. **DISTRICT NEED AND USE:** This project will provide for positive environmental restoration of lands acquired through SOR funding, consistent with the goals of the project. The first substantial purchase of land in the Kissimmee River floodplain area was the KICCO (Kissimmee Island Cattle Company) tract of approximately 7700 acres from GAC Liquidating Trust. This land includes nearly the entire western side of the Kissimmee River floodplain from State Road 60 south to one mile below S-65A. Because of the fact that all potential river restoration alternatives will require that the C-38 channel in Pool A and S-65A remain intact, restoration of river floodplain marshes in this area can be accomplished by tributary impoundment and other methods. Monitoring of the success of these restoration projects will be beneficial in future similar projects throughout the District. A number of other District Divisions and Departments are required in the overall process to develop the plans and construct the projects.
3. **SCOPE:** A total of five floodplain restoration projects have been identified for KICCO, including a) Tick Island Slough (600 + acres), b) Rattlesnake Hammock Marsh (535 + acres), c) Ice Cream Slough (250 + acres), d) Packingham Slough (500 + acres), and e) degrade southwest levee to restore hydrologic function to 161 acres of marsh.

This project was informally started in FY 86-87, and identified as a project in FY 1987-88. It will continue until floodplain restoration projects are constructed and required monitoring has been completed. Work in the future may also include other parcels acquired through SOR.

The scope of this project consists of the following steps:

- a) define the environmental concept for the project
- b) develop the hydrology and hydraulic design for the conceptual project
- c) coordinate external review (agencies and public) for the concept
- d) obtain state and federal permits for the project

Additional efforts are spent in coordination of other related activities:

- e) develop detailed engineering design drawings for the project
- f) obtain funding through the budget process
- g) bid process for construction contract

Finally, follow-up environmental monitoring of completed projects are required for a term specified by the DER permit.

4. **SCHEDULE:** Identification of candidate areas for restoration began in FY 86-87, with detailed planning efforts for Tick Island and Rattlesnake Hammock initiated in FY 87-88.

The schedule for activities in FY 88-89 are as follows:

- a) Tick Island Slough
 - 1) Resolve land access issues with Latt Maxcy - QTR 2 (Still Pending)
 - 2) Advertise for construction contract - QTR 3 (Delayed)
 - 3) Award construction contract - QTR 4 (Delayed)
- b) Rattlesnake Hammock
 - 1) Receive final permits from DER and USCOE - QTR 1
 - 2) Submit and receive permit modification - QTR 1
 - 3) Complete final engineering design drawings - QTR 1
 - 4) Advertise for construction contract - QTR 3
 - 5) Award construction contract - QTR 4
- c) Ice Cream Slough
 - 1) Complete Hydrology and Hydraulic design - QTR 2
 - 2) Submit for State and Federal permits - QTR 3
 - 3) Complete engineering design drawings - QTR 4
 - 4) Advertise for construction contract - QTR 4
- d) Degrade southwest levee
 - 1) Submit for permits - QTR 1
 - 2) Receive state and federal permits - QTR 2
 - 3) Okeechobee Field station to begin work - QTR 3
- e) Packingham Slough
 - 1) develop conceptual environmental plan - Postpone until Kissimmee River Restoration Plan is adopted by Governing Board (November 1989)

5. **PROGRESS TO DATE:** A construction contract was to have been awarded for Tick Island Slough and Phase 1 Rattlesnake Hammock during July 1988, but failure to obtain the requested access easement prior to land purchase negotiations from Latt Maxcy Corporation (required for the Tick Island Project) forced a postponement of the process. Legal will pursue land condemnation proceedings for the Tick Island project in FY 1988-89, and the Rattlesnake Hammock project may be bid separately in its entirety in FY 88-89. A conceptual plan for Ice Cream Slough has been reviewed by Water Use Division for Hydrology and Hydraulic design, and detailed plans have been prepared for the levee degradation project.
6. **PRODUCTS:** The major products from this project will be construction of four impoundments/flow through marshes on previously drained floodplains for restoration of approximately 1,925 acres of functional wetlands. In addition the levee degradation restores hydrologic connection to another 161 acres.

BONEY MARSH MANAGEMENT TECHNIQUE EVALUATION

●District Contact: Nancy H. Urban

1. OBJECTIVE: The objective of this study is to identify and develop wetland management techniques for the purpose of maintaining long-term marsh nutrient uptake capacities with minimal degradation of marsh habitat.
2. DISTRICT NEED AND USE: The SFWMD needs to know uptake potentials for floodplain marshes, since the Kissimmee River is a major contributor of phosphorus to Lake Okeechobee. Vegetation management techniques which are being tested in this project will also directly applicable to the EAA flow-way project.
3. SCOPE: The Boney Marsh is a 106 acre diked marsh area in the Kissimmee River floodplain in which water level and flow has been experimentally manipulated for over a decade. It has provided an opportunity to evaluate wetland nutrient uptake and management techniques. This research has indicated that nutrient supply from inflowing river water results in a progressive vegetation change and loss in nutrient uptake efficiency. This year controlled burning will be evaluated as a technique to reverse this trend. The marsh will be burned during spring 1989 and vegetation and soil samples will be collected and analyzed for nutrient content pre-burn and periodically for one year post-burn. Daily collection of inflow water, outflow water, and rainfall for nutrient analysis will continue. Monthly water quality transects within the marsh from upstream to downstream will also continue.
4. SCHEDULE:
 - a. Complete Technical Publication on nutrient budgets, 1976-87 - 2nd Q FY 89-90
 - b. Complete Technical Publication on vegetation and soil nutrient retention, 1976-87 - 4th Q FY 89-90
 - c. Complete post-burn water and vegetation sampling - 2nd Q FY 89-90
 - d. Complete Technical Publication on effects of drawdown and controlled burning on marsh nutrient retention - 4th Q FY 89-90
5. PROGRESS TO DATE: Vegetation succession and nutrient retention were monitored from 1976-87, during which period marsh soils remained water-saturated. The District's Technical Publication 81-1 documented the first 3 years (1976-79) of nutrient budgets. The marsh was subjected to spring dry-downs during 1987 and 1988 to evaluate effects of drawdown as a management technique on vegetation and nutrient trends.
6. PRODUCTS: Four technical publications as listed under schedule.

KISSIMMEE RIVER STRUCTURES

●District Contact: Larry V. Grosser

1. OBJECTIVE: The objective of this project is to collect surface water quality data in the Kissimmee River to determine water quality conditions at the major water control points and to detect significant changes in short and long term water quality. This project is also designed to assist in the down stream evaluation of the Kissimmee River Valley Best Management Practices monitoring project.
2. DISTRICT NEED AND USE: The primary uses of this project are to provide necessary water quality data to Departmental researchers studying the impacts of the Kissimmee Valley BMP effort on the River and subsequently, the impacts of the Kissimmee River upon Lake Okeechobee.
3. SCOPE: Sampling locations are upstream of the six major water control structures on the river (S65, S65A, S65B, S65C, S65D, and S65E).
4. SCHEDULE: Bi-weekly sampling began on this project in October of 1979.
5. PROGRESS TO DATE: This is a long term project which was initiated in 1979. The network is routinely sampled every two weeks.
6. PRODUCTS:
 - a. 3rd Quarter FY 88-89: Kissimmee River Structures Quality Assurance Report.

MODIFICATIONS TO THE EXISTING PHYSICAL SYSTEM - KISSIMMEE RIVER

●District Contact: Jayantha Obeysekera

1. OBJECTIVE: The objective of this project is to design necessary modifications to the existing physical system for improving restoration efforts.
2. DISTRICT NEED AND USE: The monitoring program of Phase I of the Kissimmee River Demonstration project has demonstrated opportunities for the improvement of the restoration effort without affecting the flood control effectiveness of the current system. Planning and design studies for such improvements will not only benefit the ongoing restoration efforts, but will also assist in the formulation of basinwide restoration plans.
3. SCOPE: Three areas are identified for immediate attention:
 - a. Modification of existing weirs in Pool B to improve flood conveyance through the system.
 - b. Outlets to the flood channel from the floodplain to provide relief for flooding in uplands during local storm events (ex. Pine Island Slough).
 - c. Regulation schedule analysis for the upper chain of lakes in order to develop a schedule that is favorable to restoration goals while maintaining the current flood control and other interests of the upper basin. The Upper Chain of Lakes routing model which already has been developed will be used for this task. This effort will be coordinated with other ongoing projects in the Upper Kissimmee Basin.
 - d. Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.
4. SCHEDULE:
 - a. Modification of weirs scheduled for completion - 1st Qtr 89-90
 - b. Complete planning and design of outlets to C-38 canal - 1st Qtr 89-90
 - c. Regulation schedule analysis to be completed - 4th Qtr 88-89
5. PROGRESS TO DATE: First two items in the above task schedule have been initiated.
6. PRODUCTS:
 - a. Modifications to the existing or future proposed restoration elements that will improve their performance.
 - b. A proposal for regulation of the Upper Chain of Lakes.

EVALUATION OF PHASE I - KISSIMMEE RIVER RESTORATION PROJECT**District Contact: Kent Loftin**

1. **OBJECTIVE:** The objective of this project is to document the hydrologic, water quality, and ecological findings of the Kissimmee River Phase I Demonstration Project. Also, the University of California (UC) Berkeley Physical and Mathematical Modeling contract is monitored under this project.
2. **DISTRICT NEED AND USE:** The original monitoring program for Phase I is to be completed in FY 88. It is expected that the demonstration project will continue to be monitored for its effectiveness of restoration goals. The wealth of data that have been collected need to be analyzed and investigated to determine key findings of the Phase I Demonstration Project.
3. **SCOPE:** The key areas of focus are hydrology, hydraulics, water quality, and ecology. The following tasks are planned:
 - a. To provide data for the University of California, Berkeley, and mathematical modeling contract.
 - b. To prepare the final report on the Kissimmee Demonstration Project.
4. **SCHEDULE:**
 - a. Provide further data to the contractor at U.C. Berkeley - 4th Qtr 88-89
 - b. Assembly of demonstration project data - 2nd Qtr 88-89
 - c. Analysis of data to be completed - 4th Qtr 88-89
 - d. Preparation of final report - 4th Qtr 88-89
5. **PROGRESS TO DATE:** Other agencies have been involved in the monitoring project and a continuous interaction with them has provided valuable information regarding the effectiveness of specific features of the demonstration project. Two discharge tests have been conducted to provide field data for the physical and mathematical modeling contract being executed at the University of California, Berkeley. Most data have been assembled. Some have been analyzed. UC Berkeley contract is on schedule. A peer review program has been initiated. Phase II is scheduled for construction this FY.
6. **PRODUCTS:** Final report on the Phase I Kissimmee Demonstration Project.

TRIBUTARY AND OXBOW REVITALIZATION PLANS AND DESIGNS**District Contact: Jayantha Obeysekera**

1. **OBJECTIVE:** The purpose of this project is to provide hydrologic and hydraulic designs for several small projects which are designed to provide hydrologic regimes that will enhance the environmental values specific to certain areas in the Kissimmee floodplain.
2. **DISTRICT NEED AND USE:** Restoration of tributaries and oxbows is a part of the overall Kissimmee restoration project.
3. **SCOPE:** Several planned tributary management and oxbow revitalization projects remain to be designed and implemented. They are:
 - a. Ice Cream Slough
 - b. Paradise Run
 - c. Buttermilk/Fodderstuck Slough
 - d. Phase II River Run Revitalization Project
 - e. Possible Phase III based on University of California, Berkeley contract recommendations, if necessary.
4. **SCHEDULE:**
 - a. Hydrologic and hydraulic designs for Ice Cream Slough, Paradise Run and Buttermilk/Fodderstuck Slough - 4th Qtr 88-89
 - b. Completion of Phase II River Run Revitalization Permit, design and specifications (S65C-XA) Project - 1st Qtr 89-90
5. **PROGRESS TO DATE:** The permit application for Phase II is complete.
6. **PRODUCTS:**
 - a. Hydrologic and hydraulic designs for Ice Cream Slough, Paradise Run, and Buttermilk/Fodderstuck Slough.

KISSIMMEE RIVER RESTORATION SYMPOSIUM**District Contact: Kent Loftin**

1. **OBJECTIVE:** To organize and conduct Kissimmee River Restoration Symposium October 18-20, 1988.
2. **DISTRICT NEED AND USE:** The Kissimmee River Restoration Symposium will provide a forum for the presentation of scientific considerations and research findings. The symposium will focus attention on environmental, engineering and economic concerns as they relate to ecologic criteria and physical options for restoration.
3. **SCOPE:** After the symposium is completed, considerable effort is needed to compile the findings and conclusions and to prepare the proceedings of the symposium.
4. **SCHEDULE:**
 - a. Preparation for symposium - 1st Qtr 88-89
 - b. Symposium to be held - 1st Qtr 88-89
 - c. Preparation of proceedings - 3rd Qtr 88-89
5. **PROGRESS TO DATE:** Most of the planning effort needed for the symposium is complete.
6. **PRODUCTS:** Proceedings of the Kissimmee River Restoration Symposium including recommendations of three panels.

ENVIRONMENTAL MONITORING

●District Contact: Louis A. Toth

1. OBJECTIVE: The objective of this project is to assess ecological responses of floodplain and oxbow communities to hydrologic changes resulting from the demonstration project.
2. DISTRICT NEED AND USE: Data collected by this project will provide ecological information on the utility of demonstration project components as river restoration techniques. It will also contribute to an improved understanding of the effects of flow and changes in the hydrologic regime on the riverine ecosystem. This is necessary input for the planning and design of future Kissimmee River restoration efforts.
3. SCOPE: Demonstration project monitoring began in June 1984. All data analysis and final report preparation will be completed in FY 88-89.

Environmental monitoring efforts are intended to evaluate specific effects of major project components (i.e., installation of weirs across C-38, creation of a flow-through marsh, and pool stage fluctuation), as well as broader, more encompassing ecological consequences in the Kissimmee River ecosystem. Monitoring studies are being conducted along 7 floodplain transects and 21 river oxbow and tributary sites. Floodplain sampling will assess effects of changes in the Pool B hydrologic regime on floodplain vegetation and secondary productivity. River oxbow and tributary studies will evaluate effects of restoration of flow on benthic habitat and invertebrate productivity and community structure.

4. SCHEDULE:
Data Analysis & First Draft of Project Report - 3rd Q FY 88-89
Complete Demonstration Project Report - 4th Q FY 88-89
5. PROGRESS TO DATE: Annual progress reports were completed in October 1984-1987. Accomplishments during FY 87-88 included monitoring of the C-38 high discharge test, completion of all scheduled sampling, and data analysis.
6. PRODUCTS: A final report (Technical Publication) that includes: a. An evaluation of the effects of restoration of flow on oxbow habitat and benthic invertebrate productivity and community structure. b. An analysis of effects of pool stage fluctuation and the flow-through marsh on floodplain vegetation and invertebrate productivity. c. An ecological assessment of demonstration project components as river restoration techniques.

UPPER KISSIMMEE LAKES

KISSIMMEE CHAIN OF LAKES WATER QUALITY STUDIES

●District Contact: Lorraine L. Janus

1. **OBJECTIVES:** The main goals of this project are to determine the nutrient assimilation capabilities by the five lakes of the Kissimmee chain (i.e. East Tohopekaliga, Tohopekaliga, Cypress, Hatchineha, and Kissimmee) in order to set nutrient loading limits to prevent their excessive eutrophication. The program will also provide information necessary to determine the impact that land use changes in their basins will have on downstream resources including Lake Okeechobee.
2. **DISTRICT NEED AND USE:** The information currently collected through the field project is needed by the District for the following reasons:
 - a. To assess and document the present water quality and trophic characteristics of the lakes to be aware of changes due to population and land use changes.
 - b. To determine the best practical approach to nutrient control through a knowledge of the sources.
 - c. To predict the impact that development in these upstream drainage basins may have on Lake Okeechobee.
 - d. To contribute to the development of reference standards for the response of Florida lakes to nutrient loads.
 - e. Information generated by this project will be essential for assessment of water quality and environmental impacts of lake and basin management strategies in the Upper Kissimmee Chain of Lakes basin.
3. **SCOPE:** The present field sampling routine is a continuation of an intensive study undertaken from 1981 to 1984 but with a reduced sampling schedule. It will serve to supplement the conclusions of the intensive period of study and allow the detection of any temporal trends since 1981. Because of the recent reductions in wastewater treatment plant discharges, yet increased impacts of urbanization, this monitoring project is critical to detecting water quality trends in these lakes.

Nutrient budgets for each of the five lakes will be constructed from the water chemistry and hydrological data. The trophic status of each lake will be assessed on the basis of its nutrient dynamics. This will provide the basis for developing nutrient loading recommendations for each lake of the chain.

The East Tohopekaliga final report will be produced in FY 88-89. This report will consist of morphometric, hydrologic, water chemistry, and biological data, an assessment of trophic condition and recommendations for what the nutrient loading limit for the lake should be.

Analogous reports for Lakes Tohopekaliga, Cypress, Hatchineha and Kissimmee, as well as a final summary for the chain of lakes will be produced in FY 89-90.

4. SCHEDULE:**a. 1st Quarter FY 88-89:**

1. Complete statistical analysis of data and eutrophication modeling for the upper two lakes, East Lake Tohopekaliga and Lake Tohopekaliga, and complete draft report.

b. 2nd Quarter FY 88-89:

1. Complete technical publication for upper two lakes.

c. 4th Quarter FY 88-89:

1. Complete technical publication for lower three lakes.

- 5. PROGRESS TO DATE:** Water quality summaries, nutrient budgets, and statistical analysis of the data for the upper two lakes have been completed. A preliminary comparative evaluation of the nutrient response of these lakes as compared to other Florida and northern temperate lakes has been completed and a draft technical publication is in progress.

6. PRODUCTS:**a. 2nd Quarter FY 88-89:**

1. Complete technical publication for upper two lakes.

b. 4th Quarter FY 88-89:

1. Complete technical publication for lower three lakes.

DEVELOPMENT OF MANAGEMENT PLANS--LAKE TOHOPEKALIGA

●District Contact: Joel A. VanArman

CONTRACT REFERENCE: Lake Tohopekaliga SWIM/HDR

1. **OBJECTIVE:** The objective of this project is to develop a Surface Water Improvement and Management (SWIM) plan for Lake Tohopekaliga (Toho) as identified in the District Report entitled, Identification of Priority Water Bodies within the South Florida Water Management District.
2. **DISTRICT NEED AND USE:** This project is required to meet the mandates of the SWIM legislation and to address priority planning projects that were identified by the District in cooperation with other agencies and local governments. The plan will be used to solicit state funding to be used to protect the natural resources associated with Lake Tohopekaliga.
3. **SCOPE:** The project consists of developing a plan that will include a schedule established by the District and agreed to by the DER for restoring the water body. This plan shall also enumerate preventive measures which need to be taken to augment surface water improvement and management efforts. A contract has been initiated with a consultant to collect baseline data necessary for the development of this plan. The project manager will be responsible for tracking the progress of these investigations and incorporating results of these studies into the final plan.
4. **SCHEDULE:** This is the first year of a continuing project. This plan is to be completed in FY 89-90. The plan is to be reviewed and, if necessary, revised annually.
5. **PROGRESS TO DATE:** This is a new project, building on previous work by the District in the Priority Water Body Report and other research activities, by other agencies, local governments and consultants. A contract for supporting studies for this project was approved at the September 1988 Governing Board Meeting and is currently underway.
6. **PRODUCTS:**
 - a. 3rd Quarter FY 88-89:
 1. A contractor will provide contract deliverables for Lake Tohopekaliga which will be sent to the DER.

DEVELOPMENT OF MANAGEMENT PLANS--EAST LAKE TOHOPEKALIGA

●District Contact: Joel A. VanArman

CONTRACT REFERENCE: Lake Tohopekaliga SWIM/HDR

1. **OBJECTIVE:** The objective of this project is to develop a Surface Water Improvement and Management (SWIM) plan for East Lake Tohopekaliga as identified in the District report entitled, "Identification of Priority Water Bodies within the South Florida Water Management District."
2. **DISTRICT NEED AND USE:** This project is required to meet the mandates of the SWIM legislation and to address priority planning projects that were identified by the District in cooperation with other agencies and local governments. The plan will be used to solicit state funding to be used to protect the natural resources associated with East Lake Tohopekaliga.
3. **SCOPE:** The project consists of developing a plan that will include a schedule established by the District and agreed to by the DER for preserving the water body. This plan shall also enumerate preventive measures which need to be taken to augment surface water improvement and management efforts. A contract has been initiated with a consultant to collect baseline data necessary for the development of this plan. The project manager will be responsible for tracking the progress of these investigations and incorporating results of these studies into the final plan. For details of the contents of the plan, please see the SM51 Project Document.
4. **SCHEDULE:** This is the first year of a continuing project. The final plan will be completed in FY 89-90. The plan is to be reviewed and, if necessary, revised annually.
5. **PROGRESS TO DATE:** This is a new project, building on previous work by the District in the Priority Water Body Report and other research activities, other agencies, local governments and consultants. A contract for supporting studies for this project was approved at the September 1988 Governing Board meeting and is currently underway.
6. **PRODUCTS:**
 - a. 3rd Quarter FY 88-89:
 1. Contractor will provide contract deliverables.

LAKE ISTOKPOGA

LAKE ISTOKPOGA AND INDIAN PRAIRIE BASIN HYDROLOGIC ANALYSIS

●District Contact: Todd Tisdale/Jim Lane/Jorge Marban

1. OBJECTIVE: The objective of this project is to provide hydrologic analysis needed to develop a water management plan for the Lake Istokpoga and the Indian Prairie Basin which will improve flood control and water supply, and promote ecological enhancement.
2. DISTRICT NEED AND USE: This project will provide information to develop a management plan for the basin in response to concerns from Highlands County and the Save Lake Istokpoga Committee about the conditions in Lake Istokpoga and the Indian Prairie Basin.
3. SCOPE: The scope of this project is
 - a. To conduct hydrologic routings of Lake Istokpoga under proposed regulation schedules to evaluate water supply and flood control capabilities of these schedules.
 - b. To complete hydrologic analysis of the Indian Prairie Basin in compliance with requirements of the agreement with the Seminole Tribe of the Brighton Reservation.
 - c. To evaluate the feasibility of installing a structure in the Istokpoga Canal, compatible with the previously planned COE structure S-66, in order to improve flood protection to the areas surrounding the lake. This could also increase the possibility of increasing the maximum of the lake regulation schedule.
 - d. To conduct hydrologic routings to evaluate possible design scenarios for the water supply augmentation pump in the C-40 basin to develop preliminary design for a pump station adjacent to S-72 and to complete additional analysis of the pump station proposed for the C-41 basin as might be required.
4. SCHEDULE:
 - a. Conduct hydrologic routings of proposed regulation schedule changes in Lake Istokpoga - 1st Qtr 88-89
 - b. Complete hydrologic analysis of the water allocation estimates to the Brighton Reservation - 1st Qtr 88-89
 - c. Develop feasibility analysis and preliminary design of S-66 in the Istokpoga Canal - 1st Qtr 89-90
 - d. Conduct hydrologic routing and develop preliminary design of water supply augmentation pump adjacent to S-72 - 1st Qtr 89-90
5. PROGRESS TO DATE: This is a new project, although some work was completed during fiscal year 87/88 on items 3a and b.
6. PRODUCTS:
 - a. Technical report on water allocation
 - b. Preliminary design of pump adjacent to S-72

- c. Preliminary design of levee improvements in the southeast shore of Lake Istokpoga.
- d. Preliminary design of structural improvements in the Istokpoga canal.

LAKE ISTOKPOGA WATER QUALITY MONITORING PROGRAM

•District Contact: Lorraine L. Janus

1. OBJECTIVES: The objectives of this project are to document the present water quality of the lake, determine water quality trends, and establish an acceptable nutrient loading limit to prevent excessive eutrophication.
2. DISTRICT NEED AND USE: This project evaluates current water quality conditions of Lake Istokpoga and collects information for development of management options for the prevention of excessive eutrophication. District monitoring has allowed us to document the effects on water quality of the Highlands County Hydrilla treatment.

The reference standards that will be constructed from these data will also prove useful for making predictions and decisions for other south Florida lakes where few data exist.

3. SCOPE: Monthly water quality monitoring is conducted in the lake and at major inflows and outflows. This monitoring project began in February 1988 and will continue for at least three years. Nutrient concentrations will be combined with discharge data collected under the WUMP plan to construct nutrient budgets for the lake. Eutrophication models will be used to establish acceptable nutrient loading limits. The final product of this project will be a technical publication summarizing the findings with a recommendation for maximum allowable nutrient loading limit.
4. SCHEDULE: Two interim reports which summarize the data collections for each year will be produced and a final report which evaluates the total data set will be written.
 - a. 4th Quarter FY 88-89:
 1. Interim report (February 1988 to January 1989 data summary).
 - b. 4th Quarter FY 89-90:
 2. Interim report (February 1989 to January 1990 data summary).
 - c. 4th Quarter FY 90-91:
 3. Technical publication for all three years providing data summary, nutrient budgets, and application of eutrophication models appropriate to determine acceptable nutrient loading rates.
5. PROGRESS TO DATE: This project began in FY 87-88. The project design was completed in January 1988 and water quality monitoring (i.e. field sampling) was initiated in February. A preliminary evaluation of initial water quality results was written, and a Project Quality Assurance Plan was completed in April 1988.
6. PRODUCTS:
 - a. 4th Quarter FY 90-91:
 1. Technical publication to summarize all three years of data collection, nutrient budgets, application of eutrophication models to determine

critical nutrient loading rates, and management recommendations specifically for Lake Istokpoga.

