Data Collection, Research and Evaluation Studies

1990-1991

The Department of Research and Evaluation

September 1991

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South Florida Water Management District
West Palm Beach, Florida 33416

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DEPARTMENT OF RESEARCH AND EVALUATION DATA COLLECTION, AND EVALUATION STUDIES FY 1990-91

This publication summarizes, by geographical area, the current data collection and research activities being pursued by the Research and Evaluation Department of the South Florida Water Management District. The purpose of this summary is to provide a general outline of the work being carried out, as well as an indication of the schedule for completion of the work.

The Research and Evaluation Department is a new Department created in October, 1989 as part of a District-wide reorganization of functions. This Department now has as its mission "to provide a sound scientific basis for management of water and related resources, in keeping with the District's mission".

To implement this mission the Department of Research and Evaluation:

- **conducts accurate, comprehensive scientific research, assessments and evaluations;**
- **collects and analyzes scientific data in a cost-effective manner;**
- **develops and maintains appropriate resource data bases and scientific tools;**
- **provides advice, guidance and support to other units of the District, federal, state and local agencies, and the public;**
- **disseminates scientific information through electronic access, technical reports and other means.**

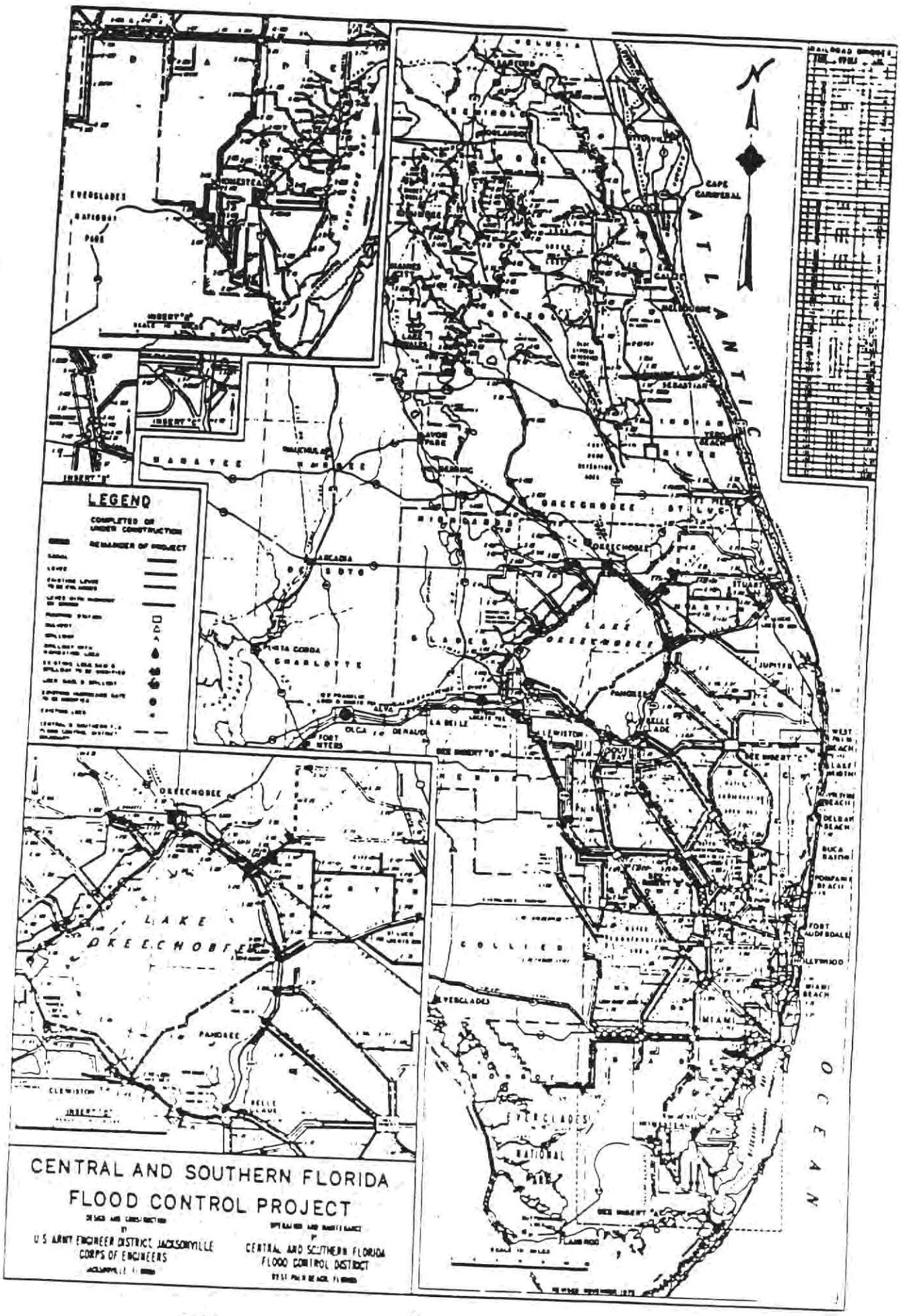
The District's role in water management in South Florida is encapsulated in the District's Mission statement which reads:

> "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."

The data collection and research activities carried out by this Department are vital to successful water management. The selection and prioritization of research topics are guided by statutory authority, state and local policy, district priorities and public input. The District's main responsibilities are found in its enabling legislation, Chapter 373 F.S., and include the following five major legislative directives:

1. general research and planning directives found in Chapter 373, Part I, Florida Statutes;
2. consumptive water use permitting directives found in Chapter 373, Part II, Florida Statutes;
3. water well permitting directives found in chapter 373, Part III, Florida Statutes;