SURFACE WATER USE PLAN FOR THE INDIAN PRAIRIE BASIN

●District Contact: Shawn Sculley

1. **OBJECTIVE:** This project is part of the District's larger initiative to develop water use management plans for all basins in the District. This project deals specifically with surface water availability in the Indian Prairie basin. It has two objectives: (a) To estimate the surface water available in the Indian Prairie basin under a variety of rainfall conditions. (These estimates will be used to improve the basis of review for water use permitting.) (b) To evaluate various alternatives for augmenting surface water supply to the Indian Prairie basin.
2. **DISTRICT NEED AND USE:** The District needs this project to develop improved permitting and allocation criteria. The results of this project will directly benefit the residents, growers, and industries of the Indian Prairie basin by providing a basis for an equitable distribution of limited surface water resources, and by identifying the best alternatives for augmenting surface water supply to this basin.
3. **SCOPE:** The tasks to be completed as part of this project are to:
 - a. Assess available hydrologic data.
 - b. Develop a methodology to determine surface water availability in the basin.
 - c. Estimate and analyze the surface water available for various rainfall conditions under current management practice: (1) Estimate the surface water availability in the Indian Prairie basin in years of normal and in 1-in-5 below normal rainfall, and other drought conditions. (2) Quantify water shortages and their frequency. (3) Develop criteria for defining water shortage conditions.
 - d. Evaluate various surface water related augmentation alternatives. Alternatives may include: (1) A change in management of the system. (2) An increase in canal conveyance. (3) Evaluation of proposed low volume water supply augmentation pumps. (4) Storage reservoirs within the basin.
 - e. Document results of the estimations and evaluations detailed above.
4. **SCHEDULE:** This project began in 1988 and is scheduled to be completed in October 1989. This schedule is consistent with the District's objectives of having a draft basis of review by January 1990 and rule making by July 1990.
 - a. Establish methodology for determining surface water availability in the basin - 3rd Qtr 87-88
 - b. Complete estimation of the surface water available for various rainfall conditions - 3rd Qtr 87-88
 - c. Complete evaluation of surface water supply augmentation alternatives - 1st Qtr 88-89
 - d. Complete criteria for defining water shortage conditions in the basin 2nd Qtr 88-89.
5. **PROGRESS TO DATE:** Available hydrologic data have been assessed. Two hydrologic models (Creams-WT and Seasonal Water Balance Model) for determining surface water availability in the basin have been investigated. Estimates of surface water availability have been made.

6. PRODUCTS:

Documentation of the following: (a) Estimates and analysis of the surface water available in the Indian Prairie basin for various rainfall conditions. (b) Evaluations of various water augmentation alternatives.

UPPER EAST COAST

GENERATION OF "CAPTURE ZONES" FOR SELECTED WELLFIELDS IN MARTIN COUNTY

●District Contact: Jose A. Alvarez and Philip K. Fairbank

1. **OBJECTIVE:** The first objective of this study is to generate capture zones using an interactive Ground Water Flow Path Analysis (GWPATH), which reflects time of travel for two of the existing major wellfields in Martin County. Capture zones refers to areas surrounding a production well from which the production well derives water.

The second objective is to provide a comparison between a numeric and analytic time-of-travel solution for one of the major wellfields in Martin County. The purpose for this comparison is to investigate the possibility of generating wellfield protection capture zones based on an analytical solution when a numeric approach is not feasible.

2. **DISTRICT NEED AND USE:** The identification of capture zones represents an acceptable means of defining regulation zones for the purpose of wellfield protection. "Capture Zones" generated via GWPATH will provide a quick, cost-effective and technically sound approach to the implementation of wellfield protection.

3. **SCOPE:** This work will be completed in four phases.

Phase I: The first phase will entail the compilation of hydrogeologic information which will enable the two dimensional discretization of hydraulic head (water level) and hydraulic conductivity data for all major wellfields throughout Martin County.

Phase II: The second phase will consist of modeling using GWPATH to delineate the production well "Capture Zones" for given times-of-travel for seven of the wellfields within Martin County.

Phase III: The third phase will compare calculated times-of-travel between numeric and analytic solutions for a given wellfield.

Phase IV: This phase will include the completion of the final report summarizing the results of this project.

4. **SCHEDULE:**

- a. 4th Quarter FY 88-89:
 1. Complete 2-D mapping of water table levels and hydraulic conductivity for seven major wellfields within Martin County.
- b. 1st Quarter FY 89-90:
 1. Completion of wellfield modeling via the use of GWPATH.
- c. 2nd Quarter FY 89-90:
 1. Comparison of numeric versus analytically generated wellfield protection capture zones.
- d. 4th Quarter FY 89-90:
 1. Final Report.

5. PROGRESS TO DATE: Proceeding with preliminary data acquisition initiated in FY 87-88.

6. PRODUCTS:

a. 2nd Quarter FY 89-90:

1. The generation of Technical Report of "Capture Zones" for seven major production wells identified in Martin County.

LOXAHATCHEE RIVER/SLOUGH RESTORATION PROJECT

●District Contact: Dewey Worth

1. **OBJECTIVE:** The objective of this project is to implement a comprehensive management plan which has been developed to direct restoration efforts and management of the Loxahatchee River system. Restoration efforts include: 1) increasing the duration of freshwater flows to the northwest fork of the river, 2) reduce discharges to the Loxahatchee estuary via S-46, 3) restore the functional role of the Loxahatchee Slough as the headwaters of the river, and enhance surface water resources for the basin, and 4) enhance and protect water quality in the basin.
2. **DISTRICT NEED AND USE:** The District has been given major responsibilities for the restoration and management of the Loxahatchee River and Slough as specified in the Loxahatchee River Wild and Scenic Management Plan, adopted by the Governor and Cabinet. Information obtained under this project will be used to develop restoration and management guidelines that are compatible with the preservation/enhancement of the river and slough.
3. **SCOPE:** Four projects are identified in FY 1988-89 as contributing towards the overall program goals:
 - 1) Environmental Investigations in the Loxahatchee River Corridor and Slough
 - 2) Loxahatchee Estuary Dynamics
 - 3) Loxahatchee Estuary Biological Studies
 - 4) Surface water hydrology
 Each contributes key information which is used in conjunction with the other programs to assess changes caused by management alternatives, or provide for simulation of hydrologic events in order to predict environmental changes.
4. **SCHEDULE:**
 - a. Coordinate project restoration efforts (1st - 4th Q FY88/89)
 - b. Continue routine water quality/hydrology sampling (1st - 4th Q FY88/89)
 - c. Draft technical publication on vegetation/hydrology (4th Q FY88/89)
 - d. Contract installation of salinity monitoring station (4th Q FY88/89)
5. **PROGRESS TO DATE:** This is a continuing project initiated in 1984.
6. **PRODUCTS:** Technical Publications concerning the river ecology and a database of water quality and hydrology. Assessments will also be made of various design and management alternatives to enhance Loxahatchee River base flows and preservation/restoration of the Loxahatchee Slough.

LOXAHATCHEE ESTUARY DYNAMICS

●District Contact: P. D. Scarlatos

1. **OBJECTIVE:** The objective of this project is to develop mathematical models for comparing the hydrodynamic and salinity effects in the Loxahatchee River estuary, based on alternative discharge scenarios. The models will be used for management purposes.
2. **DISTRICT NEED AND USE:** The historic pattern of salinity distribution within the Loxahatchee River estuary has been altered by human interference. As a result, the historical habitats are under stress. Assessment of the impact of freshwater inflows in the Loxahatchee estuary can be successfully accomplished by means of mathematical simulation. The models to be developed by this project will provide a predictive tool for estimation of the hydrodynamics and salinity levels within the estuary. This information is necessary for management and operational decisions regarding environmental restoration.
3. **SCOPE:** The modeling effort will include application of the inhouse one-dimensional hydrodynamic models (e.g. Caloosahatchee hydrodynamics model) and development of other appropriate models for quantification of the two-dimensional density stratification effects. Specific tasks of this project include:
 - a. Interaction with Environmental Sciences Division to establish specific modeling needs.
 - b. Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.
 - c. Model development, calibration, verification and application.
 - d. Suggestion of freshwater baseflow and pulse discharges for ecological enhancement.
4. **SCHEDULE:**
 - a. Complete data collection and analysis - 1st Qtr 88-89
 - b. Application and verification of one-dimensional modeling - 3rd Qtr 88-89
 - c. Complete development of specialized model(s) for simulation of the vertical salinity stratification - 3rd Qtr 88-89
 - d. Preliminary analysis of regulated freshwater baseflow and pulses - 4th Qtr 88-89
5. **PROGRESS TO DATE:** Preliminary investigation started in FY 87-88.
6. **PRODUCTS:** The final product at the end of the FY 88-89 will be a report including the following:
 - a. Preliminary rainfall-runoff analysis to be utilized for specification of the boundary conditions.
 - b. Calibration, verification and application of the one-dimensional model of the Loxahatchee River estuary hydrodynamics and salinity distribution.

- c. Development of specialized model(s) for simulation of the behavior and effects of the vertical salinity stratification.

LOXAHATCHEE RIVER BASIN STUDY

●District Contact: Steve Lin

1. **OBJECTIVE:** The object of this project is to provide basin hydrologic and hydraulic modeling of the Loxahatchee River basin which covers the C-18 basin, the South Indian River Water Control District (SIRWCD), the Cypress Creek basin, the Kitching Creek basin, and North Fork basin. The major components will include estimates of surface runoff under current and projected land use, surface water management criteria to enhance river flows, and basin storage.
2. **DISTRICT NEED AND USE:**
 - a. The surface water management criteria developed from this study will provide a basis for permitting of future development in this basin by the Surface Water Management Division, Dept. of Resource Control.
 - b. The hydrologic and hydraulic analysis will provide data support for the Loxahatchee River Restoration Project and related estuary program.
3. **SCOPE:**
 - a. Model development: The scope of this task is to develop and test hydrologic simulation models for use in the basin studies which are appropriate for south Florida conditions and are sensitive to management practices.
 - b. C-18 basin - the scope of work is:
 - 1) To provide additional hydrologic and hydraulic information for the application of the proposed 300 cfs pump station to divert storm runoff from SIRWCD into the C-18 basin, and the proposed new C-18 water control structure to enhance the Loxahatchee slough.
 - 2) To provide runoff information required by the Loxahatchee River Estuary Model.
 - c. Cypress Creek Canal basin - the scope of work is:
 - 1) To complete an evaluation of design profiles, discharge limitations for each subbasin, flood stages, and recommend a set of surface water management criteria for the future development of the basin.
 - 2) To analyze the drainage capability and retention requirements for Pal Mar Drainage District.
 - 3) To provide runoff information for the Loxahatchee River Estuary model for modeling downstream impacts resulting from watershed management action or land use changes in the basin.
 - d. Kitching Creek basin - the scope of work is:
 - 1) To update the drainage basin boundary and continue rainfall and runoff monitoring at present levels.
 - 2) To provide hydrologic and hydraulic support for the Loxahatchee River Restoration Project.
 - 3) To perform a rainfall-runoff study and provide surface water runoff information to the Loxahatchee River Estuary model.
 - 4) To develop surface water management criteria for the future development of the basin.

- e. North Fork basin - The scope of work is:
- 1) To perform a rainfall-runoff study and provide storm runoff characteristics to the Loxahatchee River Estuary model.
 - 2) To provide hydrologic and hydraulic support for the study of the Loxahatchee River Restoration Project.

4. SCHEDULE:

- a. Cypress Creek basin:
 - Development of flood management criteria - 3rd Qtr 88-89
 - Complete draft of report - 1st Qtr 89-90
 - Complete evaluation of Pal Mar retention/detention - 2nd Qtr 88-89
 - Complete first draft report - 3rd Qtr 88-89
- b. Kitching Creek basin:
 - Basin boundary delineation - 2nd Qtr 88-89
 - Complete rainfall-runoff analysis - 3rd Qtr 88-89
 - Complete model application - 3rd Qtr 88-89
 - Complete documentation of results - 4th Qtr 88-89
- c. North Fork basin:
 - Complete rainfall-runoff analysis - 3rd Qtr 88-89
 - Complete model applications - 4th Qtr 88-89
 - Complete documentation results - 4th Qtr 88-89

5. PROGRESS TO DATE:

- a. Continuous hydrologic simulation versions of the CREAMS-WT model were evaluated in FY 87-88. CREAMS-WT was developed as a tool for evaluating the effectiveness of alternative management practices in reducing nonpoint pollution. The model uses physically-based parameters that can reflect changes in management systems or land use changes, and this model was developed for flat, high water table watersheds existing in south Florida. This model has been selected for this study in those basins subject to future development.
- b. C-18 basin. Evaluation of the proposed structures in C-18 basin to restore and enhance the Loxahatchee River slough has been completed and the District is ready to proceed with its permit application to DER and the Corps of Engineers.
- c. Cypress Creek Canal basin. Channel cross sections and storage parameters of the existing system were collected and analyzed during fiscal year 87-88; however, the collection of topographic data is underway and will not be available until the end of the second quarter of FY 88-89. The hydrologic data for the basin are being collected and processed under the General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Programs to support this project. A study similar to the C-18 basin study will be completed to determine the discharge limitations and degree of flood protection of the existing system.
- d. Kitching Creek basin. Limited topographic data is available for this basin, a stream gage and rainfall recorder has been installed by USGS. The hydrologic data from the General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Programs will be analyzed and a rainfall-runoff model will be developed to provide surface water information under present conditions. Approximately 50% of the basin is currently within the Jonathan Dickinson State Park. Surface water management criteria will be developed for the portion of the basin under private ownership to preserve the present quality of the system.

- e. North Fork basin: Most of this basin is within Jonathan Dickinson State Park. Limited topographic information is available.

6. PRODUCTS:

- a. C-18 basin: (1) Information required by the permit application, (2) runoff information required by the Loxahatchee River Estuary model.
- b. Cypress Creek Canal basin: (1) Report including design backwater profiles, discharge limitations, allowable discharges, and retention requirements, (2) runoff information required by the Loxahatchee River Estuary model.
- c. Kitching Creek basin: (1) Surface water management criteria for the basin under private ownership, (2) runoff information required by the Loxahatchee River Estuary model.
- d. North Fork basin: Runoff information required by the Loxahatchee River Estuary model.

ENVIRONMENTAL INVESTIGATIONS IN THE LOXAHATCHEE RIVER CORRIDOR AND SLOUGH

● District Contact: Dewey Worth

1. OBJECTIVE: The objective of this project is to collect and evaluate baseline information concerning the status of plant communities, surface water quality and related hydrology characteristics of the Loxahatchee River Corridor and Slough.
2. DISTRICT NEED AND USE: The District has been given major responsibilities for the restoration and management of the Loxahatchee River and Slough as specified in the Loxahatchee River Wild and Scenic Management Plan, adopted by the Governor and Cabinet. Information obtained under this project will be used to evaluate and monitor success of restoration efforts.
3. SCOPE: Floodplain vegetation and soil data were collected from 1984-1986, hydrology data and water quality began in 1985 and has continued throughout the program. In FY88/89, a draft technical publication will be completed describing the vegetation and hydrology relationships within the river corridor. A low level effort will be continued to monitoring hydrology and water quality of the river and slough. Included in this effort will be the installation of a continuous salinity recorder within the river corridor that will constantly transmit data to District operations office. Technical review and evaluation of conceptual management designs will also be continued under this project.
4. SCHEDULE:
 1. Coordinate project restoration efforts (1st - 4th Q FY88/89)
 2. Continue routine water quality/hydrology sampling (1st - 4th Q FY88/89)
 3. Draft technical publication on vegetation/hydrology (4th Q FY88/89)
 4. Contract installation of salinity monitoring station (4th Q FY88/89)
5. PROGRESS TO DATE: This is a continuing project initiated in 1984. A monitoring network and field collection schedule has been previously established. All field sampling related to water quality, hydrology and salinity monitoring is current. Analysis of vegetation/hydrology data has begun.
6. PRODUCTS: Two Technical Publications are planned concerning the river ecology and a database of water quality and hydrology. Assessments will also be made of various design and management alternatives to enhance Loxahatchee River base flows and preserve/restore the Loxahatchee Slough.

LOXAHATCHEE ESTUARY

●District Contact: Robert Chamberlain

1. **OBJECTIVE:** The primary objective of this project is to evaluate the environmental impacts to the Loxahatchee Estuary, if any, that results from diverting more water down the Northwest Fork from the Loxahatchee River Basins as part of the Loxahatchee River Restoration effort. Diversion of water to the Northwest Fork of the Loxahatchee River is planned to protect and enhance the natural environmental qualities of the Northwest Fork. The effects of this increase flow to the Northwest Fork and eventually the Loxahatchee Estuary are unknown.

The secondary objective of this project is to assist the program by providing information regarding basin retention requirements of storm water. Increased urban development surrounding the estuary and within the Loxahatchee River/C-18 basin influences the estuary during storm events by allowing storm water to prematurely reach the tidal river. Therefore this project seeks to provide: a.) quantitative baseline information for evaluating the impacts from diversion of water to the Northwest Fork by data collection and analysis prior to diversion. b.) information that will help determine the retention requirements for development within the basin by conducting additional storm event sampling in the estuary.

2. **DISTRICT NEED AND USE:** The Loxahatchee Estuary, particularly the Northwest Fork is one of the last natural river and swamp systems on the east coast of Florida. In keeping with the District's mission statement of environmental protection, the District, along with the Department of Natural Resources and other governmental agencies, took action through state and federal legislation that resulted in the Loxahatchee being declared a National Wild and Scenic River. A comprehensive management plan has been developed to direct restoration efforts and management of the river system of which the District has a major responsibility. This project was required to evaluate the estuarine impacts, if any, that results from diverting more water down the Northwest Fork as part of this restoration effort and will assist in establishing an environmentally sensitive estuarine management plan that can be integrated with the Loxahatchee River Restoration Effort. In addition, the information gained from this project has, and probably will continue to, assist this agency and others when evaluating proposals for development and dredging in and around the estuary.
3. **SCOPE:**
 - a. Completion of ichthyoplankton and zooplankton samples identified by the contractor that were not completed in FY 87-88.
 - b. Conduct storm event sampling if a storm of significant magnitude occurs. Intense sampling will require 1-2 months and additional time to complete analysis. The time required to do this task may preempt and delay all other tasks.
 - c. Complete analysis of all biological field data collected as part of routine sampling.
 - d. Submit for review the first draft of District Technical Publication that reports the results of the baseline biological sampling.

4. SCHEDULE:
 - a. Complete the processing of remaining samples (identification and data entry), both in house and the samples that are the responsibility of the contractors. (1st Q FY 88-89)
 - b. Complete data analysis. (3rd Q FY 88-89)
 - c. First draft of Technical Publication. (4th Q FY 88-89)

5. PROGRESS TO DATE:
 - a. Routine baseline sampling was terminated in January 1988 after two years of data collection which included zooplankton, ichthyoplankton, benthic invertebrates, water quality, and seagrass.
 - b. Contract # 708 was executed and ichthyoplankton plus zooplankton sample identification was begun. Ninety percent of the samples of this type should be completed by end of FY 87-88.
 - c. All the animals have been identified in the benthic macroinvertebrate samples through a contract.
 - d. Literature research, data compilation and analysis was begun.

6. PRODUCTS: Project analysis of baseline information and first draft of resulting Technical Publication is scheduled for completion in September 1989 unless a major storm event occurs that would require additional sampling which would delay the writing.

INDIAN RIVER DYNAMICS

●District Contact: P. D. Scarlatos

1. OBJECTIVE: The objective of this project is to collect and analyze data related to sedimentation problems in Manatee Pocket, Indian River.
2. DISTRICT NEED AND USE: The Indian River Lagoon has been identified as a high priority area for reasearch by the SWIM legislation. Manatee Pocket has long been considered an area of regional water quality concern, due to degraded water quality and unconsolidated bottom sediments, associated with concentrations of heavy metals. Quantification of this problem will help the District to develop a stormwater management system and to design and implement BMP's for commercial and marine interests.
3. SCOPE: The scope of this project is to analyze and study the Manatee Pocket hydrodynamics and sedimentation. Specific tasks of the project will involve:
 - a. Analysis of existing data regarding ambient water quality, land uses, and sedimentation problems.
 - b. Collection of tidal data at the southern portion of the Indian River.
4. SCHEDULE:
 - a. Critical review and analysis of existing data regarding problematic area within Manatee Pocket - 3rd Qtr 88-89
 - b. Tidal data collection in the southern portion of the Indian River- 4th Qtr 88-89
5. PROGRESS TO DATE: This is a new project.
6. PRODUCTS: Brief report summarizing the finding of the data analysis.

SWIM MANAGEMENT PLANS -- INDIAN RIVER LAGOON

●District Contact: Joel A. VanArman

CONTRACT REFERENCES: Water Quality Monitoring Network for Martin and St. Lucie Counties

1. OBJECTIVE: The primary objective of this project is to update the Interim Surface Water Improvement and Management (SWIM) Plan for Indian River Lagoon as specified in the SWIM legislation and in order to protect the natural resources of the Lagoon. This project will also provide technical support for contracts managed by the Office of Resource Assistance and the Indian River Lagoon water quality monitoring contract, which will provide for a long term water quality data base to track the overall health of the Lagoon.
2. DISTRICT NEED AND USE: This project is required to meet the mandates of the SWIM legislation. In addition, development of subsequent versions of this plan will allow for resource management planning for Indian River Lagoon on a continuing basis.
3. SCOPE: The Interim SWIM plan for the Indian River Lagoon identifies a number of ongoing programs and projects that will continue during FY 88-89 within the Lagoon. The SWIM plan will be updated to reflect any new programs, projects, and management strategies that are identified for the Indian River Lagoon based on additional data or policy changes. Project SI51 consists of updating the interim management plan, reviewing and designing contractual studies, identifying new projects for the FY 90-91 SWIM budget and beyond. This project also provides technical and managerial support for the Indian River Lagoon water quality monitoring contract, including periodic water and sediment sampling in Martin and St. Lucie Counties, turbidity studies, and new contractual studies to be defined by the planning process.
4. SCHEDULE: This is the second year of a continuing project. The SWIM plan for Indian River Lagoon will be updated on an annual basis according to the following schedule for FY 88-89.
 - a. 4th Quarter FY 88-89:
 1. The interim plan is to be revised by September 30, 1989, and will include a proposed budget and projects for FY 90-91.
 - b. Continuing Basis:
 1. A contractor will provide monitoring of the Indian River Lagoon on a monthly basis.
5. PROGRESS TO DATE: The SWIM plan for the Indian River Lagoon was developed as a joint publication of the South Florida Water Management District and the St. Johns River Water Management District during FY 87-88, and was adopted by the SFWMD Governing Board in September 1988. A number of contractual projects, managed within both this Division and within the Office of Resource Assistance, have been initiated in the Lagoon based on this plan and are currently underway. A contract for the water quality monitoring project was approved by the SFWMD Governing Board in September 1988 and is currently underway.

ST. LUCIE ESTUARINE MANAGEMENT

●District Contact: Daniel E. Haurert

1. OBJECTIVE: The goal of this project is to provide a biological basis for management decisions concerning freshwater discharges to the estuary by determining ecological responses to various inflow regimes.
2. DISTRICT NEED AND USE: The District is committed to develop biologically sensitive water management plans for South Florida estuaries that are affected by flood control practices. Adverse environmental conditions in the St. Lucie estuary occur when regulatory freshwater releases from Lake Okeechobee provide too much water to the estuary and when spring surface water runoff into the estuary is severely reduced by water demands.
3. SCOPE: A St. Lucie Estuary Management Plan (SLEMP) was developed to address environmental problems associated with reduced runoff to the estuary during the spring of the year. Results from extensive environmental monitoring during the spring of 1987 and 1988 will aid in further refinement of SLEMP and assist in the determination of how to best utilize the St. Lucie Estuary hydrodynamic/salinity computer model for real-time management. SLEMP will again be implemented in the spring 1989. Two other projects will provide input to this project, allowing biological data to be assessed with a user-friendly version of a salinity-hydrodynamic model to simulate specific events.
4. SCHEDULE:
 - A. Request to implement SLEMP to Corps of Engineers and obtain final approval 2nd Q FY 88-89.
 - B. Complete report on results of 1987 and 1988 SLEMP investigation 4th Q FY 88-89.
 - C.
5. PROGRESS TO DATE: This is a continuing project utilizing all previously collected biological data and a computer model to develop water management options for the estuary. Biological and engineering studies of the St. Lucie estuary have resulted in five technical publications (TP 80-3, 85-1, 86-4, 87-1, and 88-10) and a draft water management plan (SLEMP) that is under revision. SLEMP was first implemented from April through July, 1987 and again with modifications in 1988. SLEMP provides a water management strategy to increase productivity and improve utilization of the inner estuary by juvenile fishes and invertebrates by supplementing freshwater to the estuary in the spring months.
6. PRODUCTS: The major products produced by this project for FY 88-89 include:
 - a. Documents from COE permitting SLEMP during 1989.
 - b. Report: The Effects of Pulse Discharges (SLEMP 1987 and 1988) on the Biota of the St. Lucie Estuary.

ST. LUCIE ESTUARY DYNAMICS

●**District Contact:** Charles Gove

1. **OBJECTIVE:** The objective of this project is to develop, implement, and document a computer model for simulating hydrodynamics and salinity in the St. Lucie Estuary.
2. **DISTRICT NEED AND USE:** The interest in numerically simulating discharge conditions is to forecast salinity concentrations in the estuary and manipulate the freshwater flood control discharges to control the longitudinal salinity gradients. Effective management of salinity will improve water quality and recreational opportunities in the St. Lucie Estuary for residents of the District. End users of the St. Lucie Estuary Computer Model include: (a) Jacksonville Corps of Engineers, (b) Governing Board and executive office, (c) Resource Operations Department for management of flood control discharges to the St. Lucie Estuary, and (d) Environmental Sciences Division for evaluating alternative discharge scenarios in future studies.
3. **SCOPE:** Specific tasks for this project include:
 - a. Incorporate animated graphical simulation routines into the St. Lucie Estuary Computer Model (SLECM).
 - b. Development of user-friendly procedures through computer programming to expand the audience of users of the St. Lucie Estuary Computer Model (SLECM).
 - d. Documentation of the SLECM through a user's manual to provide the guidelines needed for operating the model.
 - e. Technical publication of the St. Lucie Estuary Demonstration Project documenting utilization of the St. Lucie Estuary Computer Model (SLECM).
4. **SCHEDULE:**
 - a. Bathymetry of the St. Lucie Estuary, TP 86-4 completed - 4th Qtr 85-86
 - b. Modeling of Hydrodynamics and Salinity in the St. Lucie Estuary Model, TP 87-1 completed - 2nd Qtr 86-87
 - c. Complete SLECM users manual - 4th Qtr 88-89
 - d. Complete report on model utilization: St. Lucie Estuary Demonstration Project - 1st Qtr 89-90
 - c. Incorporation of animated graphical output into the SLECM - 3rd Qtr 88-89
 - f. Complete development of user-friendly coding for the SLECM - 4th Qtr 88-89
5. **PROGRESS TO DATE:** The St. Lucie Estuary Computer Model (SLECM) was calibrated and verified in 1986, and used in a salinity control demonstration from April through July 1987. Two reports have been completed to date: T.R. 86-4 Bathymetry of the St. Lucie Estuary, and T.R. 87-1 Modeling of Hydrodynamics and Salinity in the St. Lucie Estuary Model.
6. **PRODUCTS:**
 - a. St. Lucie Estuary Computer Model (SLECM) user's manual.
 - b. Report on SLECM simulations for St. Lucie Estuary Demonstration Project.
 - c. St. Lucie Estuary Computer Model (SLECM) featuring user-friendly operation and animated graphical output.
 - d. Evaluation and analysis of proposed water management strategies to enhance environmental conditions in the St. Lucie Estuary.

ST. LUCIE CANAL WATER QUALITY DATA COLLECTION

●District Contact: Larry V. Grosser

1. **OBJECTIVE:** The objective of this project is to collect surface water quality data in the St. Lucie Canal (C44) and its major inflows in order to characterize the water quality of the major inflows and to rank the tributaries as to their relative contribution to the canal's siltation problems.
2. **DISTRICT NEED AND USE:** The project is needed to provide data as to the contributions of copper, zinc and suspended solids from the St. Lucie Canal to the estuary. The District is studying the environmental impact of freshwater releases from Lake Okeechobee and the C44 drainage basin into the St. Lucie River estuary. Of particular interest will be the contribution of copper and zinc from adjacent agricultural operations and the quantity of suspended solids delivered through S80 which could cause siltation downstream.
3. **SCOPE:** Mid-canal samples will be taken at the beginning and end of the canal (S80 and S308C) and at four intermediate locations at five mile intervals. There will also be four major inflow stations which are sampled upstream of their discharge point. An additional 20 to 25 inflows will be screened on each trip by sampling for physical parameters. If the conductivity exceeds 1,000 umhos/cm or if there is visible turbidity at any of these inflows, then a water sample will be taken. There will also be five quality control samples taken on each trip as part of the District Quality Assurance (QA) program. A refrigerated automatic water sampler will be placed on the upstream side of S80 for the collection of weekly samples during times of peak discharge. A refrigerated automatic wet/ dry precipitation collector will be placed at S80. Two samples will be collected weekly and will become part of the Water Quality Division's Rainfall Monitoring Program (RAIN). It is anticipated that this project will be a long term monitoring effort.
4. **SCHEDULE:** Bi-weekly sampling began on this project in June of 1988. A total of 15 to 20 samples will be submitted to the Water Chemistry Laboratory depending on flow conditions.
 - a. 1st Quarter FY 88-89:
 1. An automatic sampler will be installed at S80.
 2. An automatic precipitation collector will be installed at S80.
 3. St. Lucie Canal Quality Assurance Document will be completed.
 - b. 2nd Quarter FY 89-90:
 1. Data report of first year of collection.
5. **PROGRESS TO DATE:** This is a new project which began in June of this year.
6. **PRODUCTS:**
 - a. 3rd Quarter FY 88-89: St. Lucie Canal QA Plan.
 - b. 3rd Quarter FY 89-90
 1. Data report of first year of collection.
 2. St. Lucie Canal QA Systems Audit.

SURFACE WATER USE PLAN FOR C-23, C-24, AND C-25 BASINS

●District Contact: Richard Cooper/Shawn Sculley

1. **OBJECTIVE:** This project is part of the District's larger initiative to develop water use management plans for all basins in the District. This project deals specifically with surface water availability in the C-23, C-24, and C-25 basins. It has two objectives: (a) To estimate the surface water available in the C-23, C-24, and C-25 basins under a variety of rainfall conditions. (These estimates will be used to improve the basis of review for water use permitting.) (b) To evaluate various alternatives for augmenting surface water supply to the C-23, C-24, and C-25 basins.
2. **DISTRICT NEED AND USE:** The District needs this project to develop improved permitting and allocation criteria. The results of this project will directly benefit the residents, growers, and industries of the C-23, C-24, and C-25 basins (i.e., St. Lucie County and northern Martin County) by providing a basis for an equitable distribution of limited surface water resources, and by identifying the best alternatives for augmenting surface water supply to these basins.
3. **SCOPE:** The tasks to be completed as part of this project are to:
 - a. Assess available hydrologic data.
 - b. Develop a methodology to determine surface water availability in the three basins.
 - c. Estimate and analyze the surface water available for various rainfall conditions under current management practice: (1) Estimate the surface water availability in the C-23, C-24, and C-25 basins in the years of normal rainfall as well as in 1-in-3, 1-in-5, and other drought conditions. (2) Quantify water shortages and their frequency. (3) Develop criteria for defining water shortage conditions.
 - d. Evaluate various surface water related augmentation alternatives. Alternatives may include: (1) A change in management of the system. (2) An increase in canal conveyance. (3) The Taylor Creek-Nubbin Slough diversion reservoir presently under design by the COE. (4) Storage reservoirs within the basins.
 - e. Write a report presenting the results of the estimations and evaluations detailed above.
4. **SCHEDULE:** This project began last fiscal year and is scheduled to be completed in October 1989. This schedule is consistent with the District's objectives of having a draft basis of review by January 1990 and rule making by July 1990.
 - a. Establish methodology for determining surface water availability in the basins - 1st Qtr 88-89
 - b. Complete estimation of the surface water available for various rainfall conditions - 1st Qtr 88-89
 - c. Complete evaluation of surface water supply augmentation alternatives - 3rd Qtr 88-89
 - d. Complete criteria for defining water shortage conditions in the basins - 4th Qtr 88-89
 - e. Publish final report - 1st Qtr 89-90

5. PROGRESS TO DATE: Available hydrologic data have been assessed. Two hydrologic models (Creams-WT and Seasonal Water Balance Model) for determining surface water availability in the basins are being investigated. Requests for information about land and water use in the basins have been submitted.

6. PRODUCTS:

A written report to include the following: (a) Estimates and analysis of the surface water available in the C-23, C-24, and C-25 basins for various rainfall conditions. (b) Evaluations of various surface water augmentation alternatives.

HYDROGEOLOGIC RECONNAISSANCE AND GROUND WATER RESOURCE ASSESSMENT OF THE SURFICIAL AQUIFER SYSTEM OF ST. LUCIE COUNTY, FLORIDA

●District Contact: Don G. J. Padgett

CONTRACT REFERENCES: Specialized drilling services will be contracted out for aid in sample collection. These services are described under Well Drilling Geophysics, Hydrogeologic Field Support Program.

1. **OBJECTIVE:** The objective of this project is to perform a hydrogeologic assessment of the Surficial Aquifer System in St. Lucie County and develop a three-dimensional ground water flow model of that system which will be capable of predicting the effects of current and future water use and management on the water resources of the county.
2. **DISTRICT NEED AND USE:** The District needs the assessment and three-dimensional ground water flow model to evaluate the condition of water resources in St. Lucie County to determine long-term availability of the resources and to manage the most effective development of the resources. The model will be used to perform cumulative water use impact assessments for water use allocation and water use management plans.
3. **SCOPE:** This project will be conducted in two phases: 1) hydrogeologic reconnaissance and 2) ground water flow model development. Completion of the hydrogeologic reconnaissance will require a review and evaluation of all existing data, selection and development of at least six Aquifer Performance Test (APT) sites, installation of more than 15 water table monitor wells, sample collection via specialized drilling services, collection and interpretation of data from the APT's, and finally, definition and mapping the thickness and extent of significant hydrogeologic units. Development of the ground water flow model will involve collection and evaluation of all available hydrologic data, development of a computer data base for each hydrologic system, concatenation and evaluation of selected water use, land use and water quality data, and discretization of the hydrogeologic system into model layers. The model will then be calibrated, documented and made available to water use allocation and water use management personnel. A final report presenting both the flow model and the results of the hydrogeologic reconnaissance will be the ultimate product of this project. The project is 2.5 years in duration beginning October 88 and ending with the publication of the final report in the 2nd quarter FY 90-91.
4. **SCHEDULE:**

Quarter 1, FY 88-89: Complete review of existing hydrogeologic data and select APT sites. Complete sample collection from and installation of five water level monitor wells.

Quarter 2, FY 88-89: Begin development of APT sites and collection of samples from dual case reverse air test wells. Complete sample collection from and installation of 10 more water level monitor wells.

Quarter 3, FY 88-89: Complete development of two APT sites. Complete collection of samples from dual cased test wells. Complete sample collection

from and installation of last water table monitor wells. Begin collection of all available data on hydrologic systems, including canals, water catchment areas, wetland areas, and other surface water bodies.

Quarter 4, FY 88-89: Complete development of two more APT sites. Begin examination, description and correlation of samples for definition of regional hydrogeologic zones. Begin evaluation of historical hydrologic data for selection of model calibration period.

FY 89-90: Complete a technical publication of results and findings of the reconnaissance study. Develop and calibrate the 3-dimensional model.

FY 90-91: Complete a technical publication of the results of the modelling study.

5. PROGRESS TO DATE: This is the first year of a 2.5 year project. The review of existing hydrogeologic data has begun. Selection of APT sites is underway.
6. PRODUCTS: The final products of this program will be: a new multizone water level monitoring network, a comprehensive computerized hydrologic data base, and a report which describes the hydraulic characteristics and the areal extent of hydrogeological zones within the Surficial Aquifer System in St. Lucie County and documents the three-dimensional ground water flow model required for cumulative impact assessment.

MARTIN COUNTY SURFICIAL AQUIFER SYSTEM THREE-DIMENSIONAL FLOW MODEL

●District Contact: Karin M. Adams

CONTRACT REFERENCES: Specialized drilling services will be contracted out for aid in sample collection. These services are described under Well Drilling Geophysics, Hydrogeologic Field Support Program.

1. **OBJECTIVE:** The objective of this project is to develop a three-dimensional ground water flow model for the Surficial Aquifer System in Martin County.
2. **DISTRICT NEED AND USE:** The three-dimensional flow model in its cumulative water use impact assessment format is needed for the water allocation process (Section 3.2, Volume III, Management and Water Use). The model will provide the ability to reliably allocate water based on resource availability and minimization of environmental impact.
3. **SCOPE:**
 - a. Gather data on existing ground water use.
 - b. Describe cuttings for new wells drilled for USGS water level network to determine hydrogeologic setting.
 - c. Update data from existing two-dimensional flow model (Martin County Water Resource Assessment, 1987).
 - d. Re-evaluate aquifer test data from various sources (private, USGS, SFWMD).
 - e. Re-run pump tests where practical, if necessary.
 - f. Discretize hydrogeologic system data into model layers.
 - g. Calibrate and document model.
 - h. Incorporate into cumulative impact model format.
4. **SCHEDULE:**

Quarter 1, FY 88-89: Re-evaluate existing aquifer test data. Complete data base of aquifer parameters to be used. Complete data base on Public Water Supply well construction information.

Quarter 2, FY 88-89: Describe cuttings. Develop geologic data base and add all available information. Begin re-running pump tests.

Quarter 3, FY 88-89: Complete re-running pump tests and analyzing results. Update water level information and create data files. Check validity of existing canal, rainfall, and evapotranspiration data bases from 2-D model.

Quarter 4, FY 88-89: Complete all necessary data bases. Begin creating Surfer contour maps of aquifer parameters, water levels, and geologic information.

FY 89-90: Test and calibrate the model; make predictive model runs; prepare a technical publication of the results of the modeling study.

FY 90-91: Convert model to cumulative impact format.
5. **PROGRESS TO DATE:**
 - a. Water use permits have been reviewed and put on base maps.
 - b. Existing literature has been collected.

- c. Existing pump test data have been collected.
 - d. Approximately half of the new water level monitor wells have been drilled and cuttings collected and split.
6. PRODUCTS: The final products are:
- a. A technical publication summarizing the results of the modeling study.
 - b. A completed model with documentation.
 - c. Software for using the model to make cumulative impact assessments.
 - d. A plan for periodic updating and enhancement of the flow model.

UPPER EAST COAST FLORIDAN AQUIFER THREE-DIMENSIONAL FLOW MODEL

●District Contact: Rick Bower

CONTRACT REFERENCES: Specialized drilling services will be contracted out for aid in sample collection. These services are described under Well Drilling Geophysics, Hydrogeologic Field Support Program.

1. **OBJECTIVE:** The objective of this project is to develop a three-dimensional ground water flow model for the Floridan Aquifer System in Martin and St. Lucie Counties.
2. **DISTRICT NEED AND USE:** A three-dimensional flow model to serve as the basis for a cumulative water use impact assessment model is needed for the water allocation process (Section 3.2, Volume III, Management of Water Use). In particular, this type of model is needed to evaluate water uses relative to the prohibition of pumps on Floridan wells in Martin and St. Lucie Counties (Section 3.2.2.4.9.2.) in more detail than can be done with the existing two-dimensional model.
3. **SCOPE:** To accomplish the project, it will be necessary to update the information base obtained for the development of the existing two-dimensional flow model. New geologic information will be included, and aquifer characteristics will be reevaluated. Test wells will be drilled, under contract, and aquifer tests performed. Using all of this information, the hydrogeologic system will be discretized into model layers. Water use permit information will be reviewed and summarized. The model will then be calibrated, documented, and incorporated into a cumulative impact model format. The project began during FY 87-88 and will be completed in FY 90-91.
4. **SCHEDULE:**
 - Quarter 1, FY 88-89: Develop the geologic data base and add all available information. Develop and update the water use permit data base.
 - Quarter 2, FY 88-89: Complete the contract negotiations for test well construction.
 - Quarter 3, FY 88-89: Complete the discretization of the hydrogeologic system into model layers.
 - Quarter 4, FY 88-89: Complete and test the wells drilled under contract. Complete aquifer characteristics reevaluation.
 - FY 89-90: Code and calibrate the three-dimensional model.
 - FY 90-91: Prepare a technical publication summarizing the results of the modelling study.
5. **PROGRESS TO DATE:** This is the first year of a 2.5 year project. However, as noted, a two-dimensional flow model and associated unpublished technical publication have been completed and will serve as an origin point. Additionally,

a study to determine safe casing depth for Floridan aquifer wells provides additional hydrogeologic information.

6. PRODUCTS: The final products are the completed model, its documentation, software required for cumulative impact assessment, and a plan for periodic updating and enhancement of the flow model.

UPPER EAST COAST AND LOWER EAST COAST SURFACE WATER QUALITY DATA COLLECTION

●District Contact: Larry V. Grosser

1. OBJECTIVE: The objective of this project is to collect surface water quality data in the Upper and Lower East Coast in order to determine water quality conditions at major water control points, to detect significant changes in water quality, to provide a means of determining short and long term trends, and assist in the evaluation of downstream impacts of the proposed Taylor Creek Nubbin Slough diversion.
2. DISTRICT NEED AND USE: Some uses of data generated by this project are expected to be:
 - a. (SWIM) - To provide data to assist in evaluating downstream impacts of the proposed Taylor Creek Nubbin Slough Diversion on the lower east coast, and by
 - b. Martin and St. Lucie Counties - To provide baseline water quality data for county assessments and loadings to the Indian River.
3. SCOPE: The monitoring program, which was initiated in 1979, consists of coastal stations along the District's Upper and Lower East Coast canals. This program generates 2,788 laboratory analyses annually.
4. SCHEDULE:
 - a. Seventeen Upper East Coast and Lower East Coast stations are sampled monthly.
5. PROGRESS TO DATE: This is a long-term monitoring network which was initiated in 1979 and has been routinely sampled once a month.
6. PRODUCTS:
 - a. 3rd Qtr FY 88-89: Upper East Coast and Lower East Coast Quality Assurance Plan.
 - b. 4th Quarter FY 88-89: Upper East Coast and Lower East Coast Quality Assurance Systems Audit.
 - c. 4th Quarter FY 89-90: Data will be included in an annual water quality trend analysis report.

LOWER EAST COAST

HILLSBORO CANAL BASIN WATER MANAGEMENT PLAN**District Contact:** Larry Pearson**CONTRACT REFERENCE:** Water Management Plan Hillsboro/Goals & Objectives

1. **OBJECTIVE:** This project will provide a water management plan to ameliorate flooding conditions in the Hillsboro Canal Basin.

2. **DISTRICT AND NEED USE:** Presently there is flooding during major storm events in the SW quadrant of the Basin. The existing permitting system has been formulated based on estimations about basin storm event performance. The Basin is undergoing rapid urbanization and those estimates need to be reanalyzed. Additionally, there are navigational problems in the tidal portion of the Basin. The management plan is needed to provide cost efficient solutions to water resource problems in this basin which are environmentally and politically acceptable.

3. **SCOPE:** The project is divided into two phases. Phase I will develop a program to alleviate the navigation problems and develop an interim basis for issuing surface water management permits. Phase II will develop long term solutions to the flooding problems and evaluate the use of the Hillsboro Canal to improve the hydroperiod in WCA I. Phase I will be completed under the above referenced contract.

4. **SCHEDULE:**

Interim Basis of Review for Permitting	1st Qtr 89/90
Shoaling Maintenance Program	4th Qtr 88/89
Final Basis of Review For Permitting	2nd Qtr 91/92
Water Management Plan for the Basin	2nd Qtr 91/92

5. **PROGRESS TO DATE:** The scope of work for the contract has been developed. The contract has been negotiated and signed. Coordination efforts are underway with the Corps of Engineers. Work is progressing toward the development of a mathematical model to be used to evaluate basin flood control performance. The causes of the shoaling in the tidal portion of the canal have been identified and maintenance alternatives have been developed.

6. **PRODUCTS:**

- Interim Basis of Review
- Shoaling Maintenance Program
- Final Basis of Review
- Water Management Plan
- Capital Improvement Program

C-11 BASIN**District Contact: Richard Gregg****CONTRACT REFERENCE: Water Management Study/PBSJ**

1. **OBJECTIVE:** The objective of this project is to monitor progress and provide any necessary in-house technical support to the consultant conducting the study.
2. **DISTRICT NEED AND USE:** Users of the project output will be the Surface Water Management Division, Resource Control Department and water management design engineers involved with projects in the basin.
3. **SCOPE:** The District has executed a contract with an engineering firm for a water management study of the western C-11 basin in Broward County. District participation in the project consists of the following:
 - a. Progress of the consultant has been and will be actively monitored and necessary technical information has been and will be provided.
 - b. Interim and final reports and other deliverables have been and will be reviewed and commented upon.
 - c. The final report from the consultant will be presented to the Governing Board for approval.
4. **SCHEDULE:**
Complete review of final report - 3rd Qtr 88-89
Present recommendations to Governing Board - 1st Qtr 89-90
5. **PROGRESS TO DATE:** This contract was scheduled to be completed in FY 87-88; however, it was late getting started and will extend into FY 88-89. In addition, if the contractor is required to participate in public hearings and/or public meetings after completion of the final report, and District acceptance of same, it will be necessary to amend the present contract.
6. **PRODUCTS:** A final report will be produced describing the water management operation of the western C-11 basin, including recommendations for the regulatory controls to prevent increasing the flooding potential in the basin. The report is to be used as the basis for formulating a basin rule for use in the District's regulatory program.

C-111 ENVIRONMENTAL STUDIES

●District Contact: Daniel E. Haurert

CONTRACT REFERENCES: NE Florida Bay Everglades National Park/National Park Services

**NE Florida Bay Salinity Network/Everglades National Park
Crocodile Nesting/USCOE
NE Florida Bay Changes in Freshwater Flows Fish Habits/Mangrove C-111/UF
Roseate Spoonbill**

1. **OBJECTIVE:** The objective of this project is to provide environmental information relating to the effects of hydroperiod on the marshes surrounding C-111 canal, and of freshwater flow from C-111 on the estuarine resources of northeast Florida Bay. This information will be used to evaluate water management alternatives proposed to enhance flood protection of the upper C-111 basin and provide for environmental enhancement of the District acquired marshes (Aerojet Lands), Everglades National Park panhandle marshes, and northeast Florida Bay.
2. **DISTRICT NEED AND USE:** This project is needed to provide the necessary environmental data to evaluate proposed alternatives and assist in selecting the most beneficial alternatives for implementation. These alternatives are being developed by the Corps of Engineers, which is in the process of developing a General Design Memorandum for improvements to the C-111 drainage system which will improve flood control capabilities in the upper basin, and provide greater flexibility for modifications in the lower basin to enhance existing environmental conditions.

Approximately 16,000 acres of marshland was acquired from AeroJet Inc. under the Save Our Rivers Program in 1984 immediately adjacent to C-111 and Everglades National Park boundaries to facilitate the hydroperiod and flow restoration potentials. This project will help assure that these lands are managed consistent with SOR criteria.

The information from this project will also be made available to all involved state and federal agencies, including Everglades National Park, U.S. Fish and Wildlife Service, U.S. Corps of Engineers, Florida Game and Freshwater Fish Commission.

3. **SCOPE:** The original scope of this project consisted of collection by District staff of environmental baseline data, supplemented by contract research on specific issues. The District conducted baseline field investigations in C-111 to obtain information on marsh hydrology, water quality, marsh vegetation, periphyton communities, marsh fauna, and environmental resources in the receiving waters of Manatee Bay, from October 1985-September 1987. Cooperative funding arrangements were executed with Everglades National Park and U.S. Corps of Engineers:
 - a) A two year research program assessing the effects of salinity changes on benthic habitats in near shore regions of northeast Florida Bay.

Conducted by Dr. Clay Montague, University of Florida, a final report is due in June 1989.

- b) A funding grant for hydrologic assessment of overland flow through C-111 gaps into panhandle region, to be undertaken jointly by ENP and Florida International University. Field work is scheduled from July 1988-July 1989, with a final product by September 1989.
- c) Joint funding with USCOE for a research project to assess freshwater flow/ groundwater stage impacts on crocodile nesting success at creek bank sites in Northeast Florida Bay. Field investigations occurred in summer 1987 and 1988, with a final report due in December 1988.
- d) A one year research effort to assess the habitat potential of mangrove prop roots for fisheries, and the influences of freshwater flow and salinity changes on this habitat. Field research will be initiated in October 1988 for a one and one half year period, with a final report due in March 1990.
- e) A proposal to cooperatively fund ENP and National Audubon Society for a four year assessment of the influences of hydroperiod in the C-111 marshes on Roseate Spoonbill foraging and nesting success will be initiated in FY 89.

4. SCHEDULE: The schedule of activities in FY 1988-89 are as follows:

Draft baseline environmental report will be circulated to agencies for review	QTR 3
Final report due on contract	
NE Florida Bay ENP/Natl Park Svc	QTR 3
Initiate contract agreement for Roseate Spoonbill study	QTR 3
Phase I report due on contract	
NE Florida Bay Hydrologic Assessment	QTR 2
Final report due on contract	
Crocodile Nesting/USCOE	QTR 3
Pilot study report on contract	
NE Florida Bay Changes in Freshwater Flows Fish Habits Mangrove C-111/UF	QTR 3
Phase II interim progress report (NE Florida Bay Hydrologic Assessment)	QTR 4

5. PROGRESS TO DATE: All District environmental field work is complete. A recent storm event during which the earthen plug at S-197 was pulled in August 1988 precipitated some additional monitoring of salinity and environmental responses in Manatee Bay and Barnes Sound. Draft reports on baseline monitoring should be complete for agency review in the third quarter of FY 88-89.

6. PRODUCTS: The products of the work performed by the District, and by the various cooperators and contractors will be a series of technical reports which will provide information from which to make decisions concerning water management alternatives in the C-111 basin.

NORTH BROWARD COUNTY BISCAYNE AQUIFER THREE-DIMENSIONAL FLOW MODEL

●District Contact: Jorge Restrepo

CONTRACT REFERENCES: Specialized drilling services will be contracted out for aid in sample collection. These services are described under the Well Drilling Geophysics, Hydrogeologic Field Support program.

1. **OBJECTIVE:** The objective of this project is to develop a three-dimensional ground water flow model for the Biscayne Aquifer System in North Broward County.
2. **DISTRICT NEED AND USE:** The three-dimensional flow model is needed as the basis for evaluating ground water availability and development potential and as a cumulative water use impact assessment model to support the water allocation process (Section 3.2, Volume III, Management of Water Use). The model will directly evaluate impacts among existing users and on the environment, and more indirectly, salt water intrusion potential.
3. **SCOPE:** To accomplish the project, it will be necessary to first review and evaluate existing hydrogeologic data and information. The information base obtained for the new geologic information will be updated, and aquifer characteristics will be reevaluated. Test wells will be drilled, under contract, and aquifer tests performed. Using all of this information, the hydrogeologic system will be discretized into model layers. Water use permit information will be reviewed and summarized. The model will then be calibrated, documented, and incorporated into both a water availability determination and a cumulative impact model format. A parallel model for the southern part of Broward County will be concurrently developed by the USGS as part of the cooperative studies program.
4. **SCHEDULE:**

Quarter 2, FY 88-89: Complete the contract negotiations for test well construction.

Quarter 4, FY 88-89: Complete the discretization of the hydrogeologic system into model layers. Develop the geologic data base and add all available information. Develop and update the water use permit data base.

FY 89-90: Complete and test the wells drilled under contract. Complete aquifer characteristics reevaluation. Obtain information needed for model calibration; code the model; calibrate.

FY 90-91: Make predictive model runs; transform the model into a cumulative impact format; prepare a technical publication summarizing the results of the modelling study.
5. **PROGRESS TO DATE:** This is the first year of a three year project.
6. **PRODUCTS:** The final products are the completed model, its documentation, software required for both water resource availability determination and for

cumulative impact assessment, and a plan for periodic updating and enhancement of the flow model.

SWIM MANAGEMENT PLANS -- BISCAYNE BAY

●District Contact: Joel A. VanArman

CONTRACT REFERENCES: Several Contracts That Are Managed by the Office of Resource Assistance Were Budgeted in Previous Years

1. **OBJECTIVE:** The objective of this project is to update the Interim Surface Water Improvement and Management (SWIM) plan for Biscayne Bay as mandated in the SWIM legislation and in order to protect the natural resources of the Bay. An additional objective is to provide technical support for implementation and development of contracts and studies managed by the Office of Resource Assistance.
2. **DISTRICT NEED AND USE:** This project is required to meet the mandates of the SWIM legislation. In addition, subsequent versions of this plan will be developed periodically to address new and emerging resource management issues for Biscayne Bay.
3. **SCOPE:** The Interim SWIM plan for Biscayne Bay identifies a number of ongoing programs and projects that will continue during FY 88-89 within the Bay. This Interim SWIM plan will be updated, based on new data or changes in policy, that occur during the planning process to reflect any new programs, projects, management strategies, and priorities that are identified for Biscayne Bay. This project will provide technical support for updating the management plan, review and design of contractual studies, and identification of new projects for the FY 90-91 SWIM budget.
4. **SCHEDULE:** This is the second year of a continuing project. The SWIM plan for Biscayne Bay will be updated on an annual basis according to the following schedule for FY 88-89.
 - a. 4th Quarter FY 88-89:
 1. This interim plan is to be revised by September 30, 1989, to include a proposed budget and projects for FY 90-91.
5. **PROGRESS TO DATE:** The SWIM plan for Biscayne Bay was approved by FDER as an Interim plan and adopted by the Governing Board in September 1988. A number of contractual projects that are managed by the Office of Resource Assistance have been initiated in the Bay based on this plan.
6. **PRODUCTS:**
 - a. 4th Quarter FY 88-89:
 1. Produce a revised draft SWIM plan, including a budget request for FY 90-91, which will be sent to the DER.