MAPS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REMAINDER OF PROJECT
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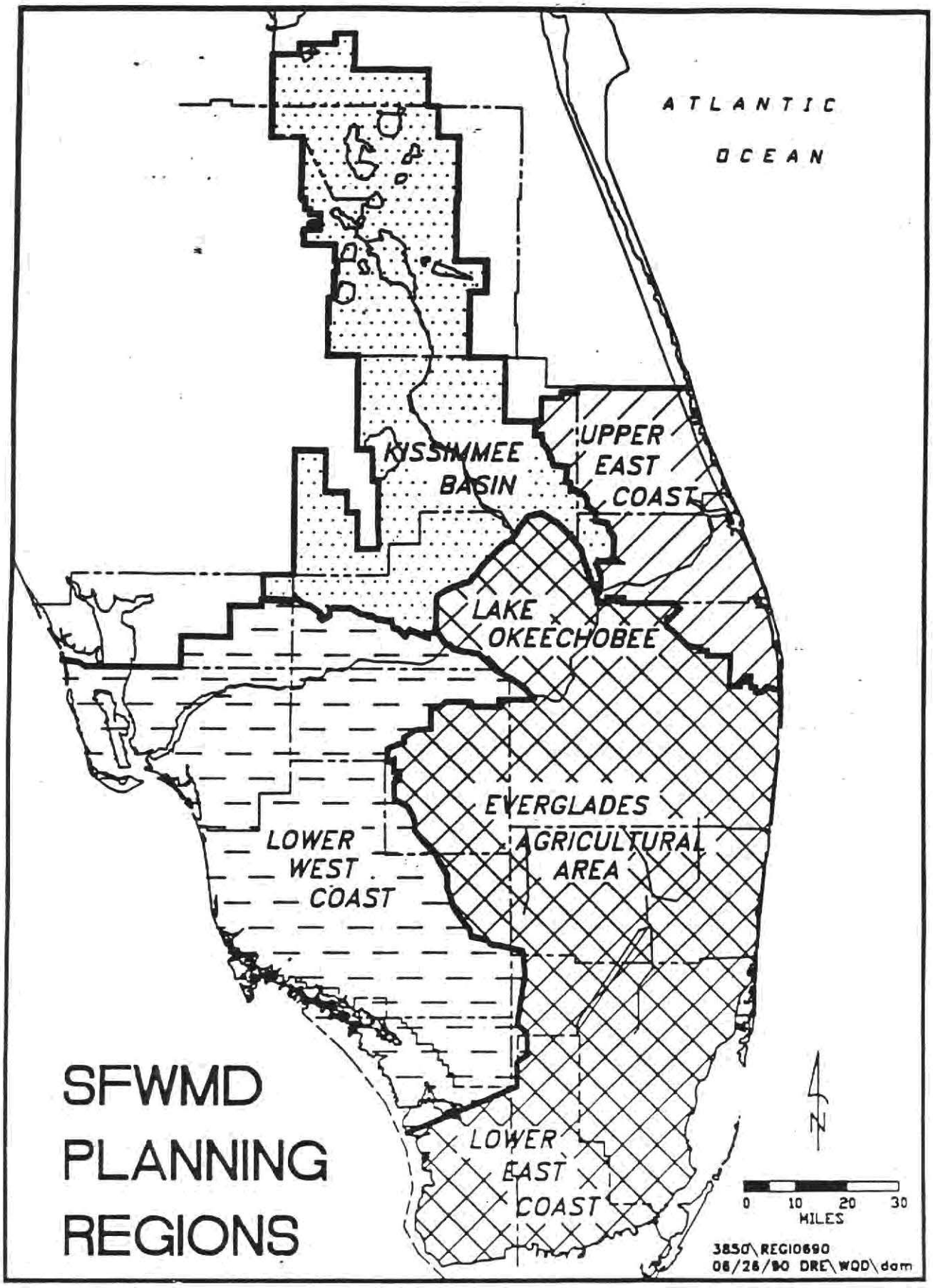
OCEAN
LAKE OKEECHOBEE
CAPE CANAVERAL
EVERGLADES NATIONAL PARK
CENTRAL AND SOUTHERN FLORIDA
FLOOD CONTROL PROJECT
U.S. ARMY ENGINEER DISTRICT, JACKSONVILLE
CORPS OF ENGINEERS
CENTRAL AND SOUTHERN FLORIDA
FLOOD CONTROL DISTRICT


ATLANTIC
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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

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

TECHNOLOGY SUPPORT - REMOTE SENSING

•District Contact: Ken Rutchey

1. OBJECTIVE: To monitor and quantify vegetation changes utilizing remote sensing applications.

2. DISTRICT NEED AND USE: Vegetation is often used as the key biological health indicator for an environment. This work enables the District to monitor the effects of restoration, hydroperiod manipulations, exotic species proliferation, and nutrient influx on vegetation patterns. Data collected through remote sensing efforts will be used by the Planning, Land Management and Construction Management Departments.

3. SCOPE: This project will be supported by District funds and will document environmental trends through vegetation monitoring. The monitoring areas will include in order of priority the regions as listed below.

   A. Lower Kissimmee Basin - Produce a vegetation map of lower Kissimmee Basin for 1992/1993 (Dependent upon available data). This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns due to Kissimmee River restoration. This is one of the objectives of the Kissimmee River Restoration Project.

   B. Upper Kissimmee Basin - Produce a vegetation map of upper Kissimmee Basin for 1992/1993 (Dependent upon available data). This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns due to regulation schedule modifications resulting from lower Kissimmee Basin restoration.

   C. Lake Okeechobee Littoral Zone - Produce a vegetation map of Lake Okeechobee littoral zone for 1993/1994 (Dependent upon available data). The current Lake Okeechobee contract will provide vegetation maps through 1992. This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns. This is part of the Lake Okeechobee SWIM Plan.

   D. Nicodemus Slough - Produce a vegetation map of Nicodemus Slough for 1992/1993 (dependent upon available data). The information gained from this would then be used to construct an historic map of the same area for 1989/1990. This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns due to hydroperiod. This is one of the objectives of the Nicodemus Slough Restoration Project.

   E. Dupuis Property - Produce a vegetation map of Dupuis property for 1992/1993 (dependent upon available data). The information gained from this would then be used to construct an historic map of the same area for 1989/1990. This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns due to hydroperiod.

4. SCHEDULE: Preliminary planning and coordination will begin this fiscal year. Image analysis and map compilation will begin fiscal year 1992/1993. Completion dates are dependent on availability of manpower and equipment.

5. PROGRESS TO DATE: This is a new project.

6. PRODUCTS: None

DRE SUPPORT FOR GIS ADMINISTRATION SYSTEM

•District Contact: Robb Startzman

1. OBJECTIVE: This is an overview of the Geographic Information System (GIS) activies planned for this year in the Department of Research and Evaluation. The objectives of these projects include providing management support for the GIS hardware and software, supporting all activities and applications relating to the manipulation of geographic data using the GIS, and providing maintenance support for the system and map coverages.

2. DISTRICT NEED AND USE: The project is needed to meet the needs of multiple users of the District's new GIS in projects requiring analysis and manipulation of geographic data, technical support in the District's project activities involving the collection and input of information into the GIS, to coordinate all the activities related to GIS through regular maintenance of the primary map coverages, and maintain the daily functioning of the GIS software and hardware.

3. SCOPE: The activities providing management support for the GIS hardware and software include: setting up standard operating procedures, project scheduling, preparing and administering data conversion contracts, coordination with the GIS Core Group for problem-reporting and technical support, and maintaining the GIS in an operational status. The scope of this project will also include coordination at the technical level between the Technical Services Department and the following departments/ divisions: Data Management, Environmental Sciences, Hydrogeology, Water Resources, Water Quality, Operations and Maintenance, Land Management, Regulation, and Planning.

   The activities providing GIS applications support include: collecting geographic data (mostly from previous maps), inputting of data into the District's GIS, analyzing and transferring of GIS data, generating output in the form of reports and graphic plots, and the plotting of map compositions. Coordination at the technical level between the GIS core group and the user departments will be included.

   The activities providing GIS system support include: maintaining departmental primary map coverages, conversion of Autocad and paper maps into the GIS, coordination of hardware and software maintenance including data and system backups, coordination of GIS Development Group and GIS User Group meetings.

   Details of scope are included for Hydrologic Data Management Division, and are attached for Hydrogeology and Environmental Sciences Divisions.

4. SCHEDULE: See Attachments A-C.

5. PROGRESS TO DATE: This is a new project.

6. PRODUCTS:

FY90-91:

A. Standard operating procedures.

B. Project schedules.

C. Data conversion contracts.

D. Interdepartmental agreement for maintaining primary map coverages.

E. Maps of data collection networks.

F. Programmatic routines to communicate with the departmental ORACLE data bases.

G. Hydrogeologic model GWZOOM/Oracle interface.

Maintenance support as necessary.

Attachment A

GIS ADMINISTRATION/APPLICATION/SYSTEM SUPPORT
ENVIRONMENTAL SCIENCES GIS SUPPORT

•District Contact: Ken Rutchey

1. OBJECTIVE: The objectives of this project are to administer, apply and provide support for use of District GIS in Environmental Monitoring Programs.

2. DISTRICT NEED AND USE: This project is needed to:

   A. Provide technical/administrative support for Division personnel using GIS Technology as an integral part of environmental analysis and monitoring.

   B. To provide orderly process and management of conversion of Division maps to District GIS standard.

3. SCOPE: The concept of a GIS system for monitoring the District's resources was approved by the board in FY 89-90. It has already been demonstrated throughout the state, county and municipal level that GIS is an indispensable tool for managing resources. Environmental Sciences will be contributing to this system by converting many of its current AutoCad and image processed satellite maps.The scope of this project is to set-up, learn, teach and utilize GIS technology.

4. SCHEDULE:

   A. FY90-91:

      1. 1st Qtr: Set-up Division GIS system and learn its features.

      2. 2nd Qtr: Teach GIS to Division technical and professional staff.

      3. 3rd Qtr: Convert maps that have been created in AutoCad and with image processing.

      3. 4th Qtr: Convert maps that have been created in AutoCad and with image processing.

5. PROGRESS TO DATE:

   This is a new project. Various GIS activities have been carried on as tasks on specific projects.

6. PRODUCTS:

   FY90-91: AutoCad and image processed maps that have been converted to the GIS system.

Attachment B

DRE SUPPORT FOR GIS ADMINISTRATION/APPLICATION HYDROGEOLOGY GIS SUPPORT

•District Contact: Barbara Dickey

1. OBJECTIVE: The objective of this project is to facilitate management of the information derived from ground water flow models, data sets, and data processors for use by District staff and the general public.

2. DISTRICT NEED AND USE: The information that has been developed to date by the Division, needs to be made available to other departments within the District in order to facilitate management of the resource. It is foreseen that the hydrogeologic data base generated under this project will be used primarily by the Research/Evaluation, Planning and Regulation Departments as well as local governments and the engineering community.

3. SCOPE: This project will be conducted solely by the Hydrogeology Division. During the next fiscal year emphasis will be placed on: 1) conceptualization of relational interactions between data sets for ground water flow model generation, 2) development of tabular formats for ground water data sets, 3) the storage of data using ORACLE to interface with GIS, and 4) the generation of base coverage maps (aquifer tops, bottoms, hydraulic characteristics, ground water levels, ground water quality etc.) for other users. External funding is not applicable.

4. SCHEDULE:

   FY90-91

   A. 1st Qtr: Conceptualization of relational interactions between data sets for ground water flow model generation. Establish formats and linkages between ORACLE and ARC/INFO.

   B. 2nd Qtr: Develop a data base for storage of base coverage maps including appropriate input data sets.

   C. 3rd Qtr: Begin generation of base coverage maps (aquifer, water availability, recharge etc.) for distribution to Research/Evaluation, Planning and Regulation Departments.

   D. 4th Qtr: Continuous updating of this system and map generation.

5. PROGRESS TO DATE: New Project

6. PRODUCTS:

   FY90-91:

   A. 2nd Qtr: Complete development of ORACLE/ARC Info linkage for storage and generation of base coverage maps.

   B. 4th Qtr: Complete generation of aquifer hydraulics, occurrence and recharge maps for coastal counties, excluding Dade County.

Attachment C

GIS DEVELOPMENT
HYDROGEOLOGIC INFORMATION SYSTEM

- **District Contact: Barbara Dickey**

1. OBJECTIVE: The objective of this task is to facilitate management of the information derived from ground water flow models, data sets, and data processors for use by District staff and the general public.
2. DISTRICT NEED AND USE: The information that has been developed to date by the Hydrogeology Division, needs to be made available to other departments within the District in order to facilitate management of the resource. It is foreseen that the hydrogeologic data base generated under this task will be used primarily by the Research/Evaluation, Planning and Regulation Departments as well as local governments and the engineering community.
3. SCOPE: This task will be conducted solely by the Hydrogeology Division. During the next fiscal year emphasis will be placed on: 1) develop the plan/format of the relational interactions between data sets for ground water flow model generation, 2) development of tabular formats for ground water data sets, 3) the storage of coastal county model data sets using ORACLE to interface with GIS, 4) the generation of base coverage maps (aquifer tops, bottoms, hydraulic characteristics, ground water levels, ground water quality etc.) for other users, and 5) generate ground water recharge maps for Land Management and Planning Departments and to meet legislative requirements (Bluebelt and Chapter 17-40 F.A.C.) External funding is not applicable.
4. SCHEDULE:

   FY90-91

   A. 1st Qtr: Conceptualization of relational interactions between data sets for ground water flow model generation. Establish formats and linkages between ORACLE and ARC/INFO.

   B. 2nd Qtr: Fill in the ORACLE data tables for the coastal models.

   C. 3rd Qtr: Begin generation of base coverage maps (aquifer, water availability, recharge etc.)for distribution to Research/Evaluation, Planning and Regulation Departments.

   D. 4th Qtr: Begin the generation of ground water recharge maps.
5. PROGRESS TO DATE: New Project
6. PRODUCTS:

   FY90-91:

   4th Qtr: Complete Hydrogeologic Information System database for the coastal counties. Complete the hydrogeologic map coverages for Broward County.

LABORATORY PLANNING

- **District Contact: Mary Lou Daniel**

1. OBJECTIVES: **The objective of this project is**
   A. **To plan for future growth in the laboratory in terms of facilities improvement and capability expansion.**
   B. **The primary areas of capability expansion are organic and soil and plant analyses.**
2. DISTRICT NEED AND USE: **This project is needed to contribute to the short and long range planning efforts to meet the needs for analytical services.**
3. SCOPE: **The scope of this project is**
   A. To maintain updated cost information on contract laboratory services.
   B. To maintain laboratory equipment cost data.
   C. To provide technical support in the design of the new laboratory.
4. SCHEDULE:
   A. FY89-90:
      1. 3rd Qtr: Investigate potential for DER Tallahassee lab to provide services currently under contract
      2. 4th Qtr: Investigate potential for DER Tallahassee lab to provide services currently under contract
      3. 4th Qtr: Presentation of findings to Governing Board.
   B. FY 90-91:
      1st Qtr: Begin design of new laboratory facility.
5. PROGRESS TO DATE:
   A. FY88-89:
      4th Qtr: Laboratory Cost Analyses to Governing Board - July 1989.
   B. FY89-90:
      3rd Qtr:
      1. Laboratory Cost Analyses updated - April 1990.
      2. Meeting with DER concerning scope of work - June 1990.
6. PRODUCTS: Estimated cost of constructing and equipping a new laboratory and technical specifications for use by architects and engineers.

WATER SHORTAGE MANAGEMENT - HYDROGEOLOGIC SUPPORT

• District Contact: Michael W. Bennett

1. **OBJECTIVE: The objective of this task is to compile data on monthly water supplies in cooperation with the U. S. Geological Survey and Regulation Department during periods of water stress conditions. A monthly report is generated to provide information to the Governing Board and general public on current ground water conditions throughout the District.**

2. **DISTRICT NEED AND USE: This task is needed to maintain a regional water supply and quality monitor network to identify water stress areas and to assess current water conditions. The information gathered through the monitor network enables the water shortage team to properly formulate management decisions to protect the water resources in stressed areas throughout the District.**

3. SCOPE: This project is being conducted solely by the Hydrogeology Division and encompasses the collection and compilation of all relevant data throughout the District to assess monthly water supplies. This information is assimilated into water shortage reports, presenting information on rainfall, ground water, salinity levels and surface water conditions as an indicator of present water availability. External funding is not applicable.

4. TASK SCHEDULE: On an as needed basis based on water resource conditions.

5. PROGRESS TO DATE: Updated ground water monitor network along the Lower East and West Coasts in cooperation with the U. S. Geological Survey.