WATER CONSERVATION AREAS

WADING BIRD SURVEYS

●District Contact: Peter David

CONTRACT REFERENCES: Foraging Habits - Snowy Egret/Audubon
Wading Bird Survey/Audubon

1. OBJECTIVE: The objective of this project is to document the utilization by wading birds of the Water Conservation Areas and the Everglades Agricultural Area (EAA) and relate the amount, timing and distribution of use to water conditions and water management practices. This program will also examine the relationships between wading bird nesting success and wetland forage habitat conditions.
2. DISTRICT NEED AND USE: The results of this project will be used by the District and other agencies to assess the effectiveness of alternative water management strategies on one of the key indicators on the environmental status of the Everglades system, and to propose water management recommendations which meet the habitat needs of declining wading bird populations in south Florida. The District is responsible not only for the management of surface waters for water supply and flood control purposes, but also for the protection and enhancement of natural environmental resources (Mission Statement) especially the unique values of the Everglades (House Document #649). The District has developed a cooperative arrangement with Everglades National Park (ENP) and Florida Game and Fish Commission (GFC) to jointly conduct this extensive bird census for south Florida.
3. SCOPE: The District, GFC and ENP have cooperatively established a Systematic Reconnaissance Flight (SRF) technique for determining the species composition and distribution of wading birds utilizing all major wetland habitats in south Florida. District personnel conducted SRF surveys of the Water Conservation Areas in 1986, and have contracted this function to National Audubon Society (NAS) for the 1987 and 1988 surveys. Surveys are conducted during the dry season nesting period (December-June) with one wet season survey in August. It is proposed in FY 1989 to fund the extension of the surveys for two more years, and expand the aerial coverage to include the EAA. Other south Florida expansions are proposed by GFC and ENP.

In addition, a research program developed by the National Audubon Society (NAS) is also being funded to monitor nesting success of tri-colored and little blue herons, in relation to the feeding conditions in the marsh and to study bird dispersal following the nesting period. This project is entering its fourth and final year.

4. SCHEDULE:
 - a. Approval for contract amendment for Foraging Habits - Snowy Egret/Audubon QTR 1
 - b. Approval for expansion and continuation of SRF surveys, Wading Bird Survey/Audubon QTR 1
 - c. Receive annual report from Wading Bird Survey/Audubon QTR 1
 - d. Receive annual report from Foraging

- Habits - Snowy Egret/Audubon QTR 2
- e. Interagency report on SRF results from 1986 QTR 2

5. PROGRESS TO DATE: This will be the third year of a contractual study with NAS for the SRF surveys (Wading Bird Survey/Audubon) and the fourth year of a four year program to study tri-colored and snowy egret foraging and nesting patterns (Foraging Habits - Snowy Egret/Audubon). Annual reports for both programs have been provided on schedule by the Contractor. Data analysis and extensive data tabulation is complete for a cooperative (ENP, GFC, SFWMD) report on the 1986 SRF flights.
6. PRODUCTS:
 - A. Quarterly reports on wading bird distribution in WCA's and EAA.
 - B. Detailed wading bird and water level distribution maps (8) for each survey.
 - C. Annual reports from two contracts.

WCA IMPACTS, MONITORING, AND NUTRIENT THRESHOLDS

●District Contact: Steven M. Davis

1. OBJECTIVE: The purpose of this project is to monitor water quality trends and hydrology in the Water Conservation Areas and to determine nutrient and hydroperiod impacts on Everglades biota.
2. DISTRICT NEED AND USE: The information from this project is needed to examine WCA water management strategies and recommend refinements toward the goal of perpetuating the Everglades as a unique ecosystem with high fish and wildlife values. The values must be protected in the WCAs as well as in Everglades National Park, and in ways that are compatible with stormwater management and water supply functions of the WCAs. WCA hydroperiods are managed according to water regulation schedules which have created prolonged flooding in some areas, drainage in others, and altered timing of water delivery. Elevated nutrient supplies enter the WCAs via EAA runoff. Nutrient supply has increased since implementation of the IAP, and supply may further increase when Lake Okeechobee management strategies are initiated. The information this project generates will contribute to the Everglades Comprehensive Planning Model. Nutrient impacts on Everglades biota, and threshold concentrations above which negative impacts occur, are essential pieces of information in formulating water quality criteria for water inflows into the WCAs. LOTAC II identified nutrient threshold concentrations as information which required refinement.
3. SCOPE: This project is comprised of 4 sub-projects during FY 88-89. Hydrology and water quality monitoring provides the basis for evaluating the impacts of these variables on vegetation communities. Details of these are given separately.

Nutrient Responses and Thresholds of Everglades Vegetation Communities. This project measures impacts of increased nutrient supply on Everglades vegetation communities and their ecological functions. This project also estimates surface water nutrient concentration thresholds, above which negative impacts to vegetation communities occur.

Alteration in WCA-2A Regulation Schedule. This project assesses the use of remote sensing to detect long-term changes in Everglades plant communities and documents community change in WCA-2A as a result of changes in regulation schedule.

WCA Water Quality Monitoring. This project determines water quality conditions at major water control points, to detect significant changes in water quality, and to provide a means of determining short and long term trends.

WCA Hydrologic Data Collection. This project documents rainfall, evaporation, surface water levels, flow and structure operations in the WCAs to assist in management of the areas and to provide support to other WCA research projects. Documentation of this project is included under General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.

4. SCHEDULE: Schedules for reports and other milestones are listed under individual projects.
5. PROGRESS TO DATE: Progress is listed under individual projects.
6. PRODUCTS: Products are listed under individual projects.

NUTRIENT RESPONSES AND THRESHOLDS OF EVERGLADES VEGETATION COMMUNITIES

●District Contact: Nancy H. Urban

1. OBJECTIVE: The objective of this study is to measure rates of cattail expansion into sawgrass, and to examine correlations between the cattail expansion rate and water quality. It will also quantify the effects of cattail expansion on transpiration water loss from the Water Conservation Areas to determine effects of vegetation change on water storage capacity of the Water Conservation Areas.
2. DISTRICT NEED AND USE: The SFWMD needs to refine threshold concentrations of P and N in WCA surface waters in order to set water quality criteria for water entering the Water Conservation Areas. Threshold concentrations can be defined as those which do not result in expansion of cattail and related negative environmental impacts. The SFWMD also needs to quantify the effects of cattail expansion on transpiration water loss and WCA water storage capacity. Preliminary calculations suggest that transpiration water loss from cattail may significantly exceed that from sawgrass. Evapotranspiration represents the single largest water loss from the WCAs. In this regard, cattail expansion may have profound impacts not only on Everglades biological communities, but also on the water storage capacity of the WCAs.
3. SCOPE:
 - a. The Cattail expansion study quantifies rates of cattail expansion in WCA2A and relates these expansion rates to water quality. Sawgrass and cattail counts are made yearly in thirty permanent plots at six sites along the nutrient gradient south of the S-10 inflow gates. Water samples are collected bi-weekly from each site for phosphorus and nitrogen analyses. A Technical Publication manuscript on the first three years of counts will be prepared during FY 88-89. An additional set of counts may also be taken during FY 88-89, if warranted, after examination of the first three years' data.
 - b. The Transpiration study measures transpiration rates of sawgrass and cattail at nutrient-enriched and background sites in WCA-2A. A wetland transpiration review during FY 87-88 determined that data collection is necessary to compare sawgrass and cattail transpiration rates and recommended feasible methods to measure transpiration in the Everglades. District staff will utilize a portable field porometer for in situ transpiration measurements on routine water sampling trips. This methodology is the same as that used for Everglades National Park transpiration studies and results will be comparable. Contractual research will independently measure sawgrass and cattail transpiration using at least one additional method as recommended in the FY 87-88 literature report.
4. SCHEDULE:
 - a. Complete Technical Publication on three years of cattail expansion-4th Q FY 88-89
 - b. Complete Technical Publication on invertebrate colonization of sawgrass and cattail detritus - 2nd Q FY 89-90

- c. Conduct 1989 cattail counts (if appropriate) - 4th Q FY 88-89
 - d. Begin porometer transpiration measurements - 4th Q FY 88-89
 - e. Complete porometer transpiration measurements - 2nd Q FY 89-90
 - f. Complete Technical Publication on porometer transpiration measurements 4thQ FY 89-90
 - g. Complete transpiration contract procurement and begin work - 4th Q FY 88-89
5. PROGRESS TO DATE: The third year of cattail counts was completed in 4th Q FY 87-88. The wetland transpiration literature review was completed in 3rd Q FY 87-88. This on-going project has previously measured sawgrass and cattail production, decomposition, microbial colonization, nutrient flux rates, and nutrient uptake pathways in relation to water quality.
6. PRODUCTS:
- a. Technical Publication on three years of cattail expansion in WCA-2A
 - b. Technical Publication on invertebrate colonization of sawgrass and cattail detritus
 - c. Technical Publication on porometer transpiration measurements
 - d. Final Report on transpiration contract

ALTERATION IN REGULATION SCHEDULE - WCA-2A

●District Contact: Dewey Worth

1. **OBJECTIVE:** The objective of this study is to assess long term changes in plant community composition in response to changes in the regulation schedule as a management tool for environmental enhancement and maintenance of Everglades ecology in WCA-2A.

2. **DISTRICT NEED AND USE:** A complete vegetation cover map of modern day plant communities in the Everglades does not currently exist. However, numerous studies have shown the everglades plant communities are continually being modified by changes in water management practices. A synoptic assessment of the existing system would provide a better understanding of the cumulative impacts of these changes. This information would assist the District in evaluating LOTAC recommendations and determining how to best mitigate downstream impacts.

3. **SCOPE:** A new regulation schedule, varying seasonally from 11.0 - 13.0 ft NGVD has been recommended based on previous drawdown studies of WCA-2A. Final authorization by the Corps is required to implement the proposed schedule. This program will demonstrate and evaluate the use of remote sensing technology to document Everglades plant community changes in response to changes in regulation schedule.

A public hearing will be conducted by the Corps and is anticipated within the first quarter of FY 88/89. Satellite and aerial infrared photography will be analyzed and compared for WCA2 and WCA3. This information will be digitally enhanced to identify and map prominent plant communities. Results will be compared with previous field investigations to ascertain sensitivity and compatibility of results. Assuming satellite data can adequately document Everglades plant communities, this program will continue as a monitoring tool to review water management practices and ascertain how they influence Everglades plant community dynamics by comparing historical trends in plant community changes.

4. **SCHEDULE:**

Tasks to be completed during FY88/89:

1. Complete COE public hearing on schedule change (1st Q FY88/89)
2. Obtain final approval from COE for schedule change (2nd Q FY88/89)
3. Complete acquisition of historical landsat data (2nd Q FY88/89)
4. Complete plant community map of existing conditions (4th Q FY88/89)
5. Begin historical comparisons (4th Q FY88/89)

Tasks to be completed during FY89/90:

1. Complete report on historical evaluation (3rd Q FY89/90)
2. Recommend future monitoring needs (4th Q FY89/90)

5. **PROGRESS TO DATE:** This is a modification of an existing study. Previous work has been reported in Technical Publications:

83-6 Preliminary Environmental Response to Marsh Dewatering and Reduction in Water Regulation Schedule in Water Conservation Area 2A.

88-6 Environmental Response of WCA-2A to Reduction in Regulation Schedule and Marsh Drawdown.

6. PRODUCTS: Major products will be technical publications, data base of satellite and aerial photography, and various map products describing plant communities of the Everglades.

WATER QUALITY MONITORING

●District Contact: Larry Grosser

1. OBJECTIVE: The objective of this study is to collect surface water quality data for the inflows and outflows of the Water Conservation Areas. This project also provides the primary water chemistry data base for routine and special water quality evaluations.
2. DISTRICT NEED AND USE: Water quality monitoring at WCA inflow and outflow points is a key element in determining long-term water quality trends and in evaluating the effectiveness of upstream management practices in reducing nutrient inputs into the WCAs. These data are instrumental in evaluating downstream impacts of the Interim Action Plan and other possible management alternatives for the EAA.
3. SCOPE: Locations are selected to determine water quality conditions at major water control points, to detect significant changes in water quality, and to provide a means of determining short and long term trends. The monitoring consists of sampling 35 Water Conservation Area inflows and outflow points.
4. SCHEDULE: This study was initiated in 1978. The Water Conservation Areas are sampled every two weeks during periods of flow. A Technical Memorandum summarizing monitoring results since 1978 will be completed 4th Q 1988-89.
5. PROGRESS TO DATE: A water quality data base for WCA inflows and outflows goes back to 1978 when the study was initiated.
6. PRODUCTS: All data available on the CAMB data base system. Technical Memorandum summarizing monitoring results since 1978.

EVERGLADES NATIONAL PARK DOWNSTREAM IMPACTS

●District Contact: Larry V. Grosser

1. **OBJECTIVE:** The objective of this study is to collect surface water quality, hydrological, and meteorological data at the Everglades National Park (ENP) inflows and to provide the primary water chemistry database needed under the terms of the ENP/ Corps of Engineers (COE)/ District Memorandum of Agreement (MOU).
2. **DISTRICT NEED AND USE:** This study will benefit the SFWMD by the inclusion of critical water quality data into the monthly Governing Board water conditions report. The data will also provide the Resource Operations Department with a telemetry interface and with structure operations feedback. The Water Resources Division will be provided with data to evaluate water supply alternatives, runoff modeling and the C-111 study. The Environmental Sciences Division will be able to determine the impacts of water and nutrients on marshes and estuaries and the Data Management Division will have quality control of data in adjacent areas as a result of this project.

In addition, this study will assist the ENP and COE by providing data support as part of the MOU. It will aid the ENP in planning evaluations of water supply and drainage alternatives and evaluating rainfall driven deliveries. The Corps will be aided by this project in their operations documentation, C-111 planning, diversions to Northeast Shark River Slough (NESRS) and water supply plan for rainfall driven releases.

3. **SCOPE:** This project includes all monitoring data required by the ENP Memorandum of Agreement with the exclusion of pesticide monitoring. It includes field sample collection at the inflows to the ENP and the watershed locations, analytical services, and the transfer of monthly data reports to the ENP. This project encompasses water quality and hydrological status at ENP inflows and hydrologic status in the East Everglades. Locations have been selected to determine water quality conditions at major water control points, to detect significant changes in water quality, and to provide a means of determining short and long term trends.

The hydrologic data collection is a cooperative effort between Data Management Division, Resource Operations Department, ENP, the USGS, and the COE. Parameter measures include flow, surface water levels, ground water levels, rainfall, and evaporation.

Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope of these hydrologic data support efforts are contained in the documentation for the project entitled General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.

4. **SCHEDULE:**
 - a. ENP inflow stations are sampled every two weeks during flow. In total, eight inflow stations are sampled. An annual meeting is held between the COE, ENP, and District to discuss water quality results under the ENP MOA.

- b. Diurnal dissolved oxygen studies are performed quarterly, and this data is submitted to the ENP.
5. PROGRESS TO DATE: This is an ongoing study that was initiated in 1979 by the COE and was taken over by the District in 1983 and has been routinely sampled every two weeks by the District since that time.
6. PRODUCTS:
- a. Results of sampling is presented monthly in the Water Conditions Report.
 - b. Monthly data transmittals to the ENP and COE.
 - c. Legal documentation of the operation of District structures on a continuous basis.
 - d. 3rd Quarter FY 88-89: ENP Quality Assurance Plan.
 - e. 4th Quarter FY 88-89: ENP Quality Assurance Systems Audit.

HOLEY LAND ENVIRONMENTAL MONITORING

●District Contact: Steven M. Davis

1. OBJECTIVE: The objectives of this project are to document trends in water quality and changes in vegetation in the Holey Land as a result of the operational schedule to be initiated during the summer of 1989.
2. DISTRICT NEED AND USE: The dual objectives of habitat restoration and water quality improvement for the Holey Land will require careful monitoring to determine to what extent the two objectives are being achieved and are compatible.
3. SCOPE: A Holey Land operational schedule will provide for 1) water level fluctuation for the purpose of habitat restoration and 2) overland flow of Miami Canal water across the marsh. A five-year test of this operational schedule will 1) document restoration success in terms of vegetation change, 2) monitor the extent of nutrient penetration into the marsh as a result of overland flow, and 3) assess nutrient impacts on vegetation communities. South Florida Water Management District remote sensing capabilities will be utilized to assist the GFC in refining a Holey Land vegetation map and updating this map each year. District staff will meet annually with GFC staff to determine how budgeted District staff time can best be utilized to achieve vegetation mapping updates. A contractual research program will periodically collect water samples from a grid of stations within the Holey Land marsh and will perform phosphorus and nitrogen analyses on marsh water samples. Water sampling schedules and locations will be specified during the RFP process.
4. SCHEDULE:
 - a. Vegetation map refinement - 4th Q annual updates through FY 93-94.
 - b. Contract award for water sampling - 4th Q FY 88-89.
 - c. Annual water quality report - 4th Q FY 89-90, with annual updates through FY 93-94.
5. PROGRESS TO DATE: Cooperative monitoring programs have been discussed with GFC staff.
6. PRODUCTS: Annual reports on Holey Land vegetation and water quality trends. Technical Publication on five-year evaluation of trends.

EVERGLADES COMPREHENSIVE PLANNING

●District Contact: Steven M. Davis

1. OBJECTIVE: To develop a comprehensive strategy to protect and restore the remaining Everglades ecosystem in the WCAs, Holey Land, flow-ways, ENP and East Everglades.
2. DISTRICT NEED AND USE: A comprehensive overview of Everglades planning is needed to avoid piecemeal planning whereby operational changes for the improvement of one area may adversely affect other areas. Survival of the remaining Everglades as an ecosystem depends upon management of the system as a whole rather than developing smaller-scale plans based on political or jurisdictional boundaries.
3. SCOPE: Planning inputs from other projects currently in progress include threshold response results, SWIM comprehensive plan inputs, EAA water resources analysis, hydrologic analysis of lower Everglades and an Everglades symposium. The major effort on this project during FY 88-89 will be planning of an Everglades symposium.

An Everglades symposium will be held in October or November 1989 in Key Largo. The symposium will be jointly sponsored by the SFWMD, ENP, the Colonial Water Bird Society and the Society of Wetland Scientists. The symposium will consist of invited and contributed papers with a central theme that (1) characterizes the historic ecosystem, (2) examines losses in ecosystem function as a result of man-made changes, (3) determines what is needed to regain original ecosystem functions, (4) considers constraints on the future management of the system, and (5) predicts what can realistically be regained and how this can be accomplished. It is anticipated that proceedings from the symposium will be published in book form.

4. SCHEDULE:
 - a. Symposium Announcement Brochure - 2nd Q FY 88-89
 - b. Everglades Symposium - 1st Q FY 89-90
 - c. Inputs from other programs as listed and scheduled in project documents
5. PROGRESS TO DATE: A steering committee including SFWMD and ENP staff plus other ecologists covering a wide range of expertise has met four times since April, 1988 to decide on dates, location, affiliations and theme of the symposium.
6. PRODUCTS:
 - a. Everglades symposium proceedings volume
 - b. Refinement of comprehensive planning as inputs from projects become available

DEVELOPMENT OF MANAGEMENT PLANS--EVERGLADES PLANNING AREA

●District Contact: David R. Swift, Sarah A. Bellmund

CONTRACT REFERENCE: SWIM Management Plan/Goals & Objectives

1. **OBJECTIVE:** The objective of this project is to develop a Surface Water Improvement and Management (SWIM) plan for The Everglades Water Conservation Areas as identified in the SFWMD Report entitled, "Identification of Priority Water Bodies within the South Florida Water Management District."
2. **DISTRICT NEED AND USE:** This project is required to meet the mandates of the SWIM legislation and to address priority planning projects that were identified by the District in cooperation with other agencies and local governments.
3. **SCOPE:** The project consists of developing a plan that will include a schedule established by the District and agreed to by the DER for restoring the water body. This plan shall also enumerate preventive measures which need to be taken to augment surface water improvement and management efforts. Contracts were initiated with consultants to collect baseline data necessary for the development of this plan. The project managers will be responsible for tracking the progress of these investigations and incorporating results of these studies into the final plan. For details of the contents of the plan, please see the SM51002PL Project Document.
4. **SCHEDULE:** This is the first year of a continuing project. This plan is to be completed by December, 1989. The plan is to be reviewed and, if necessary, revised annually.
5. **PROGRESS TO DATE:** This is a new project, building on previous work by the District in the Priority Water Body Report and other research activities, by other agencies, local governments and consultants. A contract for supporting studies for this project was approved at the September, 1988 Governing Board meeting and is currently underway. The contract for the Water Conservation Areas was terminated in April, 1989. Project tasks anticipated to be completed by contract have been reassigned to internal staff. Two other contractors are proceeding competently towards completion of their contractual obligations.
6. **PRODUCTS:**
 - A. 4th Quarter FY 88-89:
 1. A draft management plan for the Everglades Planning Area which will be sent to DER.

EVERGLADES AGRICULTURAL AREA

ANALYSIS OF EAA MODELING METHODOLOGIES

●District Contact: Terry Ortel

1. **OBJECTIVE:** The objective of this project is to gain an increased understanding of the hydrology and hydraulics of the Everglades Agricultural Area and to evaluate modeling methodologies applicable to the watershed level in the EAA. This project administered Development of On-Farm Water Management Field Test Equipment.
2. **DISTRICT NEED AND USE:** The District needs this project to examine the water management alternatives in the Everglades Agricultural Area. Information provided will benefit LOTAC in the evaluation of alternative water management strategies. Coordinates efforts between the Corps of Engineers and the District. The information provided on water table sensors from programs entitled "Development of On-Farm Water Management Field Test Equipment" will benefit Data Management Division in the use and selection of sensors.
3. **SCOPE:** The scope of this project is
 - a. To review existing modeling methodologies applicable to the EAA.
 - b. To coordinate with Hydrologic and Hydraulic Model Development, and keep current on its developments.
 - c. To model a basin of the EAA at the watershed level by either applying an existing model or through development of a model.
 - d. To calibrate and test the models using the data collected under this and other related projects.
 - e. To evaluate and assess the modeling methodology applied at the watershed level.
 - f. To monitor Development of On-Farm Water Management Field Test Equipment.
 - g. To review and evaluate the contracts deliverables.
4. **SCHEDULE:**
 - a. Review of the existing models of the EAA - 3rd Qtr 87-88
 - b. Selection of a model - 4th Qtr 87-88
 - c. Application of a model using the database compiled in the Pilot Study Inventory - 2nd Qtr 88-89
 - d. Calibration of the model using hydrological data collected under program SL30-001PL - 4th Qtr 88-89
 - e. Verification of the model using hydrological data collected under program SL30-001PL - 1st Qtr 89-90
 - f. Evaluation of the modeling methodology - 2nd Qtr 89-90
 - g. Document the analysis and evaluation - 3rd Qtr 89-90
 - h. Review the fifth quarterly report for Development of On-Farm Water Management Field Test Equipment - 1st Qtr 87-88
 - i. Internal review of the final report - 2nd Qtr 87-88
 - j. Completion of the contractor evaluation sheet - 2nd Qtr 87-88
5. **PROGRESS TO DATE:** This is the second year of this project. The project entitled Development of On-Farm Water Management Field Test Equipment was

budgeted and awarded in fiscal year 1985-86, completed in 2nd Qtr 87-88. Internal review and acceptance of the final report completed. Review of the Pilot Study Inventory database began in fiscal year 1986-87. Analysis of the pumping facilities and drainage basin delineation completed. Coordination meetings held with the Corps of Engineers for the Bolles and Cross Canal Improvements GDM.

6. PRODUCTS:

- a. Documentation containing the results of the hydraulic and hydrologic studies.
- b. Low cost water table elevation monitor applicable for field research and/or farm water table management; completed in March, 1988.
- c. Final report documenting the results of the laboratory and field studies of the water table monitor; completed in March, 1988

EVALUATION OF THE EFFECTS OF ON-FARM AGRICULTURAL PRACTICES IN THE ORGANIC SOILS OF THE EAA ON PHOSPHORUS AND NITROGEN TRANSPORT

●District Contact: Eric G. Flaig

CONTRACT REFERENCES: The Effects of On-Farm Agriculture Practices in the Organic Soils of the EAA on Phosphorus and Nitrogen Transport

1. OBJECTIVE:

The objectives of this project are:

- a. Review historical rainfall, water quality, and farming practices to determine water quality trends.
 - b. Develop practical water quality management alternatives for Everglades Agricultural Area (EAA) farms to reduce nutrient loadings to District canals.
2. DISTRICT NEED AND USE: This project addresses research recommendations identified by the Lake Okeechobee Technical Advisory Committee (LOTAC). Backpumping of water from the EAA for water supply purposes has been reduced so that the District would be able to meet its targeted nutrient loads, prevent future acceleration of eutrophication of Lake Okeechobee, and reduce downstream impacts to the water conservation areas.
3. SCOPE: This study will develop a better definition of the relationships between phosphorus and nitrogen in agricultural drainage water and on-farm water management and agricultural practices. Practical management alternatives will be assessed that could lower the nutrient content of drainage water entering the District canals from area farms. In conjunction with field research, IFAS will engage in an intensive extension program on agricultural water quality that parallels the project goals. Data gathered during this study will allow District managers and permitting staff to better evaluate water quality and crop production impacts of water management options for the area. Practices being investigated include manipulation of water management activities on the field, alternative fertilizer application practices, and alternative crop types. A water quality model and economic analysis will also be forthcoming. This is a multiyear study.

4. SCHEDULE:

- a. 1st Quarter FY 88-89:
 1. Plant commercial grower sites.
 2. Continue water quality monitoring on all sites.
- b. 2nd Quarter FY 88-89:
 1. Continue water quality monitoring on all sites.
 2. Review rain data and field sites
- c. 3rd Quarter FY 88-89:
 1. Continue water quality monitoring on all sites.
 2. Final Report Phase III B
- d. 4th Quarter FY 88-89:
 1. Continue water quality monitoring on all sites.

- e. 1st Quarter FY 89-90:
First quarter report Phase IV.
- 5. **PROGRESS TO DATE:** A MOU has been negotiated by IFAS with the FSCL and the District to support the cooperative research described in this project, to participate in cooperative decision making concerning development of practical, alternative management practices, and to promulgate promising practices. The IFAS team has conducted a thorough literature review of agricultural practices and water quality, data and processes controlling water quality. The review is to be published by IFAS. An experimental design was developed for evaluating the impact of agricultural management on water quality acceptable to FSCL and the District. A research lab for analysis of water, soils, and tissue samples was constructed for conducting chemical analyses.