   FY89-90:

   A. 1st Qtr. Updated ground water monitor network throughout the District in cooperation with the U. S. Geological Survey.

   B. 2nd Qtr: Identified areas of below normal ground water levels and elevated chloride concentrations along the Lower East and West Coasts, and recommended water restrictions where needed.

   C. 3rd Qtr: Modified and updated water shortage management reports, on a monthly basis, to reflect current water availability.

6. PRODUCTS:

   FY90-91: Ongoing:

   A. Governing Board support and presentations and generation of public information through participation on Water Shortage team.

   B. Monthly water shortage management reports generated during water stressed conditions.

Attachment A

LAND MANAGEMENT DEPARTMENT SUPPORT - WATER RESOURCES DIVISION

- **District Contact: Nestor Garrido**

1. OBJECTIVE: The objectives of this project are to provide hydrologic and hydraulic engineering support in three environmental restoration areas; i.e., Dupuis hydroperiod restoration, L-8 marsh restoration, and Shingle Creek.
2. DISTRICT NEED AND USE: This is a continuing project and is needed for hydraulic and hydrologic design recommendations for Land Management Department efforts involving environmental restoration and/or water control structure replacement.
3. SCOPE: Evaluation of proposed designs and the use of hydrologic rainfall/runoff models to determine peak flows and to size outfall structures. Save Our Rivers Division, LMD, will be involved in this project.
4. SCHEDULE:

   FY90-91:

   A. Review COE design analysis of environmental structures for Shingle Creek.

   B. Develop and apply internal simulation model of the Dupuis Reserve area.
5. PROGRESS TO DATE:

   FY89-90:

   A. Developed H&H model for the L-8 marsh restoration effort. Designed water control structure to recreate wetlands adjacent to L-8 based on H&H analysis.

   B. Participated in several meetings with the Corps of Engineers regarding the proposed environmental structures.
6. PRODUCTS:

   FY90-91:

   A. 1st Qtr: Designed recommendations for the L-8 marsh restoration effort, and recommendations for sizing/placement of proposed Shingle Creek environmental structures.

   B. 3rd Qtr: Calibrated H&H model for the Dupuis Reserve.

TECHNICAL SUPPORT TO REGULATION DEPARTMENT

• District Contact: Leslie Wedderburn/Patrick Gostel

CONTRACT REFERENCE: Computer Aided Regridding Modflow

1. OBJECTIVE: **The objective of this project is to provide technical assistance to the Department of Regulation in support of that Department's regulatory activities.**

2. DISTRICT NEED AND USE: **Several Divisional tasks have been designed in the Research and Evaluation Department to meet the immediate needs of Regulatory Department for technical tools,data and information. The project includes ongoing investigations of the water quality and the hydrologic aspects of stormwater runoff and it's treatment. Water quality monitoring of the thousands of permitted stormwater management systems in south Florida to ensure compliance with State standards for stormwater discharge is not seen as economically feasible. 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 assumption. Effective resource management may be accomplished by utilizing this information to modify and improve existing regulatory criteria. In addition, ongoing support is provided by the Hydrogeology Division in the development of user-friendly computer models which are used to evaluate water use permit applications, as well as assistance in compliance monitoring network and data collection activities.**

3. SCOPE: See attachments for details of individual Division work efforts.

4. SCHEDULE: See attachments

5. PROGRESS TO DATE:

6. PRODUCTS: See attachments

Attachment A

SUPPORT OF REGULATION DEPARTMENT - WATER QUALITY DIVISION

• District Contact: Greg Sawka

CONTRACT REFERENCE: ARS/SFWMD Coop Agreement

1. **OBJECTIVE: The objectives of this task, the Gator Slough Study, is to determine the efficiency of a wet detention area in treating runoff from a citrus grove and utilize this information to modify and improve existing surface water management permitting criteria.**

2. **DISTRICT NEED AND USE: This project is needed to investigate the hydrologic and water quality aspects of storm water and irrigation runoff quality and treatment of citrus wet detention systems. Effective resource management may be accomplished by utilizing this information to modify and improve existing design and regulatory criteria.**

3. SCOPE: The scope of this task includes:

   A. Field measurements as defined in previous contracts.

   B. A cooperative agreement between the District and the USDA ARS in application of the GLEAMS model utilizing field data from this project to aid in predicting the fate of pesticides in a citrus grove.

   C. Support from Data Management in site installation and pumping rate calibration.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr:

      1. Continue data collection and monitoring by contractor.

      2. Draft report of reconnaissance soil/pesticide sampling and soil characterization data.

      3. Continue GLEAMS model prediction analysis and field data input.

   B. 2nd Qtr:

      1. Complete data collection and monitoring by contractor.

      2. Evaluate and analyze complete data set supplied by contractor.

      3. Continue GLEAMS model prediction analysis and field data input.

   C. 3rd Qtr:

      1. Complete data evaluation and GLEAMS model analysis.

      2. Complete draft of agricultural (citrus) wet detention technical publication.

5. **PROGRESS TO DATE:**

FY89-90:

A. **1st Qtr:**

1. **Continued data collection and monitoring by contractor.**
2. **Developed reconnaissance soil/pesticide sampling and soil characterization plan.**

B. **2nd Qtr:**

1. **Continued data collection and monitoring by contractor.**
2. **Implemented reconnaissance soil/pesticide sampling and soil characterization sampling.**

C. **3rd Qtr:**

1. **Continued data collection and monitoring by contractor.**
2. **Obtained results from soil/pesticide sampling and soil characterization sampling.**

D. **4th Qtr:**

1. **Contract amended for collection of additional data and sampling under more representative hydrologic conditions by contractor to end March 1990.**
2. **Initiated GLEAMS model prediction analysis and field data input.**

6. PRODUCTS:

FY90-91: Monthly reports of soil and water chemical analysis.

A. 1st Qtr:

1. Monthly Status Reports.
2. Results of soil characterization laboratory analyses, to be included in the final report.

B. 2nd Qtr:

1. Complete field sampling and continue data evaluation.
2. Final Report Draft.

C. 3rd Qtr: Complete Final Report (Technical Publication).

Attachment B

SUPPORT OF REGULATION DEPARTMENT - WATER RESOURCES DIVISION

• District Contact: Richard Gregg

1. OBJECTIVE: **The objectives of this project are to provide engineering and technical support to the Regulation Department as requested. Computer modeling may be required to process and analyze impacts of future water use. In addition, a simplified procedure for computing backwater profiles will be developed.**

2. DISTRICT NEED AND USE:

   A. **This project is needed to appropriately analyze the regional water supply impacts of proposed major surface water and groundwater withdrawals (i.e., new wellfields)**

   B. **The user-friendly backwater canal profile program will allow a more efficient review of many surface water management (discharge) permit applications.**

3. SCOPE: **Although this is a new project for FY 90-91, it represents a continuing effort to assist the Department of Regulation in making decisions whether to issue or deny water use and discharge permits for projects having potential regional impacts. Recent efforts have included analysis of proposed wellfields in Dade and Broward counties. The HEC-2 canal backwater profile program will be modified to be more user-friendly and streamlined to analyze the simpler scenarios such as with few lateral inflow points.**

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Develop and test user-friendly backwater profile program.

   B. 4th Qtr: Document (memorandum) program and write users manual.

5. PROGRESS TO DATE:

   FY89-90: Analyses of proposed wellfields in Dade and Broward counties.