Despite the accomplishments of the IFAS team, the project schedule has been delayed. Compared to the original activity schedule for field experimentation, the project is now two years behind. The project is envisioned to include five phases. In the first phase the EREC site was to be designed and installed. During Phase II the EREC site was to be monitored while the first commercial site was designed and installed. The EREC site installation has been completed. Presently the EREC site is being hydraulically evaluated in preparation for field experimentation to begin in December. Commercial sites envisioned for Phase II and Phase III have yet to be installed. These will be installed during the 1st quarter of FY88-89 now that cooperators have been found for the commercial sites. Due to the delay in site implementation, some water quality and crop growth data from the field experiments have been lost from the five year project. Recent progress has been encouraging enough to allow project managers to recommend the project proceed through the 88-89 FY.

- 6. **PRODUCTS:**
 - a. Water quality and hydraulic monitoring data at EREC and commercial sites.
 - b. Implementation of commercial sites by end of 1988.
 - c. Annual progress report from IFAS to include data summary and evaluations.

EAA FLOW-WAY

●District Contact: **Steven M. Davis**

1. **OBJECTIVE:** The objective of this project is to implement and evaluate flow-way projects to reduce S-5A and S-6 phosphorus and nitrogen inputs into Water Conservation Area 1. The project also (1) refines flow-way operational schedules and vegetation management techniques to maximize sustained nutrient retention capability, (2) measures the success of flow-ways in reducing surface water phosphorus concentrations to threshold levels which do not cause negative impacts on WCA vegetation communities, and (3) evaluate the feasibility and land requirements for a regional-scale flow-way system to adequately treat runoff from the four major EAA canal basins (West Palm Beach, Hillsboro, North New River and Miami Canals).
2. **DISTRICT NEED AND USE:** The SFWMD needs to reduce nutrient inputs from the EAA into the WCAs to levels that do not adversely impact Everglades flora and fauna. A flow-way system would conceivably deliver EAA runoff water southward into the Everglades and reduce nutrient concentrations in that water to threshold levels that do not adversely impact Everglades flora and fauna. There is increasing evidence that southward flow of EAA water may be beneficial to NE Shark River Slough and Everglades National Park estuaries. Thus the flow-way concept has potential to solve many of the problems of water quality, as well as delivery, associated with the Everglades.
3. **SCOPE:** The EAA flow-way concept involves a large scale biological filtration system utilizing wetland vegetation or inundated agricultural crops to remove phosphorus and nitrogen from EAA runoff water flowing over them. A state-owned portion of Knight's Farm and Unit D of Arthur Marshall Loxahatchee National Wildlife Refuge will be utilized to reduce S-5A and S-6 nutrient loads and to iteratively refine flow-way operational strategies to achieve maximum load reductions. Features to be refined include (1) combinations of vegetation management techniques and water operational schedules, (2) water residence times, and (3) nutrient threshold concentrations in water entering the WCA's, below which Everglades flora and fauna are not adversely impacted. Knowledge of attainable nutrient load reductions per acre of flow-way, in combination with WCA nutrient thresholds, will be used to determine the feasibility and land requirements for regional scale flow-way systems.

Implementation of each flow-way system involves planning and design, permitting, and construction. Two preliminary planning and design efforts will proceed simultaneously beginning 1st Qtr 88-89. An engineering design group will provide a construction design of exterior levee, seepage control and water delivery systems, with emphasis on operational flexibility. In the meantime, an inter-agency group of wetland and agricultural scientists will develop plans for operation of each flow-way, including examination of operational schedules and plant management techniques that appear most promising, design of interior flow corridors, and research design to compare operational schedules and plant management techniques. Final construction design will combine the products of both groups. Construction will be accelerated with the goal of having the flow-ways operational 18-24 months after permitting. Feasibility of

proceeding with a regional-scale flow-way system will be evaluated after five years of flow-way operations.

4. SCHEDULE:

- a. Engineering design of exterior levee, seepage control, and water delivery systems - 4th Qtr FY 88-89.
- b. Operational planning of water schedules, plant management techniques, interior flow corridors and research design - 1st Q FY 89-90.
- c. Final construction design - 3rd Qtr FY 88-89.
- d. Commencement of operation - 24 months after permitting.
- e. Evaluation of regional flow-way concept - five years after commencement of operation.

5. PROGRESS TO DATE: An inter-agency group of scientists and engineers developed a conceptual design for an EAA flow-way research and development program during 3rd Qtr FY 87-88. The group prepared a draft report that will provide a basis for flow-way operational planning during FY 88-89. Two think tanks on EAA flow-way planning were held at the SFWMD during FY 87-88.

6. PRODUCTS:

- a. Engineering design and operational plan reports.
- b. Final construction design report.
- c. Flow-way construction.
- d. Annual reports on iterative test results for five years of operation.
- e. Evaluation of feasibility and land requirements of regional flow-way systems.

LOWER WEST COAST

SIX - MILE CYPRESS SLOUGH

●District Contact: Richard Cooper

1. **OBJECTIVE:** The objective of this project is to develop a water management plan that will provide hydroperiods and water levels in the Six-Mile Cypress Slough that are compatible with the environmental well-being of the slough. The water management plan will make specific recommendations of regulatory criteria for permitting of surface and groundwater use and of surface water drainage in the slough's watershed.
2. **DISTRICT NEED AND USE:** This project will provide Resource Control with information necessary to develop basin specific surface water permit criteria for the Six-Mile Cypress Slough watershed. Local Government Assistance will provide this information to Lee County for use in developing its countywide water management plan. Local Government Assistance will also use the information provided by this project in evaluation of Lee County's management plan.
3. **SCOPE:**

Phase I
Document the methodology, findings and recommendations for analyses of the basin with respect to application of existing stormwater management criteria. Flood profiles and routing for the design storms will be provided for the slough and the upland contributing subbasins to define criteria for allowable discharges, compensating storage, and flood elevations. The study will provide design storm flood profiles and stage hydrographs that can be used for tailwater conditions in contributing subbasin routings.

Phase II

 - a. Collect a minimum of one year of detailed hydrologic information (i.e., rainfall, groundwater levels, surface water levels, and stream flow). This task is to be performed by the Data Management Division. Hydrologic and meteorologic data are being collected and processed to support this project. Complete descriptions of the scope and budget of these hydrologic data support efforts are contained in the documentation for program entitled "General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Programs".
 - b. Develop a numerical model of the slough. This model will have two purposes: (1) To estimate the current range of hydroperiods and water levels in the slough. (2) To evaluate the impacts on hydroperiods and water levels in the slough of water use and drainage in the watershed under current regulatory criteria. (3) To evaluate the impacts on hydroperiods and water levels in the slough of water use and drainage in the watershed under proposed regulatory criteria.
 - c. Develop a water management plan for the slough based on the evaluations conducted under (b) above. The water management plan will include specific recommendations concerning permitting of water use and drainage in the watershed.
4. **SCHEDULE:** Work on this project will be initiated this fiscal year. It is scheduled to be completed in December 1990.
 - a. Begin collection of one year of hydrologic data in the slough - 3rd Qtr 88-89

- b. Prepare flood routing models for analysis of stormwater management criteria
 - c. Prepare Phase I report
 - d. Numerical model of the slough completed and calibrated - 3rd Qtr 89-90
 - e. Data collection completed - 3rd Qtr 89-90
 - f. Estimation of the current range of hydroperiods and water levels in the slough completed - 4th Qtr 89-90
 - g. Evaluation of the impacts on the slough of water use and drainage in the watershed under current regulatory criteria completed - 4th Qtr 89-90
 - h. Evaluation of the impacts on the slough of water use and drainage in the watershed under proposed regulatory criteria completed - 4th Qtr 89-90
 - i. Water management plan for the slough completed - 1st Qtr 90-91
5. PROGRESS TO DATE: This is a new project under the SCS Lee County Flood Plain Management Study.
6. PRODUCTS:
- a) Preliminary report on surface water management criteria analysis.
 - b) A Water Management Plan for Six-Mile Cypress Slough which will include recommended regulatory criteria for permitting of surface and groundwater use and of surface water drainage for the area surrounding the slough.
 - c) A numerical model for evaluation of the impacts on the slough of water related activities in and around the slough.

CONCEPTUAL WATER MANAGEMENT PLAN - COCOHATCHEE WATERSHED

●District Contact: Terry Ortel

1. OBJECTIVE: The objective of this project is to assist in the development of a comprehensive water management plan incorporating improvements to the Cocohatchee Canal; study will focus on enhancement of water supply and flood control for the present and projected watershed basins.
2. DISTRICT NEED AND USE: The District needs this project to develop a watershed management plan for the Cocohatchee basin. The watershed plan will be used for planning purposes and for permit criteria. The Big Cypress Basin and the District will benefit from such planning as the Big Cypress Basin board continues to adopt structures in the Big Cypress Basin as works of the basin.
3. SCOPE: The scope of this project is
 - a. Hydrologic-hydraulic analysis assistance to the Big Cypress Basin engineer.
 - b. Selection of a model.
 - c. Calibration, verification, and application of the model.
 - d. Development of alternatives.
 - e. Evaluation and selection of plan.
4. SCHEDULE:
 - a. Obtain pertinent data to establish basin characteristics - 2nd Qtr 87-88
 - b. Set up model, calibration and verification - 3rd Qtr 87-88
 - c. Model run of existing conditions - 3rd Qtr 88-89
 - d. Modeling runs to evaluate alternatives and determine the recommended plan - 3rd Qtr 88-89
 - e. Report Preparation - 4th Qtr 88-89
5. PROGRESS TO DATE: This is the second and concluding year for this project. During FY 87/88, data was collected and analyzed, a model (NETWORK) was selected and calibrated to model the hydraulics of the canal, watershed hydrologic analyses began.
6. PRODUCTS:
 - a. Documentation of the model analysis results.
 - b. Documentation of the alternatives evaluation.
 - c. Final report describing the selected plan.

EVALUATION OF REGIONAL CITRUS DEVELOPMENT

●District Contact: David W. Black

1. OBJECTIVE: The objective of this project is to evaluate the regional effects of new citrus development in southwest Florida in support of Resource Control Department's Basis of Review for Surface Water Management Permit Applications.
2. DISTRICT NEED AND USE: Many decisions are currently being made on applications for surface water management and water use permits for new citrus development. Most of the proposed plans meet current criteria and permits are being issued. There is concern, however, that the great quantity of conversion to citrus culture may create serious regional problems in the areas of wildlife habitat alteration, hydrologic changes, and water quality degradation. The District needs to assess this situation in order to make any necessary changes in permitting criteria before large scale problems develop.
3. SCOPE: This project is composed of one broad study that is in the process of being contracted out and is called the Regional Citrus Study. The study is to assess the regional short-term and long-term effects of new citrus development in southwest Florida on fish and wildlife habitat. Changes in hydrology and water quality will be addressed in the study to the extent that they affect habitat values. Based on the study's result, changes to the permitting that would minimize detrimental effects will be recommended.
4. SCHEDULE: Scheduling for this project are as follows:
 - a. 2nd Quarter FY 88-89:
 1. Award contract.
 - b. 4th Quarter FY 88-89:
 1. Completion of a literature assessment and delivery to District.
 - c. 2nd Quarter FY 89-90:
 1. Delivery of interim report.
 - d. 2nd Quarter FY 90-91:
 1. Delivery of final report.
5. PROGRESS TO DATE: A draft scope of work has been developed. A provisional selection committee has been formed and has met twice to discuss the scope of work. The scope of work has been reviewed internally and by representatives of six other agencies.
6. PRODUCTS: The products for this project are as follows:
 - a. 4th Quarter FY 88-89:
 1. Literature assessment.

CALOOSAHATCHEE ESTUARINE STUDIES

●District Contact: Robert Chamberlain

**CONTRACT REFERENCES: Estuarine Collection/Mote Marine
Benthic Macroinvertebrate Identification/Mote Marine**

1. **OBJECTIVE:** The objective of this project is to provide the basis for the development of an environmentally sensitive estuarine management plan which will address the impacts of large freshwater releases from S-79 which have historically occurred, in part, for the purpose of regulating the water level in Lake Okeechobee. This project was initiated by the District to determine the estuarine impacts caused by these releases and is comprised of two sub-projects.
2. **DISTRICT NEED AND USE:** Through this project, the District seeks to:
 - a. Define an optimum discharge plan for S-79 and Lake Okeechobee that fulfills the Lake's regulation requirements while preserving and enhancing the environmental integrity of the Caloosahatchee Estuary.
 - b. Provide information necessary for predicting estuarine health when considering a change in water management (real time management capability).
3. **SCOPE:** The two sub-projects are :
 - 1) Caloosahatchee Estuary Environmental Assessment. This project involved environmental sampling of estuarine flora, fauna and water quality at least monthly and more often during special events (storms or regulatory releases) in order to evaluate the influence of various discharge volumes. Routine sampling began in FY 85-86 and ended during the third quarter FY 88-89. Data analysis and report writing will commence during the first quarter of FY89-90.
 - 2) Caloosahatchee Model Development and Application. This project shall provide a hydrodynamic/salinity model that will help predict water quality conditions within the estuary for various discharge volumes. In FY 88-89, the model developed in FY 87-88 will be field calibrated and upgraded if necessary to eventually provide the required program information.
4. **SCHEDULE:** Important project milestones are defined below with their anticipated time schedule:
 - a. Advertise RFP and select contractor to install continuous water quality measuring instruments. (2nd Q FY 89-90 if funds approved for FY89-90 budget)
 - b. Install and start-up of continuous water quality measuring instruments. (3rd Q FY 89-90, subject to Governing Board approval)
 - c. Completion of projects' annual report. (3rd Q FY88-89)
 - d. Completion of routine biological sampling. (3rd Q FY88-89)
 - e. Upgrade existing mathematical model, add basin rainfall-runoff relationship if necessary, and publish this final user friendly model as District Technical Publication. (4th Q FY89-90)
 - f. Administer two contracts to insure the continual processing of project samples and the cataloging and compiling of data when received from the contractor until contract completion. (3rd Q FY89-90)

- g. Statistical analysis and data interpretation of biological samples. (3rd Q FY89-90)
 - h. Draft of technical publication of project 001PL results disseminated for review. (4th Q FY89-90)
 - i. Technical publication outlining projects' estuarine management plan according to biological data and computer model simulation. (4th Q FY 90-91)
5. PROGRESS TO DATE: (a) Monthly biological sampling began in FY 85-86, continued through FY 86-87 and is scheduled to end after three years in May 1989; This sampling has occasionally included intense special event sampling done weekly or bi-weekly, (b) A second contract was established with Mote Marine Lab (Estuarine Collection Identification, #708) to identify predominately plankton samples. This second contract is a three year contract that commenced in February 1988. (c) The Macroinvertebrate Identification contract (#360) is planned for completion the end of FY 88-89; (d) Estuarine Assessment project progress report was produced for work accomplished through April 1989, (e) Technical Publication 88-7, Caloosahatchee Estuary Hydrodynamics, which describes the hydrodynamics of this estuarine system, discusses the important driving forces, and defines the mathematical theory of the model to be used as the basis for the final, upgraded and calibrated hydrodynamic/salinity model. Model review continues in order to decide on the degree of sophistication that is required to accomplish program goals.
6. PRODUCTS: A Technical Publication was produced in FY 87-88 that described the mathematical theory to be used in the development of the finalized hydrodynamic model. The District Technical Publication for the final version of the hydrodynamic/salinity model is scheduled for Sept. 1990. The Technical Publication concerning the biological research is planned for 4th Q FY 89-90 and the Technical Publication outlining a Caloosahatchee Estuary Management Plan is scheduled for 4th Q FY 90-91.

CALOOSAHATCHEE ESTUARY ENVIRONMENTAL ASSESSMENT

●District Contact: Robert Chamberlain

1. **OBJECTIVE:** The objective of this project is to determine the environmental impacts to the Caloosahatchee Estuary caused by freshwater releases through S-79 that have historically occurred, in part, for the purpose of regulating the water level of Lake Okeechobee.
2. **DISTRICT NEED AND USE:** In order to fulfill the District goals of establishing an environmentally sensitive estuarine management plan, this project seeks to evaluate the influence of various freshwater discharge volumes on a variety of flora and fauna by conducting routine (monthly) and special event sampling.
3. **SCOPE:** Specific task descriptions for this project include:
 - a. Routine sampling of ichthyoplankton, zooplankton, phytoplankton, benthic, macroinvertebrates, seagrass, and water quality at least monthly and more often during special events (storm and regulatory releases from Lake Okeechobee).
 - b. Provide an annual program status report on field, laboratory, and contract progress.
 - c. Confer with modelers concerning status of model and lend assistance when appropriate.
 - d. Administer contracts entitled, Estuarine Collection/Mote Marine and Benthic Macroinvertebrate Identification/Mote Marine to insure shipment and receipt of samples so timely processing of project data can be maintained.
 - e. Provided technical assistance upon request concerning management issues as they pertain to the Caloosahatchee Estuary and other estuarine systems in south Florida.
4. **SCHEDULE:** Major tasks and schedules are as follows:
 - a. Completion of routine sampling. (3rd Q FY 88-89)
 - b. Project annual report. (3rd Q FY 88-89)
 - c. Contract entitled "Estuarine Collection/Mote Marine" renewal and approval of additional funds. (1st Q FY 88-89)
 - d. Installation and begin start-up of permanent and continuous water quality measuring instruments. (3rd Q FY 89-90)
 - e. Administer contracts until completion. (2nd Q FY 89-90)
 - f. Complete data base design and statistical analysis. (3rd Q FY 89-90)
 - g. Technical publication of biological research results and conclusions. (4th Q FY 89-90)
5. **PROGRESS TO DATE:** A three year sampling activity begun in FY 85-86 was continued through its second year in FY 87-88. Monthly sampling was conducted as planned except during extreme weather conditions or equipment failure. Another series of spring regulatory releases (pulses) were sampled during intense bi-weekly sampling. Also in FY 87-88: (1) another contract (Estuarine Collection/Mote Marine) with Mote Marine Laboratory was executed and sample processing begun, (2) shipment of invertebrate samples continued as part of Benthic Macroinvertebrate Identification/Mote Marine, (3) efforts to install permanent continuous water quality measuring instruments

was delayed and rescheduled for 89-90, and (4) design of a project data base was begun that will store all project data.

6. PRODUCTS:

- a. Reference collection of biological organisms and bibliography of estuarine literature which will assist District during future research.
- b. An extensive quantitative data base of biological, discharge, and water quality information collected simultaneously for three years will allow evaluation of various management strategies for the Caloosahatchee and will also provide quantitative baseline data for possible future work if needed.
- c. District technical publication that evaluates the estuary's response to changing freshwater discharges. This publication and the information it contains will be crucial to attaining the program goals.
- d. Long term water quality measuring network that operates continuously and provides instantaneous information through telephone connection, so real time management can take place. This will assist in determining the possible consequences of changing standard operating practices.

CALOOSAHATCHEE RIVER MANAGEMENT AND REGULATION

●**District Contact:** P. D. Scarlatos

1. **OBJECTIVE:** Objective of this project is to apply the Caloosahatchee estuary hydrodynamic model for determination of the schedule of freshwater releases from structure S-79 that creates the desirable salinity conditions.
2. **DISTRICT NEED AND USE:** This project falls within the guidelines established by LOTAC for protection of estuarine waters from extreme freshwater releases.
3. **SCOPE:** Freshwater releases from structure S-79 to the Caloosahatchee estuary made without any consideration of the downstream impact, may be detrimental to the ecosystem. To maintain a healthy environment, the salinity within the estuary should fluctuate within certain limits. Since the schedule of discharges from S-79 depends on other factors, such as flood control and water use, a management project should be established for the amount and duration of the discharges, that include the environmental goals. This project will incorporate all of the components of the system along with their seasonal characteristics. For that purpose, the Caloosahatchee estuary hydrodynamics model will be utilized. Various hydrologic scenarios will be analyzed and the impact of the freshwater releases will be assessed. Optimization of the operational mode of structure S-79 will be investigated.

Specific tasks for this program include:

- a. Receive input from Environmental Sciences Division regarding of salinity fluctuation criteria.
 - b. Supply the existing hydrodynamic model and identify the freshwater discharge scenarios that will provide optimum salinity conditions.
 - c. Develop preliminary operational schedule of freshwater releases through structure S-79.
4. **SCHEDULE:**
 - a. Complete review and analysis with Environmental Sciences Division of the existing data regarding physical and environmental parameters in the Caloosahatchee estuary - 4th Qtr 88-89.
 - b. Summarize conclusions of the data analysis and define salinity distribution requirements - 4th Qtr 88-89.
 - c. Complete application of hydrodynamic model and identification of the sensitivity of the system with respect to the various hydrologic components - 4th Qtr 88-89.
 - d. Complete selection of the release schedules that produce the best salinity conditions for the environment and document in a technical publication - 4th Qtr 89-90.
 - e. Development of a management plan for freshwater releases through structure S-79 - 4th Qtr 90-91.
 5. **PROGRESS TO DATE:** The hydrodynamic model has been completed.

6. **PRODUCTS:** The final product at the end of FY 88-89 will be a progress report including the following:
 - a. Sensitivity analysis of the estuarine system by means of mathematical simulation.
 - b. Optimization of freshwater releases from structure S-79 with respect to the salinity distribution levels.
 - c. Preliminary management plan for the estuary, depending on data availability.

WESTERN COLLIER COUNTY GROUND WATER RESOURCE ASSESSMENT

●District Contact: Mary-Jo Shine

CONTRACT REFERENCES: Collier County Ground Water Optimization Model

1. OBJECTIVE: This project will provide the District with a three-dimensional ground water flow model capable of assessing the impacts of withdrawals on the four principal fresh water aquifers of western Collier County.
2. DISTRICT NEED AND USE: The model will be used in the development of sectional water use management plans, permit evaluations, and drought impact assessments. It will have significantly greater capabilities than the present model used by the District in dealing with issues of interactions between aquifers and between ground and surface waters. The end users and uses of the products will be:
 - a. Resource Planning Department - in the development of water use plans under the WUMP initiative.
 - b. Resource Control Department - as a water use cumulative impact model for permit evaluations.
 - c. Collier County/City of Naples - as a model for analyzing development scenarios.
3. SCOPE: The study area will consist of all Collier County west of SR 29 and adjacent land in Lee and Hendry Counties. The study will use the existing hydrogeologic data base and updated land use and demand data. A three-dimensional model will be coded using this information, and will then be calibrated. This model and the optimization model will be used to determine the optimal long-term development potential for the water resource.
4. SCHEDULE:
 - a. Update hydrogeologic, water use and land use data. 3rd Quarter FY 88-89
 - b. Regionalize hydraulic data, complete discretization, and assemble the model. 1st Quarter FY 89-90
 - c. Complete calibration and validation of the model. 3rd Quarter FY 89-90
 - d. Complete technical publication. FY 90-91
5. PROGRESS TO DATE: Preliminary work on water use and hydrogeologic data collection has been completed.
6. PRODUCTS:
 - a. An updated data base suitable for incorporation into the District GIS.
 - b. A calibrated multilayer ground water flow model which incorporates cumulative impacts of demands from several fresh water aquifers.
 - c. A report documenting the model and hydrogeologic regime.

HENDRY COUNTY SHALLOW AQUIFERS THREE-DIMENSIONAL FLOW MODEL

●District Contact: Keith R. Smith

1. **OBJECTIVE:** The objective of this project is to develop a three-dimensional ground water flow model for the Surficial Aquifer System in Hendry County.
2. **DISTRICT NEED AND USE:** A three-dimensional ground water flow model to serve as the basis for a cumulative ground water use impact assessment is needed for the water allocation process (Section 3.2, Volume III, Management of Water Use). Agricultural water use is rapidly increasing throughout Hendry County. This model will be capable of evaluating the effects of the projected significant increases in ground water withdrawals from the lower Tamiami and sandstone aquifers.
3. **SCOPE:** All of the field work needed to support the development of the model has been completed as part of the Hendry County Ground Water Resource Assessment (Technical Publication 88-12). Geologic and hydrogeologic data generated from the field work, as well as data from various consultant reports, will be reevaluated. This information will be used to discretize the hydrogeologic system into model layers. Rainfall, evaporation, and surface water data will be incorporated into the model. Water use information will be reviewed, updated, and summarized. The model will then be calibrated, documented, and incorporated into a cumulative impact format. This project began in FY 87-88 and will be completed by October 1990.
4. **SCHEDULE:**

Quarter 1, FY 88-89: Geologic and hydrogeologic reevaluation. Begin work on water use and surface water information.

Quarter 2, FY 88-89: Continue work on water use and surface water data. Complete the discretization of the hydrogeologic data into model layers.

Quarter 3, FY 88-89: Begin assembling discretized data and other information into model. Complete preliminary model runs.

Quarter 4, FY 88-89: Calibrate the model.

FY 89-90: Make predictive model runs; convert to cumulative impact format; prepare a technical publication summarizing the results of the modelling study.
5. **PROGRESS TO DATE:** As previously stated, all the required field work is complete. The geologic and hydrogeologic reevaluation has begun. An inventory of water use permit information was completed in 1986; but this needs to be updated.
6. **PRODUCTS:** The final products will be the completed model, its documentation, software required for cumulative impact assessment, and a plan for periodic updating and enhancement of the model. A technical publication will also be produced as part of this project.

CALOOSAHATCHEE RIVER WATER QUALITY MONITORING

●District Contact: Larry V. Grosser

1. **OBJECTIVE:** The objective of this project is to collect surface water quality, hydrologic, and meteorologic data along the Caloosahatchee River, and to provide the primary water chemistry database for routine and special water quality evaluations.
2. **DISTRICT NEED AND USE:** The water chemistry data generated by this project will be provided externally to the DER, Corps of Engineers, Brighton Seminole Indians, City of Fort Myers and Lee and Hendry Counties for various applications including salt water intrusion monitoring, water use planning efforts and navigation evaluations. Internally, the data will be used by the Resource Control, Planning and Operations Departments for criteria development, water quality loadings and special projects (eg: Nicodemous Slough plan) and documentation of project structure operations, respectively. Additionally, the data will be used in the SWIM program for the evaluation of downstream impacts from diversion of S-4.
3. **SCOPE:** Locations are selected to determine water quality conditions at major water control points, to detect significant changes in water quality, and to provide a means of determining short and long term trends which will be used to evaluate downstream impacts of any proposed S-4 diversion. This project encompasses major water control structures along and discharging into the Caloosahatchee River.

Hydrologic parameters measured are water levels, flow, structure operations, and rainfall. The USGS maintains an extensive periodic ground water network in addition to monitoring flow and stages at structures along the Caloosahatchee River. Data Management Division monitors rainfall and tributary flow.

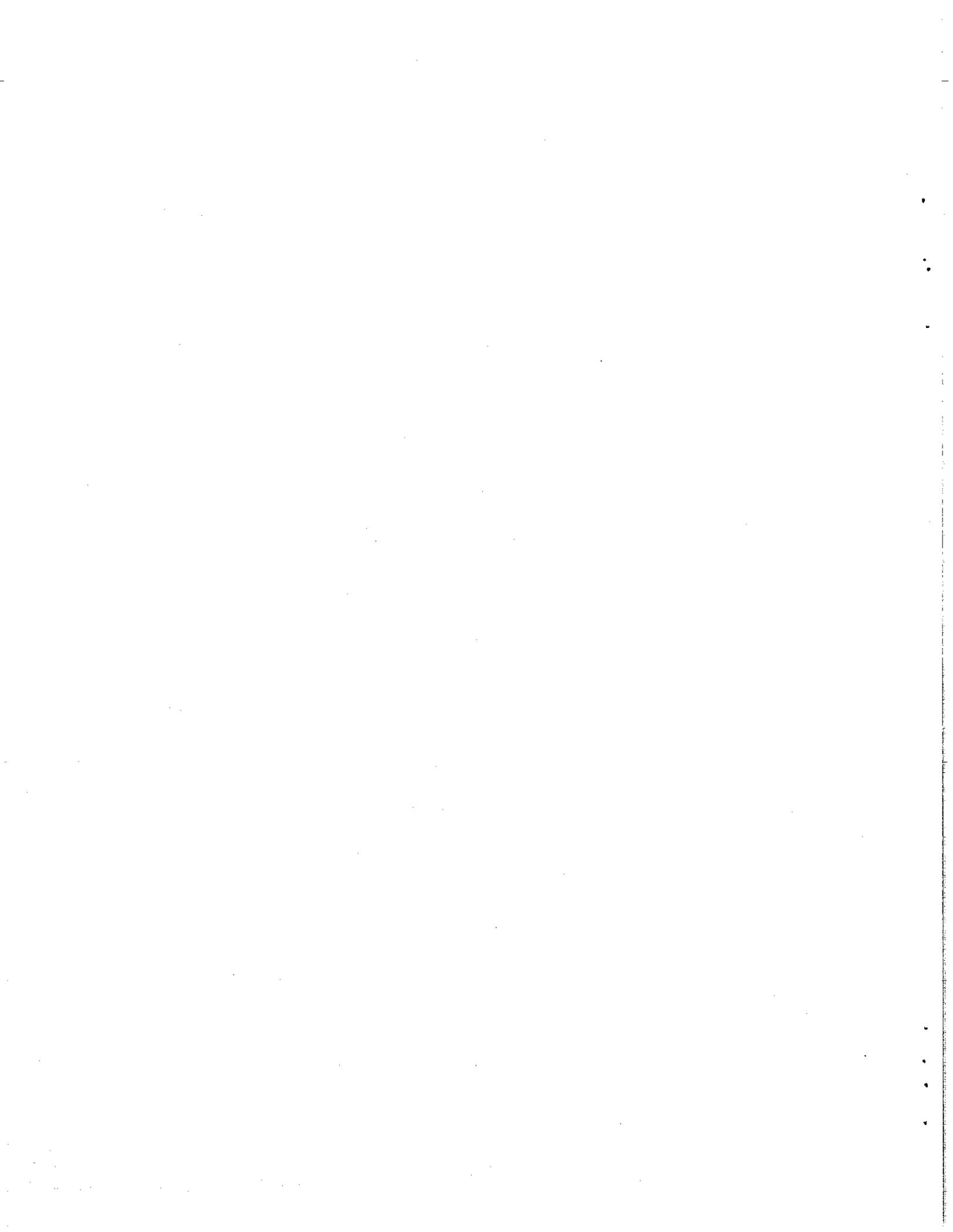
Hydrologic and meteorologic data are being collected and processed to support his project. Complete descriptions of the scope and budget of these hydrologic data support efforts are contained in the documentation for the project entitled General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Projects.

4. **SCHEDULE:** Four Caloosahatchee River water quality stations are sampled every two months at the upstream sides of S78, S79, S235, and S47D.
5. **PROGRESS TO DATE:** This is an ongoing project which was initiated in 1978 and is routinely sampled once every two months.
6. **PRODUCTS:**
 - a. 1st Quarter FY 88-89:
 1. Water quality trend analysis report.

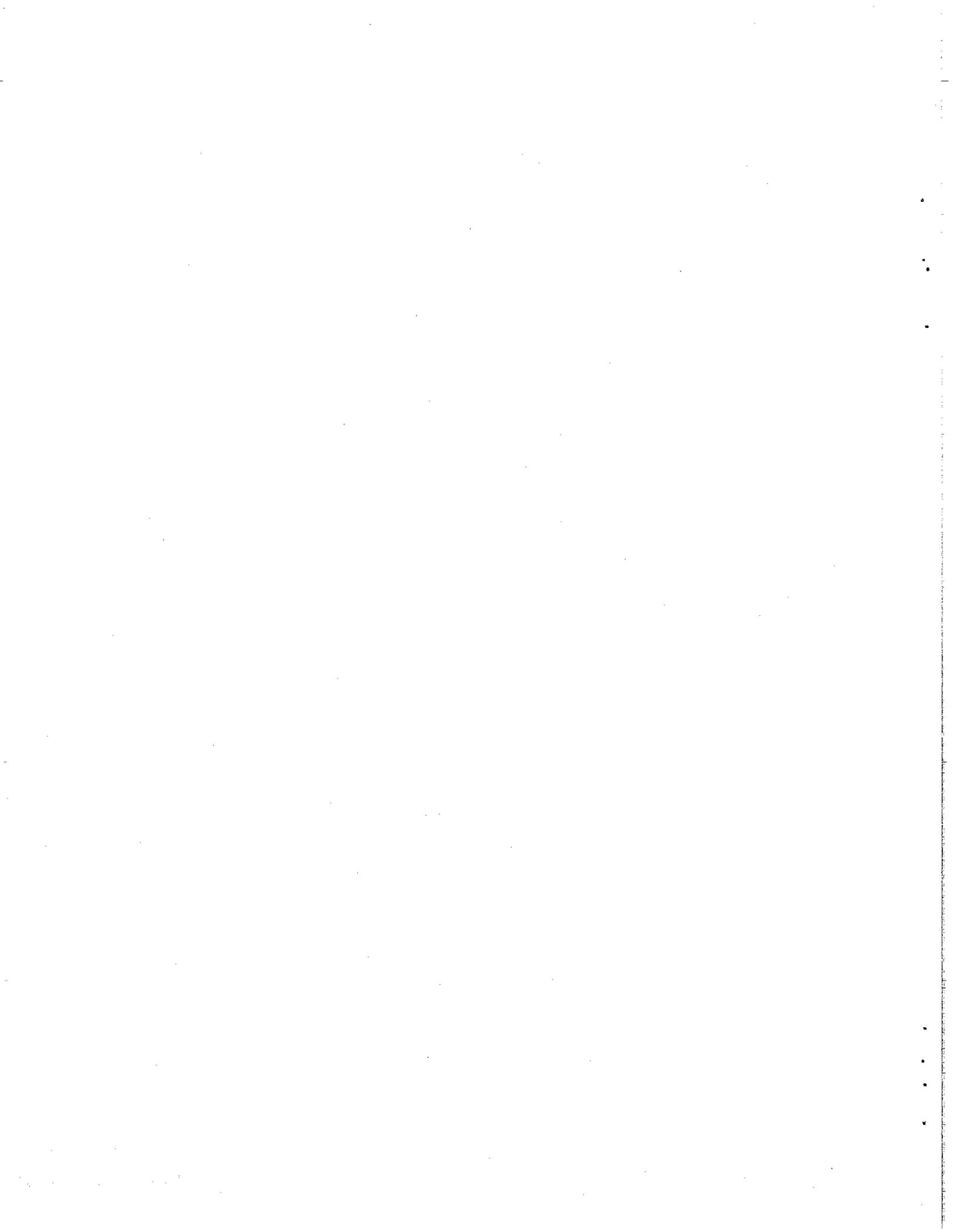
- b. 3rd Quarter FY 88-89:
 - 1. Caloosahatchee River Quality Assurance Plan.

- c. 4th Quarter FY 88-89:
 - 1. Caloosahatchee River Quality Assurance Systems Audit.

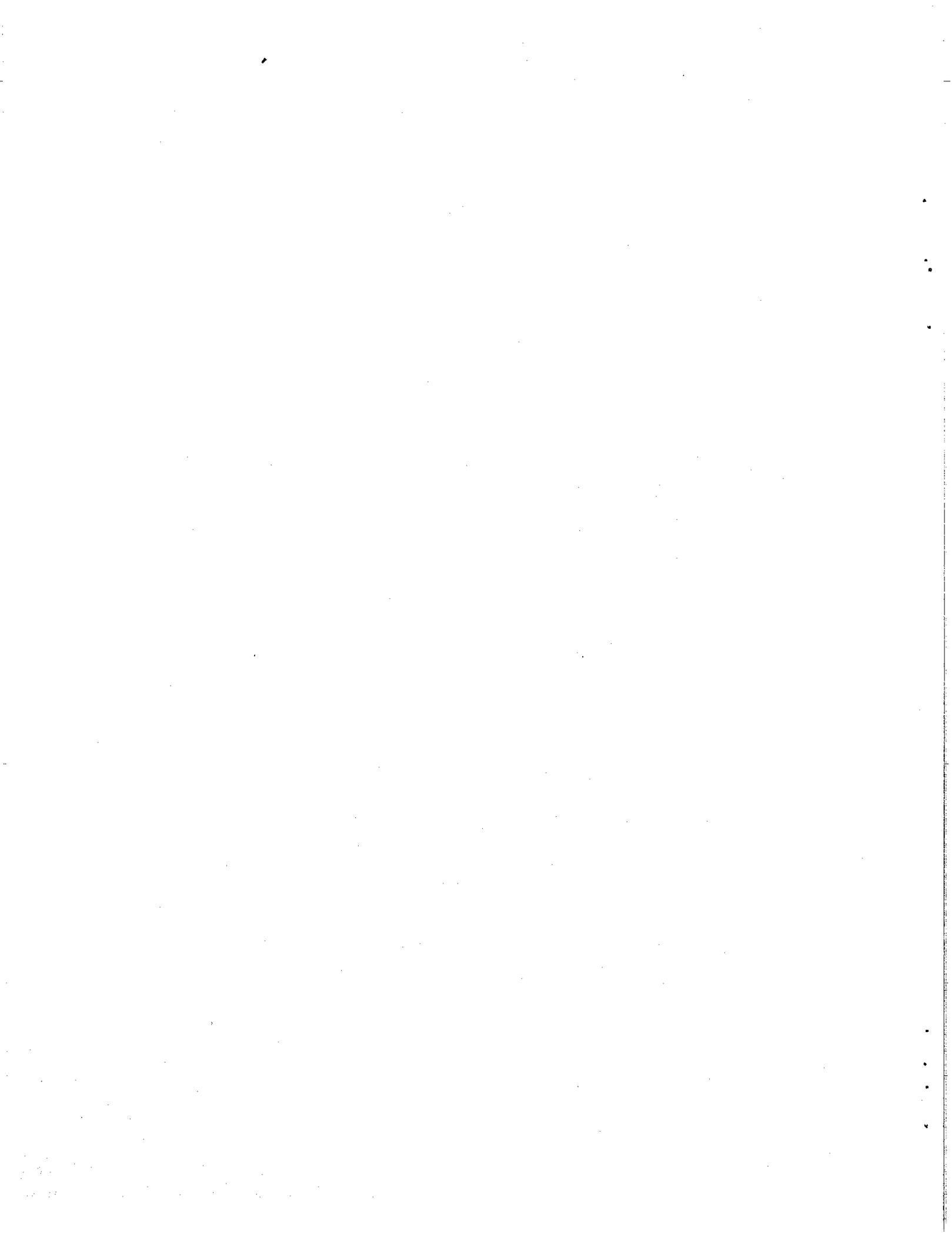
APPENDICES



PROJECT CROSS REFERENCES



Guide 1: PROJECTS BY COUNTY OF MAJOR IMPACT



Guide 1: PROJECTS BY COUNTY

List of Projects	Page #	Broward	Charlotte	Collier	Dade	Glade	Henry	Highlands	Lee	Martin	Monroe	Okeechobee	Orange	Osceola	Palm Beach	Polk	St. Lucie
DISTRICT WIDE																	
Water Quality Evaluation of Surface Water Management Systems	2			X			X								X		
Development of Basin-Wide Water Quality Criteria	4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Environmental Assessment-Save Our Rivers	6														X		
Floodplain Storage Analysis	8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Frequency Analysis of Rainfall for SFWMD	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Remote Sensing Applications Environmental Sciences Division	11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hydrologic and Hydraulic Model Development	12	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Channel Routing Model	14	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
Predevelopment Runoff Methods	15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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List of Projects	Page #	Broward	Charlotte	Collier	Dade	Glade	Henry	Highlands	Lee	Martin	Monroe	Okeechobee	Orange	Osceola	Palm Beach	Polk	St. Lucie
Maintenance and Improvement of Existing Models	17	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wetland Modeling	18	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Rainfall-Runoff Modeling	19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
South Florida Water Management System Analysis and Operation	21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Data Processing Software Support	23	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Data Base	25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Programs	26	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Instrument Evaluation	40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stream Gauging	42	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hydrogeologic Data Base Development	43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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USGS Cooperative Studies Coordination	44	X						X	X	X		X	X	X	X		X
Well Drilling Geophysics, Hydrogeologic Field Support	47	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Use Management and Planning	49	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Inorganic Lab Charges	51	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chemistry Lab Data Base	53	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wet/Dry Precipitation Collection	54	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pesticide Water Quality Monitoring Network	55				X	X	X				X	X			X		
Water Quality Information Systems and Support	58	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Economic Analysis of Water Demand and Costs	60	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Use Management Plan-Demand Projections	62	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wetland Resource/Water Requirements	64	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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SWIM Management Plans-- Identification of Other Priority Water Bodies	65	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LAKE OKEECHOBEE																	
Phosphorus Dynamics and Circulation Study	67				X	X	X			X		X			X		
Lake Ecosystem Study	69					X	X			X		X			X		
Surface Water Use Plan for the Lake Okeechobee Service Area	72					X	X		X	X		X			X		
Lake Okeechobee Monitoring and Hydrologic Data Collection	74					X	X			X		X			X		
Water Quality Evaluation of Herbicide Spray Program	76					X	X			X		X			X		
LAKE OKEECHOBEE TRIBUTARY BASIN																	
L8 Backpumping Data Acquisition	79														X		

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Acquifer Storage and Recovery (ASR) Demonstration Project	80											X					
Demonstration and Evaluation of Biological Treatment Technologies for Phosphorus Control on Dairies	82							X		X		X					
Chemical Treatment Demonstration Technology	85							X		X		X					
Confinement Dairy Demonstration	87							X		X		X					
S-4 Basin Nutrient Reduction Plan	89					X											
Biogeochemical Behavior and Transport of Phosphorus in the Lake Okeechobee Basin	90					X		X		X		X			X		
Development of Fertilization Practices for Beef Cattle pastures to Minimize Nutrient Loss in Runoff	92					X		X		X		X		X	X	X	
Phosphorus Feed Reduction	94							X		X		X					

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S-236	96				X	X				X					X		
Design of BMPs-Taylor Creek Nubbin Slough	97									X		X					
SWIM Management Plans--Lake Okeechobee	98					X	X			X		X			X		
Taylor Creek Nubbin Slough BMP Monitoring	99									X		X					
Lower Kissimmee River Water Quality Monitoring Program	101					X		X				X					
Dairy Monitoring St. Lucie Canal Basin	103									X							
Dairy Monitoring S-4 Basin	104					X	X										
Dairy Monitoring Arbuckle Creek	105							X								X	
KISSIMMEE RIVER																	
Floodplain Restoration Projects in the KICCO Wildlife Management Area	107							X				X		X		X	
Boney Marsh Management Technique Evaluation	109							X				X		X		X	

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Kissimmee River Structures	110				X			X				X		X		X	
Modifications to the Existing Physical System	111							X				X		X		X	
Evaluation of Phase I - Kissimmee River Restoration Project	112							X				X		X		X	
Tributary and Oxbow Revitalization Plans and Designs	113							X				X		X		X	
Kissimmee River Restoration Symposium	114							X				X		X		X	
Environmental Monitoring	115							X				X		X		X	
UPPER KISSIMMEE LAKES																	
Kissimmee Chain of Lakes Water Quality Studies	117													X		X	
Development of Management Plans--Lake Tohopekaliga	119													X			
Development of Management Plans--East Lake Tohopekaliga	120													X			

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LAKE ISTOKPOGA																	
Lake Istokpoga and Indian Prairie Basin Hydrologic Analysis	122			X				X									
Lake Istokpoga Water Quality Monitoring Program	124							X									
Surface Water Use Plan for the Indian Prairie Basin	126			X				X									
UPPER EAST COAST																	
Generation of "Capture Zones" for Selected Wellfields in Martin County	129									X							X
Loxahatchee River/Slough Restoration Project	131									X					X		
Loxahatchee Estuary Dynamics	132									X					X		
Loxahatchee River Basin Study	134									X					X		
Environmental Investigation in the Loxahatchee River Corridor and Slough	137									X					X		

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Loxahatchee Estuary	138									X					X		
Indian River Dynamics	140									X							
SWIM Management Plans-- Indian River Lagoon	141									X							X
St. Lucie Estuary Management	142									X							
St. Lucie Estuary Dynamics	143									X							
St. Lucie Canal Water Quality Data Collection	144									X							
Surface Water Use Plan for C- 23, C-24, and C-25 Basins	145									X							X
Hydrogeologic Reconnaissance and Ground Water Resource Assessment of the Surficial Aquifer System of St. Lucie County, Florida	147																X
Martin Co. Surficial Aquifer System - 3-D Flow Model	149									X							

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Upper East Coast and Lower East Coast Surface Water Quality Data Collection	153	X			X					X	X				X		X
LOWER EAST COAST																	
Water Management Plan - Hillsboro Canal Basin	155	X													X		
C-11 Basin	156	X															
C-111 Environmental Studies	157				X						X						
North Broward County Biscayne Aquifer Three-Dimensional Flow Model	159	X															
SWIM Management Plans-- Biscayne Bay	161				X						X						
WATER CONSERVATION AREA																	
Wading Bird Surveys	163	X			X	X	X								X		
WCA Impacts, Monitoring, and Nutrient Thresholds	165	X	X												X		
Nutrient Responses and Thresholds of Everglades Vegetation Communities	167	X													X		

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Alteration in regulation Schedule - WCA-2A	169	X										X			X		
Water Quality Monitoring	171	X		X											X		
Everglades National Park downstream Impacts	172			X	X						X						
Holey Land Environmental Monitoring	174														X		
Everglades Comprehensive Planning	175	X			X						X				X		
Development of Management Plans-- Everglades Water Conservation Areas	176	X			X						X				X		
EVERGLADES AGRICULTURAL AREA																	
Analysis of EAA Modeling Methodologies	178						X								X		
Evaluation of the Effects of On-Farm Agricultural Practices in the Organic Soils of the EAA on Phosphorus and Nitrogen Transport	180						X								X		

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EAA Flow-Way	182														X		
LOWER WEST COAST																	
Six-Mile Cypress Slough	185								X								
Conceptual Water Management Plan-Cocohatchee Watershed	187			X													
Evaluation of Regional Citrus Development	188			X					X								
Caloosahatchee Estuarine Studies	189								X								
Caloosahatchee Estuary Environmental Assessment	191								X								
Caloosahatchee River Management and Regulation	193								X								
Western Collier County Groundwater Resource Assessment	195			X													
Hendry County Shallow Aquifers Three-Dimensional Flow Model	196																X

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Caloosahatchee River Water Quality Monitoring	197					X	X		X								



Guide 2: PROJECTS BY LAND USE



Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
DISTRICT WIDE									
Water Quality Evaluation of Surface Water Management Systems	2	X	X						
Development of Basin-Wide Water Quality Criteria	4		X						
Environmental Assessment-Save Our Rivers	6			X	X	X	X		
Floodplain Storage Analysis	8		X						
Frequency Analysis of Rainfall for SFWMD	9								
Remote Sensing Applications Environmental Sciences Division	11			X	X	X			
Hydrologic and Hydraulic Model Development	12	X	X	X	X	X			
Channel Routing Model	14								
Predevelopment Runoff Methods	15			X			X		
Maintenance and Improvement of Existing Models	17								
Wetland Modeling	18	X		X					

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Rainfall-Runoff Modeling	19	X	X	X					
South Florida Water Management System Analysis and Operation	21	X	X						
Data Processing Software Support	23								
Data Base	25								
General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Programs	26								
Instrument Evaluation	40								
Stream Gauging	42								
Hydrogeologic Data Base Development	43								
USGS Cooperative Studies Coordination	44								
Well Drilling Geophysics, Hydrogeologic Field Support	47								
Water Use Management and Planning	49	X	X	X	X	X			
Inorganic Lab Charges	51								

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Chemistry Lab Data Base	53								
Wet/Dry Precipitation Collection	54								
Pesticide Water Quality Monitoring Network	55								
Water Quality Information Systems and Support	58								
Economic Analysis of Water Demand and Costs	60	X							
Water Use Management Plan-Demand Projections	62	X	X						
Wetland Resource/Water Requirements	64			X					
SWIM Management Plans-- Identification of Other Priority Water Bodies	65			X	X	X			
LAKE OKECHOBEE									
Phosphorus Dynamics and Circulation Study	67								
Lake Ecosystem Study	69				X				
Surface Water Use Plan for the Lake Okechobee Service Area	72	X	X						

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Lake Okeechobee Monitoring and Hydrologic Data Collection	74				X				
Water Quality Evaluation of Herbicide Spray Program	76				X			X	
LAKE OKEECHOBEE TRIBUTARY BASIN									
L8 Backpumping Data Acquisition	79								
Acquirer Storage and Recovery (ASR) Demonstration Project	80								
Demonstration and Evaluation of Biological Treatment Technologies for Phosphorus Control on Dairies	82	X							
Chemical Treatment Demonstration Technology	85	X							
Confinement Dairy Demonstration	87	X							
S-4 Basin Nutrient Reduction Plan	89	X	X						

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Biogeochemical Behavior and Transport of Phosphorus in the Lake Okeechobee Basin	90	X	X	X					
Development of Fertilization Practices for Beef Cattle pastures to Minimize Nutrient Loss in Runoff	92	X							
Phosphorus Feed Reduction	94	X							
S-236	96	X							
Design of BMPs-Taylor Creek Nubbin Slough	97	X							
SWIM Management Plans-- Lake Okeechobee	98	X	X	X	X	X			
Taylor Creek Nubbin Slough BMP Monitoring	99	X							
Lower Kissimmee River Water Quality Monitoring Program	101	X							
Dairy Monitoring St. Lucie Canal Basin	103	X							
Dairy Monitoring S-4 Basin	104	X							

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Dairy Monitoring Arbuckle Creek	105	X							
KISSIMMEE RIVER									
Floodplain Restoration Projects in the KICCO Wildlife Management Area	107				X				
Boney Marsh Management Technique Evaluation	109				X				
Kissimmee River Structures	110							X	
Modifications to the Existing Physical System	111				X			X	
Evaluation of Phase I - Kissimmee River Restoration Project	112				X			X	
Tributary and Oxbow Revitalization Plans and Designs	113				X			X	
Kissimmee River Restoration Symposium	114				X			X	
Environmental Monitoring	115				X			X	
UPPER KISSIMMEE LAKES									
Kissimmee Chain of Lakes Water Quality Studies	117					X			

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Development of Management Plans--Lake Tohopekaliga	119					X			
Development of Management Plans--East Lake Tohopekaliga	120					X			
LAKE ISTOKPOGA									
Lake Istokpoga and Indian Prairie Basin Hydrologic Analysis	122				X			X	
Lake Istokpoga Water Quality Monitoring Program	124				X				
Surface Water Use Plan for the Indian Prairie Basin	126								
UPPER EAST COAST									
Generation of "Capture Zones" for Selected Wellfields in Martin County	129								X
Loxahatchee River/Slough Restoration Project	131			X		X			
Loxahatchee Estuary Dynamics	132					X			

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List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Loxahatchee River Basin Study	134	X	X	X					
Environmental Investigation in the Loxahatchee River Corridor and Slough	137			X					
Loxahatchee Estuary	138					X			
Indian River Dynamics	140					X			
SWIM Management Plans-- Indian River Lagoon	141	X	X	X		X			
St. Lucie Estuary Management	142					X			
St. Lucie Estuary Dynamics	143					X			
St. Lucie Canal Water Quality Data Collection	144							X	
Surface Water Use Plan for C-23, C-24, and C-25 Basins	145	X	X						
Hydrogeologic Reconnaissance and Ground Water Resource Assessment of the Surficial Aquifer System of St. Lucie County, Florida	147								