6. PRODUCTS:

   FY90-91:

   4th Qtr:

   A. 1st Qtr:

      1. Tested/verified computer backwater profile program.

      2. Technical Memorandum, Frequency Analysis of 1- and 3-day Rainfall Maxima for Central and South Florida.

   B. 3rd Qtr: Backwater profile program documentation.

Attachment C

SUPPORT OF REGULATION DEPARTMENT - HYDROGEOLOGY DIVISION

- **District Contact: Wm. Scott Burns**

1. **OBJECTIVE: The objective of this task is to provide technical support to Regulation on short and long term water use issues.**
2. **DISTRICT NEED AND USE: Hydrogeologic services are routinely needed to support the water use permitting process. The Hydrogeology Division provides modeling services, and technical review on an as needed basis.**
3. **SCOPE: The scope of this task is to provide technical support to the Water Use Division on an as needed basis, as well as to complete the following specific evaluations:**
   - A. Development of QA criteria for the SALT Monitoring Network.
   - B. Refinement of the statistical data scanning software to identify trends in the SALT water level/quality data base.
   - C. Provide Phase II of the GWZOOM model regridding software.
   - D. Provide technical and policy support for the revision of the Water Use Basis of Review.
4. SCHEDULE:

   FY90-91:

   A. 1st Qtr:
      1. Develop criteria and provide technical support for the revision of "Basis of Review".
      2. Administer technical review of GWZOOM contract.
      3. Development of QA plan for SALT network.
      4. Conduct review meeting for N. Martin County Wellfield Impact Assessment.

   B. 2nd Qtr: Complete evaluation, testing and training on operation of GWZOOM.

   C. 3rd Qtr: Begin production of hydrogeologic maps.

   D. 4th Qtr: Complete refinement of statistical methodology for evaluating data from the SALT network.
5. PROGRESS TO DATE:

   FY89-90: Routine support includes weekly participation in Water Use permit review meetings.

   A. 2nd Qtr:
      1. Completed Martin County Wellfield Impact contract and assembled model.
      2. Provided support on Broward County North Wellfield Model evaluation.

B. 4th Qtr:

1. Completed model development and draft documentation for Martin County Wellfield study, including the defining of criteria for assessing the impacts of "hardpan layers" on ground water flow regimes.

2. Technical support provided on revision of Basis of Review.

6. PRODUCTS:

FY90-91:

A. 2nd Qtr: Technical report on the model development of Jensen Beach

B. 4th Qtr:

1. SALT Monitor Network Report (Technical Memorandum).

2. Revised Basis of Review.

3. Documentation and code for GWZOOM.

OPERATIONS AND MAINTENANCE DEPARTMENT SUPPORT

• District Contact: Leslie Wedderburn/Patrick Gostel

1. **OBJECTIVE: The objectives of this project are:**
   - **A. Develop and implement a storm runoff prediction model for coastal urban catchment basins.**
   - **B. Develop and implement a storm surge model for predicting hurricane tidal stages of coastal water control structures in Broward and Dade counties.**
2. **DISTRICT NEED AND USE: This project is needed to assist the Operations and Maintenance Department assess the potential effects of major storms on the District's coastal water conveyance system.**
3. **SCOPE: This is a new project. The purpose of this project is to (1) identify, obtain, and implement a storm runoff prediction model for urbanized coastal catchment basins and (2) identify, obtain, and implement a surge model for predicting hurricane tidal stages at coastal water control structures in Broward and Dade counties. Both models will be used by the Operations and Maintenance Department to predict hydrologic conditions resulting from major storms at coastal water control structures.**
4. SCHEDULE:
   - A. FY89-90: Support to the Drought Management team:
     1. Computation of weekly water supply allocations to the EAA.
     2. Continued projections of Lake Okeechobee and water conservation area statge.
   - B. FY90-91:
     1. 1st Qtr:
        - a. Collect data for calibration and verification of storm runoff model.
        - b. Assess applicability of existing surface runoff models to South Florida urban catchment hydrology and select the one most appropriate for use in Broward and Dade counties.
        - c. Collect data for calibration and verification of storm surge model.
        - d. Assess applicability of existing storm surge models and select the one most appropriate for use in Broward and Dade counties.
     2. 2nd Qtr: Enter storm surge model into Unix-based computer workstation.
     3. 3rd Qtr: Enter storm runoff model into Unix-based computer workstation.
     4. 4th Qtr: Calibrate and verify storm runoff model and the storm surge model.

C. FY91-92:

lst Qtr:

1. Submit draft of final report for storm runoff model.
2. Submit draft of final report for storm surge model.

5. PROGRESS TO DATE:

6. PRODUCTS:

FY90-91

2nd Qtr:

A. Memorandum reporting on selection of surface runoff algorithms to be used in storm runoff model.

B. Memorandum reporting on selection of storm surge model.

CONSTRUCTION MANAGEMENT DEPARTMENT SUPPORT

• District Contact: Leslie Wedderburn/Patrick Gostel

1. OBJECTIVE: To provide engineering and coordination support in the form of hydrologic and hydraulic analysis and/or design to Construction Management Department projects.

2. DISTRICT NEED AND USE: This project is needed to:

   A. Provide hydraulic and hydrologic design recommendations to Construction Management Department projects involving environmental restoration and/or water control structure replacement.

   B. Develop and implement project-specific models to verify the recommended water control structure configuration.

   C. Apply the canal surface water profile program, HEC-2, in order to analyze existing conveyance capacity. This is being done under the CMD's canal conveyance capacity (CCC) program.

3. SCOPE: To perform CCC analyses as required; participate in monthly Capital Program Status meetings; perform engineering analysis of internal flow distribution of Everglades Nutrient Removal Project.

4. SCHEDULE:

   FY90-91

   A. 1st Qtr: Implementation of Phase III conceptual design.

   B. 2nd Qtr: Interior design of ENR project.

   C. 3rd Qtr: Review and comments on implementation II; design and construction of levees and pumpstation of ENR project.

   D. 4th Qtr: Review and comments on implementation II; design and construction of levees and pumpstation of ENR project.

5. PROGRESS TO DATE:

   A. FY88-89: This is a continuing project. Reviewed conceptual design document of the Everglades Nutrient Removal Project (ENR).

   B. FY89-90:

      1. 1st Qtr. Reviewed draft Everglades Nutrient Removal Management Plan

      2. 2nd Qtr: Reviewed design memorandum of perimeter levee system of ENR project

      3. 3rd Qtr: Reviewed design memorandum of ENR pumping station

      4. 4th Qtr: Reviewed design memorandum of interior configuration.

6. PRODUCTS

   FY90-91: Documented analyses of selected SFWMD canals' conveyance. Memorandum report to be reviewed.

TECHNICAL SUPPORT - RESEARCH & EVALUATION DEPARTMENT

• District Contact: Leslie Wedderburn/Patrick Gostel

1. OBJECTIVE: **The objective of this project is to provide an umbrella for DRE support to a wide variety of District activities and coordination of various interdepartmental technical activities including technical support to SWIM (Surface Water Improvement Management) Plans.**
2. DISTRICT NEED AND USE: **Various programs and activities require that DRE provide scientific/technical input to resource evaluation, management or policy decision making. This Department is charged with the responsibility of responding in a timely manner with scientifically sound, technically accurate and supportable information to make optimal decisions. The various tasks performed under this project may be unanticipated as in the case of drought and storm events, or may be carried out on a routine basis but in support of many areas within the District, such as provision of routine system storage and water level information. The type of tasks required by the Department may include data collection, assessments, modeling, data summaries, graphics, reports, presentations, field installations, well drilling and document reviews. Requests may be generated internal to the Department from other Departments, Executive Office, Governing Board, other agencies or the general public.**
3. SCOPE: See attachments for details of individual Division work efforts.
4. TASK SCHEDULE: See attachments.
5. PROGRESS TO DATE: See attachments.
6. PRODUCTS: See attachments.

Attachment A

DRE SUPPORT - ENVIRONMENTAL SCIENCES DIVISION

- **District Contact: Steve Davis**

1. OBJECTIVE: Provide technical support for on-going projects within the Department of Research and Evaluation.
2. DISTRICT NEED AND USE: Various activities and events require that DRE provide technical/ scientific input to resource evaluation, management, or policy decision making. The tasks performed under this project may be unanticipated.
3. SCOPE: Technical support will be provided to Divisions within DRE and other Departments within the District for a wide variety of projects. Support will include demonstration and training of computer applications needed for certain phases of projects. These may include writing programs, modelling, database retrieval and setup (LIMS, DBHYDRO, and ORACLE) and assistance with canned software products. Also, field work support will be provided to Data Management and Water Quality for the maintenance of stage recorders/cooperative water quality studies. Environmental support, as needed, for outside requests for assistance.
4. SCHEDULE: As needed to support special request that are otherwise not provided under existing programs.
5. PROGRESS TO DATE: This is an on-going support function.
6. PRODUCTS: As required.

DRE SUPPORT - WATER RESOURCES DIVISION

• District Contact: Paul Trimble

1. **OBJECTIVE: The objectives of this project are:**
   - **A. Provide daily and monthly information and analysis of hydrologic conditions and available surface water within the District.**
   - **B. Prepare special reports for extreme hydrologic events such as droughts, significant storms and hurricanes.**
   - **C. Project surface water supplies on a monthly basis.**
   - **D. Provide hydrologic information to other agencies such as the COE, DOT, local governments and engineering consultants as requested.**
2. DISTRICT NEED AND USE: This project is needed to:
   - A. Assess the status of the surface water storage within the District.
   - B. To inform others on past and present hydrologic conditions throughout the District.
3. SCOPE: The purpose of this program is to summarize the current hydrologic conditions, to project future conditions under various rainfall scenarios, and to report on the severity of extreme rainfall and drought events as they occur.
4. TASK SCHEDULE:

   FY90-91: Daily storage reports and monthly stage projections and rainfall isohyetals of District; a complete drought report will be necessary once the drought is over; other tasks upon request.
5. PROGRESS TO DATE:

   FY89-90
   - A. Special report, Analysis of the 1988-1989 Drought
   - B. Special report, Analysis of the 1989-1990 Drought
   - C. Daily surface water storage reports covering the Upper Kissimmee Chain of Lakes, Lake Istokpoga, Lake Okeechobee, and the Water Conservation Areas.
6. PRODUCTS:

   FY90-91:
   - A. Continued daily surface water storage reports
   - B. Documentation (special reports) of extreme rainfall and drought events, if any.

DRE SUPPORT - HYDROGEOLOGY DIVISION

- **District Contact: Wm. Scott Burns**

1. OBJECTIVE: The objective of this task is to provide hydrogeologic expertise and technical resources, on an as needed basis, to support special projects or requests which are not covered under other Divisional projects.
2. DISTRICT NEED AND USE: Requests for hydrogeologic services are received on an unscheduled basis throughout the year. Staff can be redirected on a short term basis in a cost effective manner.
3. SCOPE: This task is being conducted solely by the Hydrogeology Division. Work anticipated includes special drilling projects, other hydrogeologic data collection activities, definition of ground water recharge areas, represent District on Bluebelt and P-2000 committees, and technical review or interpretation on an as needed basis. External funding is not applicable.
4. SCHEDULE: Unscheduled work on an as needed basis.
5. PROGRESS TO DATE:
   A. Completed a total of over 20 wells for Operations and Maintenance Department, Land Management, and DRE.
   B. Attended Bluebelt and P-2000 meetings in Tallahassee.
   C. Provided hydrogeologic review of SOR lands for Land Management.
6. PRODUCTS: On an as needed basis.

TECHNICAL SUPPORT - PLANNING DEPARTMENT

• District Contact: Leslie Wedderburn/Patrick Gostel

1. **OBJECTIVE: The objective of this project is to facilitate coordination between the Planning Department and the Department of Research and Evaluation on technical issues particularly relating to environmental, water quality, hydrologic, and hydrogeologic issues.**

2. **DISTRICT NEED AND USE: Various programs and activities carried out in the Planning Department require close coordination with the Research and Evaluation Department. The need for coordination at the technical level is particularly critical between the Environmental Sciences, Water Quality , Water Resources and Hydrogeology Divisions of the Research and Evaluation Department and the Water Supply Planning Divisions of the Planning Department. Various environmental and water quality, hydrologic and hydrogeologic assessments are being carried out and computer models developed for use by the Planning Department. The products from these efforts must fit into the schedule for production of water resource management plans being developed by the Planning Department. An important part of this effort is ensuring that research needs are identified, work plans coordinated and work products meet objectives.**

3. SCOPE: See attachments for details of individual Division works efforts.

4. TASK SCHEDULE: See attachments

5. PROGRESS TO DATE: See attachments

Attachment A

TECHNICAL SUPPORT TO PLANNING DEPARTMENT - ENVIRONMENTAL SCIENCES DIVISION

- **District Contact: Steve Davis**

1. OBJECTIVE: Provide technical support for on-going projects within the Department of Planning.
2. DISTRICT NEED AND USE: Various activities and events require that DRE provide technical/ scientific input to the Planning Department to assist in resource evaluation, management, or policy decision making. The tasks performed under this project may be unanticipated.
3. SCOPE: Technical support will be provided to Divisions within the Planning Department for a wide variety of projects. Support will include assistance with SWIM related projects and input to development of SWIM Plans.
4. SCHEDULE: As needed to support special request that are otherwise not provided under existing programs.
5. PROGRESS TO DATE: This is an on-going support function.
6. PRODUCTS: As required.

Attachment B

TECHNICAL SUPPORT TO PLANNING DEPARTMENT - WATER QUALITY DIVISION

- **District Contact: Tom Fontaine**

1. OBJECTIVE: To review SWIM plans and respond to other data/analytical needs of the Planning Department.
2. DISTRICT NEED AND USE: The Planning Department requires input from all DRE divisions on SWIM plans and other planning issues so that interpretation of DRE research results is accurate and applied correctly.
3. SCOPE: Coordination with Planning Department in identifying research needs.
4. SCHEDULE: As needed to support special request that are otherwise not provided under existing programs.
5. PROGRESS TO DATE: This is an on-going support function.
6. PRODUCTS: As required.

Attachment C

TECHNICAL SUPPORT TO PLANNING DEPARTMENT - WATER RESOURCES DIVISION

- **District Contact: Shawn Sculley**

1. **OBJECTIVE: To provide continued hydraulic and hydrologic engineering support to planning initiatives.**
2. **DISTRICT NEED AND USE: This project is needed to provide the necessary research and development engineering element for flood control and water supply planning efforts.**
3. **SCOPE: The objective will be achieved primarily through model development and testing. Continued support will be provided for the Primary System Evaluation initiative and for compliance of the Special Districts Bill. External funding for this project is not applicable.**
4. TASK SCHEDULE:
   - A. 1st Qtr:
     1. Develop production versions of regional models on engineering workstations.
     2. Extend primary system evaluation database to Broward and Palm Beach counties.
   - B. 1st-4th Qtr: Provide R&D engineering support, including model development as needs arise.
5. PROGRESS TO DATE:

   FY89-90:
   - A. 2nd Qtr:
     1. Development of primary system evaluation database for Dade County.
     2. Analysis of proposed west Dade County wellfield.
   - B. 3rd Qtr: Model simulation of LEC water supply backpumping alternatives and documentation thereof.
   - C. 4th Qtr:
     1. Instruction of regional models to Planning Department staff.
     2. Development of regional model pre- and post-processor programs.
6. PRODUCTS

   FY90-91:
   - A. 1st Qtr:
     1. Recalibrated SFWMM (1-and 4-mi^2 versions)executable on engineering workstation.
     2. Executable user-friendly version of SFRRM on engineering workstation.
     3. Additional analysis of proposed west Dade County wellfield via SFWMM simulations.
   - B. 2nd Qtr: Primary system evaluation database for Palm Beach and Broward counties.