Guide 2: PROJECTS BY LAND USE

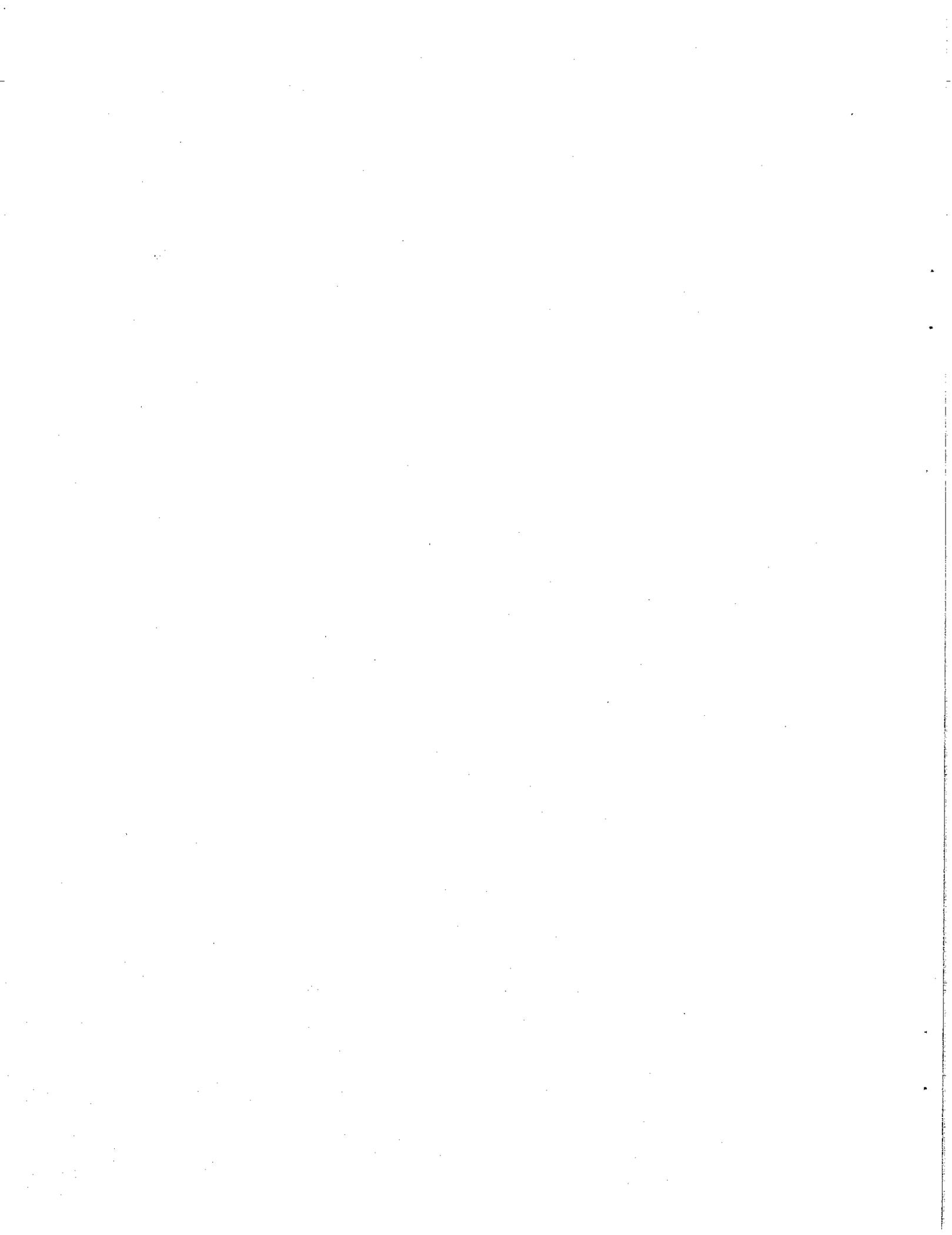
List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Martin Co. Surficial Aquifer System - 3-D Flow Model	149								
Upper East Coast and Lower East Coast Surface Water Quality Data Collection	153								
LOWER EAST COAST									
Water Management Plan Hillsboro Canal Basin	155	X	X	X		X			
C-11 Basin	156	X	X						
C-11 Environmental Studies	157			X		X			
North Broward County Biscayne Aquifer Three-Dimensional Flow Model	159								
SWIM Management Plans-- Biscayne Bay	161					X			
WATER CONSERVATION AREA									
Wading Bird Surveys	163			X					
WCA Impacts, Monitoring, and Nutrient Thresholds	165			X					
Nutrient Responses and Thresholds of Everglades Vegetation Communities	167			X					

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List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Alteration in regulation Schedule - WCA-2A	169			X					
Water Quality Monitoring	171			X					
Everglades National Park downstream Impacts	172			X					
Holey Land Environmental Monitoring	174			X					
Everglades Comprehensive Planning	175			X					
Development of Management Plans-- Everglades Water Conservation Areas	176	X	X	X					
EVERGLADES AGRICULTURAL AREA									
Analysis of EAA Modeling Methodologies	178	X							
Evaluation of the Effects of On-Farm Agricultural Practices in the Organic Soils of the EAA on Phosphorus and Nitrogen Transport	180	X							
EAA Flow-Way	182			X					

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
LOWER WEST COAST									
Six-Mile Cypress Slough	185			X					
Conceptual Water Management Plan-Cocohatchee Watershed	187	X	X	X		X			
Evaluation of Regional Citrus Development	188	X		X			X		
Caloosahatchee Estuarine Studies	189					X			
Caloosahatchee Estuary Environmental Assessment	191					X			
Caloosahatchee River Management and Regulation	193					X			
Western Collier County Groundwater Resource Assessment	195								
Hendry County Shallow Aquifers Three-Dimensional Flow Model	196								
Caloosahatchee River Water Quality Monitoring	197								



Guide 3: PROJECTS BY AREA OF STUDY

Guide 3: PROJECTS BY AREA OF STUDY

List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
DISTRICT WIDE											
Water Quality Evaluation of Surface Water Management Systems	2			X					X		
Development of Basin-Wide Water Quality Criteria	4	X		X					X		
Environmental Assessment-Save Our Rivers	6	X									
Floodplain Storage Analysis	8			X							
Frequency Analysis of Rainfall for SFWMD	9						X				
Remote Sensing Applications Environmental Sciences Division	11	X						X			
Hydrologic and Hydraulic Model Development	12			X							
Channel Routing Model	14			X							
Predevelopment Runoff Methods	15			X							
Maintenance and Improvement of Existing Models	17			X							
Wetland Modeling	18			X							
Rainfall-Runoff Modeling	19			X							
South Florida Water Management System Analysis and Operation	21			X							
Data Processing Software Support	23			X			X				

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List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
Data Base	25			X			X				
General Network Hydrologic Data Acquisition and Documentation of Hydrologic Data Collection in Support of Other Programs	26			X			X				
Instrument Evaluation	40			X			X				
Stream Gauging	42			X			X				
Hydrogeologic Data Base Development	43				X						
USGS Cooperative Studies Coordination	44				X						
Well Drilling Geophysics, Hydrogeologic Field Support	47										
Water Use Management and Planning	49		X					X			
Inorganic Lab Charges	51								X		
Chemistry Lab Data Base	53								X		
Wet/Dry Precipitation Collection	54						X		X		
Pesticide Water Quality Monitoring Network	55								X		
Water Quality Information Systems and support	58								X		
Economic Analysis of Water Demand and Costs	60		X							X	

Guide 3: PROJECTS BY AREA OF STUDY

List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
Water Use Management Plan-Demand Projections	62		X					X		X	
Wetland Resource/Water Requirements	64	X									
SWIM Management Plans--Identification of Other Priority Water Bodies	65							X			
LAKE OKEECHOBEE											
Phosphorus Dynamics and Circulation Study	67					X			X		
Lake Ecosystem Study	69	X							X		
Surface Water Use Plan for the Lake Okeechobee Service Area	72			X				X			
Lake Okeechobee Monitoring and Hydrologic Data Collection	74			X			X		X		
Water Quality Evaluation of Herbicide Spray Program	76								X		
LAKE OKEECHOBEE TRIBUTARY BASIN											
L8 Backpumping Data Acquisition	79								X		
Acquirer Storage and Recovery (ASR) Demonstration Project	80				X				X		
Demonstration and Evaluation of Biological Treatment Technologies for Phosphorus Control on Dairies	82								X		X

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List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
Chemical Treatment Demonstration Technology	85								X		X
Confinement Dairy Demonstration	87								X		X
S-4 Basin Nutrient Reduction Plan	89							X	X		
Biogeochemical Behavior and Transport of Phosphorus in the Lake Okeechobee Basin	90								X		X
Development of Fertilization Practices for Beef Cattle pastures to Minimize Nutrient Loss in Runoff	92								X		X
Phosphorus Feed Reduction	94										X
S-236	96			X					X		
Design of BMPs-Taylor Creek Nubbin Slough	97										X
SWIM Management Plans--Lake Okeechobee	98	X		X		X		X	X		
Taylor Creek Nubbin Slough BMP Monitoring	99								X		X
Lower Kissimmee River Water Quality Monitoring Program	101								X		X
Dairy Monitoring St. Lucie Canal Basin	103								X		X
Dairy Monitoring S-4 Basin	104								X		X
Dairy Monitoring Arbutle Creek	105								X		X
KISSIMMEE RIVER											

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List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
Floodplain Restoration Projects in the KICCO Wildlife Management Area	107	X		X							
Boney Marsh Management Technique Evaluation	109	X		X					X		
Kissimmee River Structures	110								X		
Modifications to the Existing Physical System	111			X							
Evaluation of Phase I - Kissimmee River Restoration Project	112	X		X					X		
Tributary and Oxbow Revitalization Plans and Designs	113			X							
Kissimmee River Restoration Symposium	114	X	X	X				X	X		
Environmental Monitoring	115	X									
UPPER KISSIMMEE LAKES											
Kissimmee Chain of Lakes Water Quality Studies	117					X			X		
Development of Management Plans--Lake Tohopekaliga	119	X		X		X		X			
Development of Management Plans--East Lake Tohopekaliga	120	X		X		X		X			
LAKE ISTOKPOGA											

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List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
Lake Istokpoga and Indian Prairie Basin Hydrologic Analysis	122			X							
Lake Istokpoga Water Quality Monitoring Program	124					X			X		
Surface Water Use Plan for the Indian Prairie Basin	126			X			X				
UPPER EAST COAST											
Generation of "Capture Zones" for Selected Wellfields in Martin County	129				X						
Loxahatchee River/Slough Restoration Project	131							X			
Loxahatchee Estuary Dynamics	132			X							
Loxahatchee River Basin Study	134			X							
Environmental Investigation in the Loxahatchee River Corridor and Slough	137	X							X		
Loxahatchee Estuary	138	X									
Indian River Dynamics	140	X		X							
SWIM Management Plans--Indian River Lagoon	141	X		X				X			
St. Lucie Estuary Management	142	X									
St. Lucie Estuary Dynamics	143			X							

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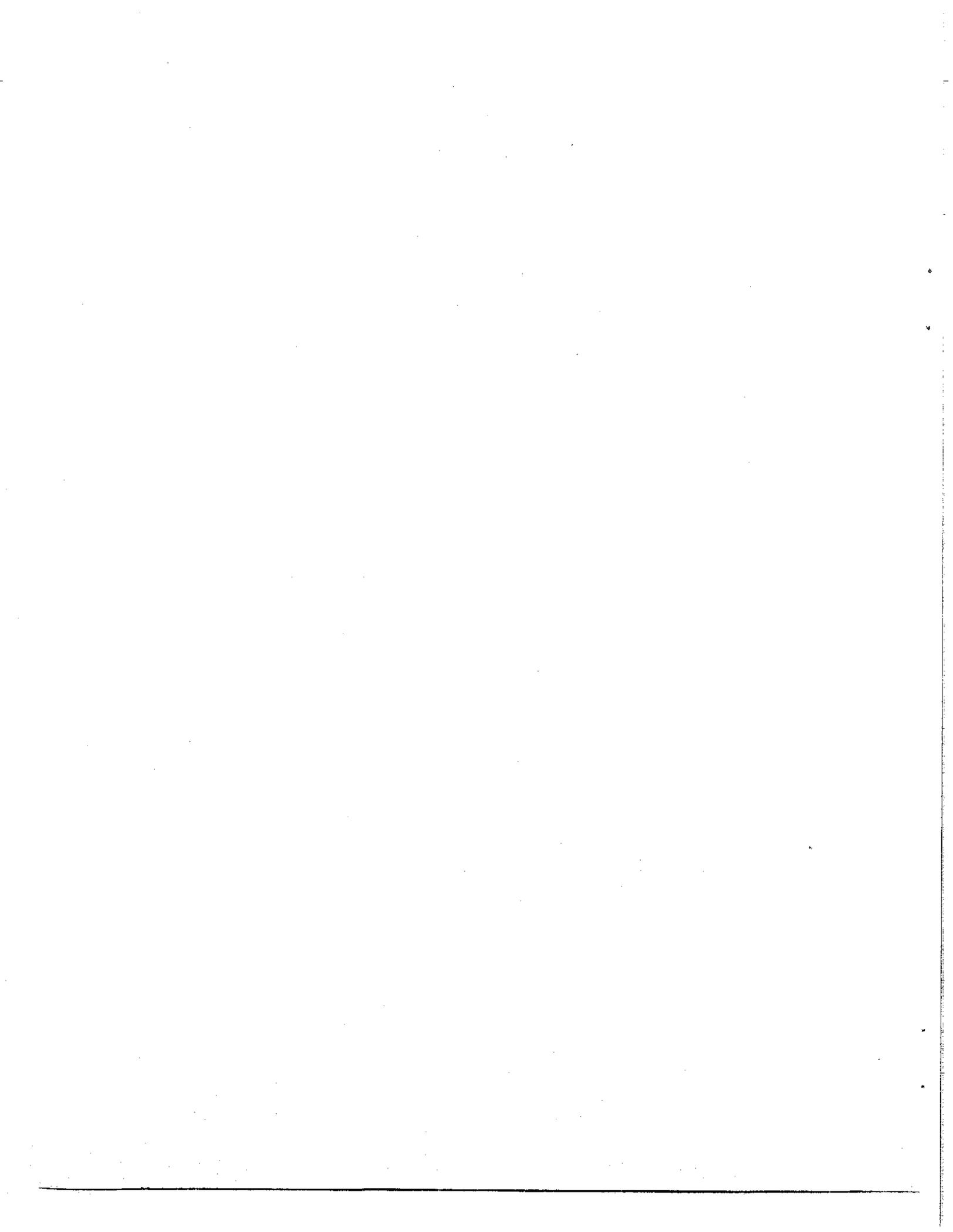
List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
St. Lucie Canal Water Quality Data Collection	144								X		
Surface Water Use Plan for C-23, C-24, and C-25 Basins	145			X			X	X			
Hydrogeologic Reconnaissance and Ground Water Resource Assessment of the Surficial Aquifer System of St. Lucie County, Florida	147				X						
Martin Co. Surficial Aquifer System - 3-D Flow Model	149				X						
Upper East Coast and Lower East Coast Surface Water Quality Data Collection	153								X		
LOWER EAST COAST											
Water Management Plan - Hillsboro Canal Basin	155	X									
C-11 Basin	156			X							
C-111 Environmental Studies	157	X									
North Broward County Biscayne Aquifer Three-Dimensional Flow Model	159				X						
SWIM Management Plans--Biscayne Bay	161							X			
WATER CONSERVATION AREA											
Wading Bird Surveys	163	X									

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List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
WCA Impacts, Monitoring, and Nutrient Thresholds	165	X		X					X		
Nutrient Responses and Thresholds of Everglades Vegetation Communities	167	X							X		
Alteration in regulation Schedule - WCA-2A	169	X									
Water Quality Monitoring	171								X		
Everglades National Park downstream Impacts	172			X			X		X		
Holey Land Environmental Monitoring	174	X							X		
Everglades Comprehensive Planning	175	X		X				X			
Development of Management Plans-- Everglades Water Conservation Areas	176	X		X				X	X		
EVERGLADES AGRICULTURAL AREA											
Analysis of EAA Modeling Methodologies	178			X							
Evaluation of the Effects of On-Farm Agricultural Practices in the Organic Soils of the EAA on Phosphorus and Nitrogen Transport	180										X
EAA Flow-Way	182	X							X		
LOWER WEST COAST											
Six-Mile Cypress Slough	185			X							

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List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
Conceptual Water Management Plan-Cocohatchee Watershed	187			X							
Evaluation of Regional Citrus Development	188	X		X					X		X
Caloosahatchee Estuarine Studies	189	X		X							
Caloosahatchee Estuary Environmental Assessment	191	X									
Caloosahatchee River Management and Regulation	193			X							
Western Collier County Groundwater Resource Assessment	195				X						
Hendry County Shallow Aquifers Three-Dimensional Flow Model	196				X						
Caloosahatchee River Water Quality Monitoring	197								X		



**RESOURCE
PLANNING
DEPARTMENT
PUBLICATION LISTING**

SFWMD
LISTING OF TECHNICAL PUBLICATIONS, MEMOS REPORTS, AND STUDIES FROM RPD

Year	Doc. No. & Type	Title	Author
1989	89-1 Tech Pub	SFWMD Ambient Ground Water Quality	Herr, Shaw WQ
1989	(04/89) April Tech Memo	Review of Predevelopment Runoff Analysis Methods Vol 1	Lin, Perkin WR
1989	(03/89) March Tech Memo	Lake Okeechobee Pesticide Monitoring Report, 1987	Pfeuffer WQ
1989	(03/89) March Tech Memo	Peak Runoff Estimation From Undeveloped Lands	Cooper, Neidrauer WR
1989	(02/89) February (03/89) Mar SWIM Plan	Interim SWIM for Lake Okeechobee Appendices A-I	SFWMD
1988	88-13	Groundwater Availability Assessment for the Surficial Aquifer on Pine Island, Lee County, Florida	Wm. Scott Burns Richard F. Bower Hydro
1988	88-12 Tech. Pub. (2 Parts)	Part 1: Ground Water Resource Assessment of Hendry County, Florida Part 2: Appendices	Keith Smith Karin Adams Hydro
1988	88-11 Tech. Pub.	Flood Management Study of C-18 Basin	Steve Lin WR
1988	88-10 Tech. Pub.	Sediment Characteristics and Toxic Substances in St. Lucie Estuary, Florida	Daniel Haurert ES
1988	88-09 Tech. Pub	Assessment of Urban Land Use/Stormwater Runoff	Paul Whelan Michael Cullum WQ
1988	88-08 Tech. Pub	Herbicide Monitoring Program for the Active Ingredient Fluridone	Richard Pfeuffer WQ
1988	88-07 Tech. Pub	Caloosahatchee R. Estuary Dynamics	Peter Scarlatos WR
1988	88-06 Tech. Pub.	Cattail Nutrient Dynamics	Lou Toth ES
1988	88-05 Tech. Pub.	Preliminary Evaluation of the Lake Okeechobee Regulation Schedule	Paul Trimble Jorge Marban WQ
1988	88-04 Tech. Pub. (2 Parts)	Production Zones of Major Public Water Supply Wellfields for the Counties in the South Florida Water Management District (Text - inc. appendix. I) Appendix II	Jose A. Alvarez Dennis D. Bacon Hydro

SFWMD

LISTING OF TECHNICAL PUBLICATIONS, MEMOS, REPORTS, AND STUDIES FROM RPD

Year	Doc. No. & Type	Title	Author
1988	88-03 Tech. Pub.	Surface Water Quality Monitoring Network South Florida Water Management District	Guy Germain Jon. Shaw WQ
1988	88-02 Tech. Pub.	Environmental Response of WCA-2A to Reduction in Regulation Schedule and Marsh Drawdown	Dewey F. Worth ES
1988	88-01 Tech. Pub.	Herbicide Monitoring Program for the Active Ingredient Glyphosate	Richard J. Pfeuffer WQ
1988	(12/88)	User's Guide for Multi-Basin Routing Model	Richard S. Tomasello Jocelyn Branscome Wm. A. Perkins Water Res. Div. WR
1988	(11/88) November Tech Memo	An Atlas of Martin County Surface Water Management Basins	Richard M. Cooper Ray Santee WR
1988	(11/88) November Tech Memo	An Atlas of St. Lucie County Surface Water Management Basins	Richard M. Cooper Ray Santee WR
1988	(11/88) Report of Proceedings	Disposal of Concentrates from Brackish Water Desalting Plants: Proceedings of a Seminar (SFWMD/NWSIA)	SFWMD/NWSIA
1988	(09/88) September Tech Memo	Hydrologic Characteristics of the Kissimmee River Floodplain Boney Marsh Experimental Area	R. Mierau P. Trimble DM WR
1988	(09/88) SWIM Plan	SWIM Interim Plan for Biscayne Bay, Florida and Appendices A-K	SFWMD
1988	(08/88) August Tech Memo	Lake Okeechobee Water Quality Monitoring Prgm Annual Report Year Four	WQ
1988	(08/88) SWIM Plan	Interim SWIM Plan for Indian River Lagoon and Appendices	SFWMD/SJRWMD Joint Recon. Report.
1988	(06/88) June Tech Memo	Permittable Water Use Estimates of the Floridan Aquifer System in the Upper East Coast Planning Area	Hydro RPD
1988	(06/88) June Tech Memo	Water Budget Analysis Water Conservation Area 1	S. Lin R. Gregg WR
1988	(06/88) June Tech Memo	An Atlas of Eastern Palm Beach County Surface Water Management Basins; w/ map	Rick Cooper, Lane WR

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LISTING OF TECHNICAL PUBLICATIONS, MEMOS REPORTS, AND STUDIES FROM RPD

Year	Doc. No. & Type	Title	Author
1988	(06/88) Special Report	Biscayne Bay SWIM Plan With Appendix	VanArman WQ
1988	(03/88) Mar Tech Memo	Orlando Retrofit Water Conservation Program -- Evaluation by the SFWMD	Sandra Wood WU
1988	(03/88) Mar Tech Memo	Investigation of Water Use, Land Use, and the Groundwater Monitoring Network in Hendry County	Keith Smith Tim Sharp George Shih Hydro
1988	(02/88) Feb. Tech Memo	Lake Okeechobee Water Quality Monitoring Program Annual Report - Year 3	WQ
1988	(02/88) Report	Identification of Priority Water Bodies within the SFWMD	SFWMD
1988	(01/88) Jan Tech memo	Rural Clean Waters Program	WQ RPD
1987	87-06 Tech. Pub.	Effects of Hydrologic Regimes on Lifetime Production and Nutrient Dynamics of Sawgrass	Louis A. Toth ES
1987	87-05 Tech. Pub.	Field Testing of Exfiltration Systems	Joycelyn Branscome Richard S. Tomasello WR
1987	87-04 Tech. Pub.	Desalination A Viable Alternative for Local Government Water Supply Planning in S. Fla.	Khanal RPD Staff
1987	87-03 Tech. Pub.	Vegetation Changes in the Lake Okeechobee Littoral Zone 1972-1982	James F. Milleson ES
1987	87-02 Tech. Pub.	Periphyton and Water Quality Relationships in the Everglades Water Conservation Areas 1978-82	David W. Swift Robert Nicholas ES
1987	87-01 Tech. Pub.	Modeling of Hydrodynamics and Salinity in the St. Lucie Estuary	Fred Morris WR
1987	(11/87) Nov Tech Memo	An Atlas of E. Dade County Surface Water Management Basins	R. M. Cooper Jim Lane WR
1987	(11/87) Nov Report	Indian River Lagoon Joint Reconnaissance Report	VanArman, Steward WQ
1987	(10/87) Oct. Tech Memo	One Foot Drawdown Zone of Influence Wellfields in Palm Beach County Surrounding Municipal Water Supply	Don Padgett Hydro
1987	(08/87) Report of Proceedings	Desalination in South Florida: Proceedings of a Seminar (NWSIA and SFWMD)	SFWMD/NWSIA

SFWMD
LISTING OF TECHNICAL PUBLICATIONS, MEMOS REPORTS, AND STUDIES FROM RPD

Year	Doc. No. & Type	Title	Author
1987	(03/87) Mar Special Report	Western C-51 Basin: Palm Beach County Population and Land population and dwelling unit estimates; Use Projections (1985-2040)	Water Use Planning Division, RPD WUP
1986	86-6 Tech. Pub.	Frequency Analysis of SFWMD Rainfall	Shawn Sculley WR
1986	86-5 Tech. Pub.	A Routing Model for the Upper Kissimmee Chain of Lakes	Andrew Fan WR
1986	86-04 Tech. Pub.	Bathymetry of the St. Lucie Estuary (w/ maps)	Frederick W. Morris WR
1986	86-03 Tech. Pub.	South Florida Regional Routing Model	Paul Trimble WR
1986	86-02 Tech. Pub.	Upland Detention/ Retention Demonstration Final Report. Impacts of Agricultural Land Use on Water Quality and Utilization of Wetlands for Detention/Retention in the Kissimmee River Basin	Alan L. Goldstein WQ
1986	86-01 Tech. Pub (2 Parts)	PART 1- Preliminary Assessment of the Ground Water Resources of Western Collier County, FL PART 2- Appendices	Michael S. Knapp Wm. Scott Burns Timothy S. Sharp Hydro
1986	(12/86) December Tech Memo	Okeechobee County Airport Landfill Investigation Pilot Study	Jeffry W. Herr WQ
1986	(08/86) August Tech Memo	South Dade Agricultural Pilot Study	S. Anderson WQ
1986	(07/86) July Tech Memo	Nicodemus Slough/C-19 Project Conceptual Design Report	Steve Reel RPD Staff
1985	85-03 Tech. Pub.	A Wet Season Field Test of Experimental Water Deliveries to Northeast Shark River Slough	Thomas K. MacVicar DM
1985	85-02 Tech. Pub.	Pesticide Residue Monitoring in Sediment and Surface Water Bodies within the South Florida Water Management District	Richard J. Pfeuffer WQ
1985	85-01 Tech. Pub.	Short Term Effects of a Freshwater Discharge on the Biota of St. Lucie Estuary, Florida	D. Haurert R. Startzman ES
1985	(11/85) Nov.	Rainfall Drought Frequency and Availability of Surface Water in Martin County	Andrew Fan WR
1985	(10/85) Oct	Program Documentation - A General Program to Compute Flow Through Gated Culverts	Andrew Fan WR
1985	(09/85) Sept Tech Memo	Urban Water Demand Estimates for Martin County: 1983 Existing and Committed, and Buildout	Stephen Opalat WU

SFWMD
LISTING OF TECHNICAL PUBLICATIONS, MEMOS REPORTS, AND STUDIES FROM RPD

Year	Doc. No. & Type	Title	Author
1985	(08/85) Aug Report	Report of Tropical Storm Bob July 22-24, 1985	WR Res Op Res Control
1985	(06/85) June Tech Memo	Preliminary Evaluation of Hydrologic Data Collected from the C103 Basin, Dade Cty	Jon Shaw Hydro
1985	(03/85) March Study	The Role of the South Florida Water Management District in Growth Management	Report by Warren Viessman, Dept. Env. Eng. Science/ U/F
1984	84-11 Tech. Pub.	Vol. I Evaluation of the Water Management System at a Single Family Residential Site: Hydrology and Hydraulics of Timbercreek Subdivision in Boca Raton, Florida Vol. II Evaluation of the Water Management System at a Single Family Residential Site: Analysis for Selected Storm Events at Timbercreek Subdivision in Boca Raton, Florida	James R. Gregg WR Michael G. Cullum WQ
1984	84-10 Tech. Pub.	Preliminary Water Resource Assessment of the Mid and Lower Hawthorn Aquifers in Western Lee County, Florida APPENDICES	M.. Knapp,p W. S. Burns T. S. Sharp Geo. Shih Hydro
1984	84-09 Tech. Pub.	Wading Bird Utilization of Lake Okeechobee Marshes 1977-1981	Michael Zaffke ES
1984	84-08 Tech. Pub.	Cattail Leaf Production, Mortality, and Nutrient Flux in Water Conservation Area 2A	Steven M. Davis ES
1984	84-07 Tech. Pub.	Meteorological and Hydrological Analysis of the 1980-82 Drought	Steve Lin Jim Lane Jorge Marban WR
1984	84-06 Tech. Pub.	An Evaluation of Wastewater Reuse Policy Options for the South Florida Water Management District	Bruce P. Adams, Davis J. Samples L. Carl Woehlcke WU
1984	84-05 Tech. Pub.	Resistivity Investigation of the Coastal Ridge Aquifer Hydrostratigraphy Martin County, Florida	A. M. Stodghill Mark T. Stewart Hydro
1984	84-04 Tech. Pub.	Phytoplankton, Chlorophyll a, and Primary Production in Lake Okeechobee	B. Jones A. Federico WQ
1984	84-03 Tech. Pub	South Florida Water Management Model Documentation Report	T. MacVicar T. VanLent, A. Castro