Attachment D

TECHNICAL SUPPORT TO PLANNING DEPARTMENT - HYDROGEOLOGY DIVISION

• District Contact: Wm. Scott Burns

1. **OBJECTIVE: The objective of this task is to provide hydrogeologic expertise and technical support to the Water Supply components of the Planning Department.**

2. **DISTRICT NEED AND USE: Technical experience, data and ground water models available from the Hydrogeology Division are needed to help quantify available ground water resources which is a necessary component of water supply planning. Resource quantification and hydrogeologic research is conducted in the Hydrogeology Division to support the Planning Department.**

3. SCOPE: Regional ground water flow models will be assembled and calibrated for use by the Planning Department. Specialized research involving ET/recharge rates and availability of water from the Floridan aquifer in the Lower East Coast and Lower West Coast will be initiated with periodic status reports. A feasibility study of a regional ASR project in the C-24 Basin will be conducted under project SL01. Both technical and manpower support will be provided along with the calibrated models on an as needed basis to support the water supply planning schedule.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Deliver the following regional flow models to the Planning Department with Hydrogeology staff support: N. Broward, S. Broward, Martin, St. Lucie, and Collier.

   B. 2nd Qtr: Deliver the Upper East Coast Floridan Aquifer flow model to the Planning Department with staff support. Provide policy and technical review of the Broward County and Lower West Coast water supply plans.

   C. 3rd Qtr: Provide documentation of the ET/Recharge package for use with the MODFLOW models. Provide policy/technical review and support of the Water Supply Policy document and the Basis of Review.

5. PROGRESS TO DATE:

   FY89-90:

   1st Qtr.

   A.. Completed model assembly calibration and draft documentation of the North Martin County Model.

   B.. Completed model assembly for N. Broward, S. Broward, Martin, St. Lucie and Western Collier Counties.

   C. Developed draft Water Supply Policy Document.

   D. Completed C-24 ASR Concept Plan.

6. **PRODUCTS:**

FY90-91:

A. 1st Qtr: Calibrated models for S. Broward, N. Broward, Martin, St. Lucie and Collier Counties.

B 2nd Qtr:

1. Final technical report for North Martin County study.
2. Calibrated model for the UEC Floridan Aquifer.

C. 3rd Qtr:

1. Complete revised Basis of Review.
2. Final report of the Water Supply Planning Document.

D. 4th Qtr: Final technical reports for N. Broward, Martin, St. Lucie and Collier models.

APPLIED WATER RESOURCES RESEARCH

• District Contact: Bob Hamrick and Todd Tisdale

1. OBJECTIVE: The objectives of this project are:
   A. Study evapotranspiration in the EAA and WCA-1.
   B. Examine the usefulness of object-oriented software design for hydrologic/hydraulic modeling.
   C. Investigate scientific visualization techniques on Unix-based engineering workstation.
   D. Identify "now-casting" applications using NEXRAD radar to measure instantaneous areal rainfall intensities.
   E. Develop rating curves for flow through gated culverts from an in-house physical model.
   F. Develop runoff models to interface with the Water Resources Division's channel routing model.
   G. Investigate climate changes impact on the SFWMD region.
2. DISTRICT NEED AND USE: This project is needed to:
   A. Improve the ability of District models to simulate evapotranspiration.
   B. Enable modelers to efficiently develop hydrologic/hydraulic models using modular, reusable code.
   C. Provide modelers with the ability to effectively examine model output through graphical means.
   D. Provide improved rainfall data to Operations and Maintenance Department and improve the quality of rainfall data used as input to District hydrologic/hydraulic models.
   E. Provide Data Management Division with a reliable set of rating curves for computing discharges through gated culverts.
   F. Provide District modelers with a set of runoff models to be used for simulating catchment runoff.
   G. Provide basis for climate-based policy development.
3. SCOPE: This project directly supports the Department of Research and Evaluation's mission of conducting applied scientific and engineering research. It is composed of six subprojects that examine scientific and engineering techniques for improving the ability of department staff to study hydrologic/hydraulic problems encountered in the District. Three subprojects are linked with other projects, and the remaining three operate independently. The examination of object-oriented software design will identify a candidate computer program for development using object-oriented programming from FY 1990-1991 projects in which computer programs will be under development. The investigation of scientific visualization techniques will report on computer graphics applications developed for other projects such as Maintenance

Improvement of Existing Models and Operations and Maintenance Department Support. The development of runoff models will be linked to Operations and Maintenance Department Support, which will be developing a storm runoff model for urban catchments in coastal areas. A task schedule is not given for evapotranspiration studies in the EAA and WCA-1, because this project is proposed as a joint venture with USGS and must obtain USGS approval before it can begin. A task schedule is also not provided for identification on "now-casting" applications using NEXRAD, because the specific data product to be made available by NOAA, who operates NEXRAD, has not yet been determined. Efforts will continue to attract research and supply to study climate effects in this region. Proposals for study will be developed with appropriate collaborators and submitted to funding sources. The current USGS effort on ET in the EAA is the prototype. No task schedule is possible since this will operate on a "target of opportunity" basis.

4. SCHEDULE:

A. FY90-91:

1. 1st Qtr:

   a. Obtain hardware for object-oriented software design project (workstation server).

   b. Obtain software for objected-oriented software design project (Interactive Development Environment C++ programming language).

   c. Conduct literature review of physical models for gated culverts.

   d. Conduct inventory of gated culverts existing in the District.

   e. Conduct literature review of existing runoff simulation algorithms.

   f. Collect data for calibration and verification runoff models.

2. 2nd Qtr:

   a. Train personnel in the principles of objected-oriented software design and to program in C++.

   b. Select a candidate programming application for development using objected-oriented software design.

   c. Submit a memorandum detailing work accomplished to date concerning scientific visualization techniques on workstations in various WRD projects.

3. 3rd Qtr:

   a. Design physical model for gated culvert.

   b. Submit a report or literature review of physical gated culvert models, inventory of actual gated culverts in the District, and the experimental design for the physical gated culvert model.

4. 4th Qtr:

   a. Develop programming application using object-oriented software design.

b. Submit a memorandum detailing work accomplished to date concerning scientific visualization techniques on workstations in various WRD projects.

c. Construct physical model of gated culvert.

d. Calibrate and verify runoff models.

B. FY91-92:

1. 1st Qtr: Submit draft of final report on object-oriented programming, this will continue into 2nd Qtr.

2. 3rd Qtr: Conduct experiments with gated culvert model, collect field data from actual gated culverts, and analyze laboratory field data.

3. 4th Qtr: Submit final draft of report on gated culvert model and discharge rating curves obtained from the model.

5. PROGRESS TO DATE: Training course in C++ attended by a staff water resources engineer

6. PRODUCTS: Memorandum reporting progress to date in the development of scientific visualization techniques on workstations for WRD projects.