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Year	Doc. No. & Type	Title	Author
1984	84-02 Tech. Pub.	Hydrogeologic Data Collected from the Kissimmee Planning Area, South Florida Water Management	D. Reece, R. Belles and M. Brown Hydro
1984	84-01 Tech. Pub. (2 Parts)	PART 1 - TEXT - Hydrogeology of the Kissimmee Planning Area, South Florida Water Management District PART 2 - APPENDICES - Hydrogeology of the Kissimmee Planning Area, South Florida Water Management.	J. E. Shaw and S. Trost Hydro
1984	(12/84) Dec Report	Preliminary Report of Rainfall Event of November 21-26, 1984 - South Florida Coast Area	
1984	(10/84) Oct. Tech Memo	Summary of 1983-84 Dry Season Hydrologic Conditions	Steve Lin WR
1984	(09/84) Sept. Tech Memo	Interim Modifications to the Faka-Union Canal Outlet System	Steve Lin WR
1984	(07/84) July Tech Memo	Water Budget for Upper Kissimmee Chain of Lakes	Andrew Fan, Steve Lin WR
1984	(07/84) July Report	Evaluation Report - A Thirty Day Field Experiment of Water Deliveries to Northeast Shark River Slough (April-May 1984)	T. MacVicar T. VanLent DM
1984	(06/84) June Report	Preliminary Report of Rainfall Event May 22-31, 1984 Lower East Coast	RPD, WR, Res, Ops, Fld Eng, Res Op
1984	(05/84) May Report	Summary of 1983 Hydrologic Conditions Div.	WR RPD
1984	(04/84) April Tech Memo	Preliminary Evaluation of the Groundwater Monitor Network in Collier County, Florida	W. S. Burns George Shih Hydro
1984	(04/84) April Tech Memo	Groundwater Quality Study of the Water Conservation Areas	D. Nealon Hydro
1984	(03/84) March Tech Memo	North New River Backpumping Water Quality Impact Study Report No. 1 Preconstruction and Initial Operation	Water Chem. Div. WQ
1984	(03/84) March	Water Management Planning for the Western C-51 Basin	RPD Staff
1983	83-08 Tech. Pub.	Well Plugging Applications to the Inter-Aquifer Migration of Saline Groundwater in Lee County, Florida	Wm. Scott Burns
1983	83-07 Tech. Pub.	Field Investigation into the Feasibility of Storing Fresh Water in Saline Portions of the Floridan Aquifer System, St. Lucie County, Florida	L. Wedderburn Mike Knapp

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Year	Doc. No. & Type	Title	Author
1983	83-06 Tech. Pub.	Preliminary Environmental Responses to Marsh Dewatering and Reduction in Water Regulation Schedule in Water Conservation Area-2A. September 1983.	Dewey Worth
1983	83-05 Tech. Pub.	The Post Eocene Stratigraphy of Southern Collier County, Florida. July 1983.	Roland Peacock
1983	83-04 Tech. Pub.	Decomposition, Nutrient Uptake and Microbial Colonization of Sawgrass and Cattail Leaves in Water Conservation Area 2A.	Pamela B. Reeder Steven M. Davis.
1983	83-03 Tech. Pub.	Hydrogeology of the Shallow Aquifer South of Naples, Collier County.	Paul G. Jakob
1983	83-02 Tech. Pub.	Rainfall Averages and Selected Extremes for Central and South Florida.	T. K. MacVicar
1983	83-01 Tech. Pub.	Upper East Coast - Water Quality Studies.	A. Federico
1983	(10/83) October Report	Report of Rainfall Event, September 22-25, 1983. North & west P.B. County	RPD, ROD, RCD
1983	(06/83) June Tech Memo	Preliminary Water Quality and Trophic State Assessment of the Upper Kissimmee Chain of Lakes, Florida, 1981-82,	B. L. Jones P. S. Millar T. H. Miller D. R. Swift A. C. Federico
1983	(05/83) May Tech Memo	Data Analysis to Detect Rainfall Changes in South Florida	George Shih
1983	(05/83) May Tech Memo	Plant Communities of Water Conservation Area 3A; Base-Line Documentation prior to the Operation of S-339 and S-340	M. Zaffke
1983	(03/83) May Tech Memo	A potable Water Use Data Base for South Florida 1980	C. Woehlicke J. Bucca Don Loving
1983	(03/83) March Tech Memo	Surface Water Availability of the Caloosahatchee Basin	Andrew Fan Ray Burgess
1983	(02/83) February Report	Report to the United States Army Corps of Engineers Requesting a Review of Central and Southern Florida Flood Control Project Facilities in the C-111 Basin, Dade County, Florida	RPD
1983	(01/83) January Tech memo	Lake Okeechobee Water Quality - April 1981 - March 1982	B. Jones
1982	82-08 Tech. Pub.	Taylor Creek Headwaters Project Phase I and Report; Water Quality. October 1982.	G. Ritter Hartwell Allen

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Year	Doc. No. & Type	Title	Author
1982	82-07 Tech. Pub.	Performance of District Structures during Critical Storm Events in West Miami, and Proposed Alternatives to Reduce Flooding. (Revised October 1982).	N. Khanal
1982	82-06 Tech. Pub.	Application of DC Resistivity Surveys to Regional Hydrogeologic Investigations, Collier County, Florida	M. Stewart, P. Lizanec and M. Layton
1982	82-05 Tech. Pub.	Geophysical Signature of Pliocene Reef Limestones Using Direct Current and Electromagnetic Resistivity Survey Methods Collier County, Florida (Final Project Report-USF/SFWMD Cooperative Program, Phase III, Collier County Reef Mapping Project). July 1982.	Michael C. Layton Mark T. Stewart
1982	82-04 Tech. Pub.	A Survey of Water Quality Characteristics and Chlorophyll a Concentrations in the Caloosahatchee River System, Florida. July 1982.	T. H. Miller, A. Federico and J. Milleson
1982	82-03 Tech. Pub.	Water Quality Characteristics of the Lower Kissimmee River Basin, Florida	A. Federico
1982	82-02 Tech. Pub.	Patterns of Radiophosphorus Accumulation in the Everglades after its Introduction into Surface Water	Steve Davis
1982	82-01 Tech. Pub. (3 Parts)	Part 1 - TEXT - Hydrogeologic Reconnaissance of Lee County, Florida Part 2 - ATLAS Part 3 - APPENDICES	L. A. Wedderburn M. S. Knapp D. P. Waltz W. S. Burns
1982	(12/82) Dec Tech Memo	Upland Detention/Retention Demonstration Project (Fourth Annual Report to the Coordinating Council-KR)	Alan Goldstein
1982	(12/82) Dec	Seasonal Variations of Manning's Roughness Coefficient in a Subtropical Marsh	S.F. Shih, G. S. Rahi
1982	(12/82) Dec	Evapotranspiration Studies on Rice in Relation to Water Use Efficiency	S. F. Shih, G. S. Rahi, D. S. Harrison
1982	(08/82) Aug	Rainfall Variation Analysis and Optimization of Gaging Systems	S. F. Shih
1982	(06/82) June Report	Report on Tropical Storm Dennis - August 16-18, 1981	SFWMD-WRD
1982	(05/82) May Report	Preliminary Report on Rainstorm of April 23-26, 1982	S. Lin
1982	(04/82) April Tech Memo	Long Term Tropical Storm Incidence- Kissimmee River Basin Rainfall Analysis	N. Khanal R. Hamrick
1982	(04/82) April Report	Preliminary Report on Rainstorm March 28-29	S. Lin/J. Lane

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Year	Doc. No. & Type	Title	Author
1982	(04/82) April	Consumptive Use and Supplemental Water Requirements of Crops Grown in the Everglades Agricultural Area (NOT PUBLISHED)	N. Khanal
1982	(03/82) March Tech Memo	Lake Okeechobee Water Quality, April 1980 March 1981	B. L. Jones
1982	(03/82) Mar Summary Report	Project 2WM Summary Report	
1982	(02/82) February	An analysis of Water Supply Backpumping for the Lower East Coast Planning Area	SFWMD
1981	81-5 Tech. Pub.	Preliminary Investigation of Periphyton and Water Quality Relationships in the Everglades Water Conservation Areas.	David R. Swift
1981	81-4 Tech. Pub.	Management of Water Levels in the "Frog Pond" Area, South Dade County, Florida	L. Wedderburn, S. Trost, and J. Lane
1981	81-03 Tech. Pub.	Frequency Analysis of Rainfall Maximums for Central and South Florida	T. MacVicar
1981	81-02 Tech. Pub.	Lake Okeechobee Water Quality Studies and Eutrophication Assessment.	A. Federico, K. Dickson, C. Kratzer, and F. Davis
1981	81-01 Tech. Pub.	Mineral Flux in the Boney Marsh, Kissimmee River. (1) Mineral Retention and Relation to Overland Flow During the Three Year Period Following Reflooding.	Steven M. Davis
1981	(12/81) Dec. Executive summary	Water Quality Management Strategy for Lake Okeechobee - Executive Summary	RPD
1981	(12/81) Dec.	Water Quality Management Plan	RPD
1981	(11/81) Nov	Agricultural Water Use - UECPA	S. Popalzai
1981	(10/81) Oct	PRELIMINARY Assessments of Drainage Impacts in the East Everglades Area of Dade County	Ronald Mierau, E. C. Lane
1981	(09/81) Sept	Water Shortage Planning and Review Team for County meeting, Special interest meeting, and General Public meeting	Bruce Adams
1981	(08/81) Aug	A Methodology for Estimating Economic Impacts in South Florida from Agricultural Drought Research Project-Program No. 8007	T. Cowne, (J. Toomey)
1981	(07/81) July	Upland Detention-Retention / Demo Project... Third Annual Report	RPD Goldstein
1981	(06/81) June	Agricultural Water Use Modeling (Presentation at Moscow State University, Moscow)	N. Khanal

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Year	Doc. No. & Type	Title	Author
1981	(06/81) June	Indirect Flow Measuring Devices for Moscow)Agricultural Water Use Data Collection (Presentation at Moscow State University,	N. Khanal
1981	(05/81) May	Water Quality Analysis in WCA 1978-1979	Paul S. Millar
1981	(05/81) May	Guidebook to the South Florida Water Management District's Geophysical Logging and Digitized Data Processing Techniques	Mike Brown Sharon Hynes Wedderburn
1981	(04/81) April	Open Channel Flow Monitoring under Small Water and Surface Gradients	Mierau
1980	80-09 Tech. Pub.	The Stratigraphy of the Floridan Aquifer System East and Northeast of Lake Okeechobee, Florida	Rodney T. Mooney III
1980	80-08 Tech. Pub.	A Geographic Overview of 1977 Land Use/Cover Patterns in the Lower West Coast Planning Area of South Florida.	L. Isern and R. T. Brown
1980	80-07 Tech. Pub.	Plant Communities of the Kissimmee River Valley	J. Milleson, R. Goodrick, and J. VanArman
1980	80-06 Tech. Pub.	Advanced Water Supply Alternatives for the Upper East Coast Planning Area, Parts I and II. August 1980.	N. Khanal
1980	80-05 Tech. Pub.	Hydrogeologic Data Collected from the Upper East Coast Planning Area South Florida Water Management District. May 1980	D. Reece, S. Hynes, and M. Brown
1980	80-04 Tech. Pub.	Effect of Urban Stormwater Runoff to a Man-Made Lake on Groundwater Quality. May 1, 1980.	M. Weinberg, D. Reece, and D. Allman
1980	80-03 Tech. Pub.	Some Seasonal Fisheries Trends and Effects of a 1000 cfs Fresh Water Discharge on the Fishes and Macroinvertebrates in the St. Lucie Estuary, Florida January 1980,	Daniel Haurert and , J. R. Startzman
1980	80-02 Tech. Pub.	Demonstration Project on Water Use Data Collection Storage and Retrieval System. January 1980.	Nagendra Khanal
1980	80-01 Tech. Pub.	Aquifer Recovery Test Data and Analyses of the Floridan Aquifer System in the Upper East Coast Planning Area, South Florida Water Management District. Jan. 1980	Michael P. Brown
1980	(10/80) Oct	SFWMD Water Quality Monitoring Network 1980 Annual Report	Kevin Dickson
1980	(10/80) Oct	Economics of Surface Water Runoff Storage in Brackish Aquifers in South Florida	Stanley Winn N. Khanal
1980	(10/80) Oct	Environmetrics 81 Program Committee	G. Shih
1980	(09/80) Sept	Water Quality Aspects of the Caloosahatchee System, Phase II, 1978-79	Tom Miller

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Year	Doc. No. & Type	Title	Author
1980	(08/80) Aug	Hydrogeologic Investigation along Eastern Portion of Lake Okeechobee	Jon Shaw
1980	(07/80) July Tech Memo	Upland Detention/Retention Demonstration Project (3rd Annual report to Coordinating Council on the Restoration of the Kissimmee River Valley and Taylor Creek/Nubbin Slough Basin	A. Goldstein
1980	(07/80) July	Overview of Cooperative Water Quality Studies in Everglades and Lake Okeechobee - SFWMD and Sugar Cane League	
1980	(07/80) Jul	Boney Dike Marsh Water Budget	Paul Trimble Ron Mierau
1980	(03/80) Mar	Chlorinated Hydrocarbon Pesticide Residues in Freshwater Fishes within the South Florida Water Management District	J. Milleson
1980	(01/80) Jan Report	Upland Detention/Retention Demonstration Project. Semi-Annual Report to KRCC	A. Goldstein, T. MacVicar, R. Mierau M. Smith, R. Ulevich
1979	79-03 Tech. Pub.	An Analysis of Water Requirements and Water Demands for the South Florida Water Management District. December 1979	John W. Toomey, and Carl Woehlcke
1979	79-02 Tech. Pub	Improvement of the Canal-Aquifer Flow Regime in the C-1N Basin	D. Allman, P. Jakob, and T. McCann
1979	79-01 Tech. Pub.	Floodplain Management Studies of the Shingle Creek Basin	S. Lin, J. Lane and T. McCann
1979	(11/79) Nov	Natural Gamma Ray/Neutron Porosity Logging	M. Brown S. Anderson
1979	(11/79) Nov	Modified Water Quantity Receiving Model for the Florida Conservation Areas	
1979	(11/79) Nov	Non Conventional Water Supply Alternatives (Part of Water Use Plan)	N. Khanal
1979	(09/79) Sept	Clad Model and its Applications (Draft)	Jay Foy
1979	(09/79) Sept	Non-Agricultural Water Use in the Upper East Coast Planning Area (revised Dec. 1980)	C. Woehlcke D. Loving
1979	(07/79) Jul	The Application of the Receiving Water Quantity Model to the Conservation Areas of South Florida	Steve S.T. Lin
1979	(07/79) Jul	Mathematical Models in Water Resources	A. Shahane

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Year	Doc. No. & Type	Title	Author
1979	(07/79) Jul	Membrane Plants in South Florida	N. Khanal Stanley Winn
1979	(05/79) May Report	Preliminary Report on the Severe Storm of April 24-25, 1979	SFWMD
1979	(05/79) May	Interim Progress Report - Water Quality Aspects of the Caloosahatchee River System, Phase I	Thomas H. Miller
1979	(01/79) Jan	Alternatives for Curing the End-of-the Water Pipe Syndrome in Florida (Part of the Water Use Plan)	N.Khanal
1979	Tech. Map Series 79-1	Hydrogeologic Reconnaissance of the Floridan Aquifer System Upper East Coast Planning Area	M. P. Brown D. E. Reece
1978	78-03 Tech. Pub	Water Quality in the Everglades Agricultural Water Quality in the Everglades Agricultural Area and its Impact on Lake Okeechobee with Appendix:	Kevin G. Dickson, A. Federico and J. Lutz
1978	78-02 Tech. Pub	Environmental Studies in the Chandler Slough Watershed	A. Federico, J. Milleson, P. Millar and M. Rosen
1978	78-01 Tech. Pub.	Limnological Investigations of Seven Lakes in the Istokpoga Drainage Basin	James F. Milleson
1978	(07/78) July	Overview of Cooperative WQ Studies in the SFWMD and Florida Sugar Cane League	Wtr Chem Div
1978	(06/78) June	The Water Quality Planning Model	A. Shahane John R. Maloy
1978	(03/78) Mar	Final draft - Hydro. and WQ Studies in Upper Taylor Creek and Chandler Slough	D. Ammon W. Huber J.P. Heaney
1977	77-06 Tech. Pub.	Water Quality and Nutrient Loadings of the Major Inflows from the Everglades Agricultural Area to the Conservation Areas, Southeast Florida	John Lutz
1977	77-05 Tech. Pub.	Development of an Operational Water Quantity Model (with Technical Supplement)	Ashok Shahane
1977	77-04 Tech. Pub.	Water Quality Characteristics of Several Southeast Florida Canals (supplement combined with text)	John Lutz
1977	77-03 Tech. Pub.	Investigations of the Relationship between Land Use, Rainfall, and Runoff Quality in the Taylor Creek Watershed	A. Federico
1977	77-02 Tech. Pub.	Phytoplankton and Primary Productivity Studies in Lake Okeechobee During 1974	M. Marshall

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Year	Doc. No. & Type	Title	Author
1977	77-01 Tech. Pub.	The Major Plant Communities of Lake Okeechobee, Florida, and their Associated Inundation Characteristics as Determined by Gradient Analysis	G. Pesnell R. Brown
1977	(06/77) June Report	A Framework of the Water Quality Planning Model for the Conservation Areas of the Florida Everglades	A. Shahane D. Paich R. L. Hamrick
1977	(02/77) Feb	Landsat Investigation of Water Quality in Lake Okeechobee	M. Marshall J. Gervin
1976	76-03 Tech. Pub.	Environmental Responses to Marshland Re-flooding in the Kissimmee River Basin	J. Milleson
1976	76-02 Tech. Pub.	Predictive Water Demand Model for Central and Southern Florida	N. Khanal
1976	76-01 Tech. Pub.	Synthetic Data Generator - A Joint Distribution Technique	Tony Shih
1976	(09/76) Sept	C-51 Leakage	Dave Allman G. Winter
1976	(08/76) Aug	Water Management Plan for the Western C-9 Basin	RPD
1976	(08/76) Aug	Hydrologic Aspects of On-Site Retention	N. Khanal
1976	(08/76) Aug	Systems for Urban Storm Runoff for Presentation at the ASCE Specialty Conference on Water Resources Policy & Urban Growth. Minneapolis, Minn.	
1976	(06/76) June Report	Addendum to Annual Report 1974-75	RPD
1976	(05/76) May	Final Report - Environmental Resources	Huber Heaney
1976	(05/76) May	Management Studies of the Kissimmee River Basin	Bedient Bowden
1976	(03/76) Mar	Direct Calcium and Magnesium Analysis by a Modified Atomic Absorption Spectrophotometry Aspiration System	T. H. Miller W.H. Edwards
1976	(01/76) Jan	Hydrologic Carrying Capacity of the (UNPUBLISHED)	N. Khanal Western Portion of the Canal 9 Basin
1975	75-04 Tech. Pub.	Hydrologic Aspects of On-Site Retention Systems for Urban Storm Runoff	N. Khanal
1975	75-03 Tech. Pub.	Agricultural Reservoir Study	C. Tai
1975	75-02 Tech. Pub.	Progress Report Upper Kissimmee Chain of Lakes Water Quality and Benthic Invertebrate Sampling	J. Milleson

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Year	Doc. No. & Type	Title	Author
1975	75-01 Tech. Pub.	Chemical and Biological Investigations of Lake Okeechobee. January 1973 - June 1974 Interim Report	F. Davis M. Marshall
1975	(12/85) Dec Report	The Development of an Operational Water Quantity Model	A. Shahane P. Berger R. Hamrick
1975	(12/85) Dec	FCD Comp Prgms for Area Calculation	Sun-Fu Shih
1975	(12/75) Dec	Report on Investigation of Back-Pumping Reversal and Alternative Water Retention Sites (Miami Canal and North New River Canal Basins Everglades Ag. Area) (HOLEYLAND REPORT)	W. Storch
1975	(12/75) Dec	Seepage Invest for the Holey Land	B. Cutright
1975	(12/75) Dec	The Recent Chlorination Controversy	A. Shahane
1975	(09/75) Sept	FCD Backwater Profile Computation	Sun Fu Shih
1975	(08/75) Aug	Guideline for Evaluation of Irrigation Use Permits	RPD
1975	(07/75) July Summary	Summary of the Condition of South Florida Water Storage Areas in the 1974-75 Dry Season	W. V. Storch
1975	(07/75) July	Water Availability in the Dade County Agricultural Area	R. Mierau R. Taylor N. Khanal W. Storch G. E. Dail
1975	(07/75) July	A Framework for the Operational Water Quantity Model	.Shahane P. Berger R. Hamrick
1975	(06/75) June Study	Shingle Creek Flood Plain Study	S. Lin
1975	(06/75) June	Water Use & Water Supply Development. (Rough draft of Part II)	RPD Dept
1975	(06/75) June	Interdisciplinary Models and Optimization Techniques used in Water Resource Planning	A. Shahane
1975	(03/75) Mar	Lake Okeechobee-Kissimmee Basin Water Quality Information	W. Storch
1975	(03/75) Mar	Lake Okeechobee - Kissimmee Basin Proposals for Management Actions	W. Storch
1975	(02/75) Feb Report	Report to the Gov Board on Regulatory Levels for the Lakes of the Upper Kissimmee Basin	W. Storch
1974	74-04	Supplemental Water Use in the Everglades Agricultural Area	R. Mierau

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Year	Doc. No. & Type	Title	Author
1974	74-03 Tech. Report	Water Consumption Trends within the Central and Southern Florida Control District Level Fluctuation in the Kissimmee River Valley	A.Kreitman R.Walker. J. Beck
1974	74-02 Tech. Report	Studies of Floodplain Vegetation and Water	R. Goodrick J. Milleson
1974	74-01	Chemical Quality of Water in Conservation Area 2A and Associated Canals	P. Gleason
1974	(11/74) Nov	Impact of Upland Marsh on Water Quality. IIA. Dy Study; IIB. Roughness Coefficients; IIC. Quality Sampling	Sun-Fu Shih David Hallett
1974	(09/74) Sept Memo Report	Memo Report on Surface Water Availability in the Caloosahatchee Basin	R. L. Mierau R. E. Irons C.Tai R.L. Taylor W. V. Storch
1974	(09/74) Sept	Water Yield to Kissimmee River Basin by Use of the FCD Model	N. Khanal
1974	(08/74) Aug Report	Response to U. S. C/E Draft Survey . Review Report on the Hillsboro Canal Basin	RPD Dept
1974	(07/74) July Report	Memo Report on Surface Water Availability in the St. Lucie County Area	R. Mierau R. L. Taylor W. V. Storch
1974	(07/74) July Memo Report	Memo Report on Surface Water Availability in the Lake Istokpoga -Indian Prairie Area	R.L. Mierau R.D.Knittel- R.L.Taylor W. V. Storch
1974	(04/74) Apr Report	Report on Progress of Hydrologic, Water Quality and Land Use Studies in the Kissimmee River Watershed and Lake Okeechobee	RPD Staff
1974	(03/74) Mar Report	A Modified Monte Carlo Technique to solve Thiessen Coefficients	T. Shih R. Hamrick
1973	(10/73) Oct Report	Preliminary Evaluation Report on Land and Water Management Planning in the C-51 Watershed	RPD Staff
1973	(10/73) Oct	Water Management and Environmental Control in South Florida	W. V. Storch
1973	(07/73) July	Kissimmee River Basin Water Quality University o Model Study	Miami, Civil Engineering Department
1973	(07/73) July	Summary of the Condition of South Florida and 1971-72 dry season	W.V.Storch Water Storage Areas in the 1970-71

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Year	Doc. No. & Type	Title	Author
1973	(06/73) June	Evaluation of the West Palm Beach Canal Watershed Tributary to Pumping Station S-5A	RPD Staff
1972	05/72 - 06/72) May-June	Examination of the Effects of C-51 Back-pumping on the Water Regime of the Conservation Areas	W. V. Storch
1972	(12/72) Dec	Statement on the Kissimmee Basin Project presented to the Governor and Cabinet	W. V. Storch
1972	(07/72) July	Role of Synthetic Time Series in Hydro-meteorological Data Analysis	A. N. Shahane
1972	(06/72) June	A Simplified Approach to Predict Surface Runoff and Water Loss Hydrographs	Lalit K. Sinha
1972	(03/72) Mar	Hydrologic Data for Phase II of the Economic Model Study	N. Khanal
1971	(12/781) Dec	Estimation of Rainfall for the Kissimmee River Basin	L. K. Sinha N. Khanal
1971	(12/71) Dec	An Operational Watershed Model: General Considerations, Purposes, and Progress	L. K. Sinha L. E. Lindahl
1971	(12/71) Dec	A Progress Report on the Routing System of Upper Kissimmee Basin	L. K. Sinha
1971	(12/71) Dec	An Approach to Operation of a Regional Primary Water Control System	W. V. Storch R. L. Hamrick
1971	(12/71) Dec	Operational Analysis of a Flood in the Lower Kissimmee River Basin	Engr. Dept
1971	(10/71) Oct	An Approach to Optimization of an Existing Large Complex Drainage System	N. Khanal R. L. Hamrick
1971	(08/71) Aug	A Stochastic Model for Daily Rainfall Data Synthesis	N. Khanal R. L. Hamrick
1971	(07/71) July	Operational Analysis of a Flood in the Lower Kissimmee River Basin	SFWMD-Engr.
1971	(06/71) June	Hydrologic Reconnaissance of Conservation Areas one, two, and three of the Central and Southern Florida Project (Report for C&SFCD)	J.P. Heaney W. C. Huber
1971	(06/71) June	Some Aspects of the Hydrology of Conservation Area No. 3	RPD
1971	(05/71) May	Pollution Control Aspects of Water Management	W. V. Storch

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Year	Doc. No. & Type	Title	Author
1970	(08/70) Aug	Report of the Special Study Team on the Florida Everglades	G. Cornwell R.L. Downing, A.R. Marshall J. N. Layne
1970	(01/70) Jan	The Potential and Practicality of Watershed Models in Operational Water Management	L. E. Lindahl R. L. Hamrick
1969	(10/69) Oct	An Operational Watershed Model; Step 1-B Regulation of Water Levels in the Kissimmee River Basin	L. K. Sinha
1968	(09/68) Sept	Report on Development of Hydrologic Model	L. Lindahl
1968		Some Environmental Effects of Drainage in Florida	W. V. Storch R. L. Taylor