INORGANIC LAB CHARGES

• District Contact: Mary Lou Daniel

1. **OBJECTIVE: The objectives of this project are**
   - **A. To provide analytical chemistry support for the District's water quality monitoring.**
   - **B. To collect the costs (personnel and commodities) associated with the projects listed under the SCOPE.**
   - **C. To distribute the costs to projects (by the Accounting Division) based on the percentage of workload on a monthly basis.**
2. **DISTRICT NEED AND USE: This project is needed to**
   - **A. Support the monitoring of the impacts of water management decisions and practices on water quality in the District.**
   - **B. To evaluate the effectiveness of BMP's, from data produced by the projects, to inform the Governing Board and public about the quality of water within the District.**
   - **C. To provide an historical basis for comparing and documenting water quality changes.**
3. SCOPE: This project provides water sample analysis with 42 analytical tests performed routinely. The eight nutrient tests for nitrogen and phosphorus compounds account for approximately 60% of the laboratory workload. The predicted workload for FY89-90 was 190,000 analyses for routine monitoring programs but is reduced to 125,000 analyses due to the drought. Support is also provided to field sampling personnel. External funding does not apply. This project provides support for the following projects:
   - A. Department of Regulation Support
   - B. Department of Planning Support
   - C. Everglades Nutrient Reduction Data Acquisition
   - D. Lake Istokpoga Data Acquisition
   - E. Chemistry Laboratory Overhead (Quality Control)
   - F. Surface Water Quality Monitoring Network
   - G. Works of the District Rule 40E-61
   - H. Regulatory Enforcement Evaluation Program
   - I. Caloosahatchee Estuarine Studies
   - J. Indian River Lagoon Water Quality Monitoring
   - K. Water Conservation Area Impacts/Monitoring
   - L. Taylor Creek/Nubbin Slough Best Management Practices
   - M. Kissimmee Valley Best Management Practices Data Acquisition
   - N. Lake Okeechobee Data Acquisition
   - O. ENP Data Acquisition
   - P. Caloosahatchee River Data Acquisition
   - Q. Upper Kissimmee Chain of Lakes Data Acquisition
   - R. Holeyland Data Acquisition
   - S. Arbuckle Creek Best Management Practices Data Acquisition

4. SCHEDULE:

FY90-91: The anticipated load for FY90-91 is 160,000 analyses. The analyses for nutrients, cations, anions, and physical parameters are completed within five working days following sample submission. The analyses for trace metals are completed within 28 calendar days following sample submission. The analysis load is rainfall dependent.

5. PROGRESS TO DATE:

A. FY82-83: 78,900 analyses

B. FY83-84: 57,500 analyses

C. FY84-85: 67,500 analyses

D. FY85-86: 80,200 analyses

E. FY86-87: 104,000 analyses

F. FY87-88: 143,200 analyses

G. FY88-89: 132,200 analyses (decrease due to drought)

H. FY89-90: 120,400 analyses (decrease due to drought)

I. For G and H, time not spent in analysis was used for training, methods development and maintenance.

6. PRODUCTS:

FY90-91:

A. Analytical results

B. Support for field sampling effort.

CHEMISTRY LABORATORY OVERHEAD

- **District Contact: Mary Lou Daniel**

CONTRACT REFERENCE: **Atomic Absorption/Perkin Elmer, Chemistry Laboratory Equipment Maintenance/Alpkem, Spectrophotometer Maintenance/Milton Roy, Chromatograph/Dionex**

1. **OBJECTIVES: The purpose of this project is to provide laboratory support and management which are required by all programs such as quality control and instrument maintenance and for charges which are not identified with a specific program.**

2. **DISTRICT NEED AND USE: This project is needed to provide an accounting center for laboratory overhead charges.**

3. **SCOPE: This project is comprised of areas such as the administration of quality assurance, attendance at conferences, instrument maintenance, capital outlay for general use equipment, and personnel time which cannot be distributed to specific projects.**

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Comprehensive Laboratory Quality Control Reports.

   B. 1st Qtr: Field Quality Control Reports prepared weekly.

   C. 2nd Qtr: Comprehensive Laboratory Quality Control Reports.

   D. 2nd Qtr: Field Quality Control Reports prepared weekly.

   E. 3rd Qtr: Generic Quality Assurance Plan updated annually.

   F. 3rd Qtr: Comprehensive Laboratory Quality Control Reports.

   G. 3rd Qtr: Field Quality Control Reports prepared weekly.

   H. 4th Qtr: Comprehensive Laboratory Quality Control Reports.

   I. 4th Qtr: Field Quality Control Reports prepared weekly.

5. PROGRESS TO DATE:

   A. FY88-89/89-90:

      1. 3rd Qtr: Comprehensive Laboratory Quality Control Reports

      2. 4th Qtr: Comprehensive Laboratory Quality Control Reports

   B. FY89-90:

      1. 1st Qtr: Comprehensive Laboratory Quality Control Reports delayed due to new software and computer problems.

      2. 2nd Qtr: Generic Quality Assurance Plan approved by DER, February 1990.

   C. FY90-91:

      1. 2nd Qtr: Comprehensive Laboratory Quality Control Reports completed through 2nd quarter.

2. **2nd Qtr:** **Comprehensive Laboratory Quality Control Reports in progress.**

CHEMISTRY LAB DATA BASE

• District Contact: Lori Robeson

CONTRACT REFERENCE: LIMS Maintenance/Perkin-Elmer

1. **OBJECTIVES: The objectives of this project are to provide 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 program are:**

   FY90-91:

   A. To collect, process, archive, and disseminate computerized water quality information.

   B. To provide operation and maintenance support for LIMS.

4. SCHEDULE:

   FY90-91:

   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.

   2nd Qtr: Replace existing LIMS hardware and software.

5. PROGRESS TO DATE:

   FY89-90: The LIMS has processed over 550,000 results to date.

6. PRODUCTS:

   FY90-91: Analytical data reports and machine readable data are provided to project managers and in response to external data requests.

SURFACE WATER QUALITY MONITORING NETWORK

• District Contact: Larry Grosser

1. **OBJECTIVE: The objective of this project is to collect routine water quality information from a network of stations located throughout the District.**

2. **DISTRICT NEED AND USE: The water quality data acquisition system is established to support the philosophy and goals of the District through acquiring information on the water quality resources that the District is required to manage for multi-purpose objectives. The network aids in addressing legal mandates, key resource issues, and general purpose needs.**

   A. Upper East Coast and Lower East Coast Surface Water Quality Data Collection. Data collected will:

      1. Assist the Planning Department (SWIM) in evaluating impacts of the proposed Taylor Creek/Nubbin Slough Diversion Project.

      2. Provide baseline water quality data to determine downstream impacts upon the Indian River, St. Lucie River, Loxahatchee River and Lake Worth estuarine systems.

   B. St. Lucie Canal Water Quality Data Collection

      This data is used primarily to determine 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 S-80 which could cause siltation downstream.

   C. Wet/Dry Precipitation Collection

      The primary use of this network 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.

   D. Kissimmee River Structures

      The primary uses of this network 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.

   E. Everglades Agricultural Area Surface Water Quality Data Collection

      Data will be collected to assist the Planning Department (SWIM) in monitoring the downstream impacts of pumping discharges via the WMD canal system to the Water Conservation Areas and Everglades National Park.

3. SCOPE:

A. All of the projects generate water quality analyses which are performed by the Chemistry Laboratory Division. Projects A, B and D are supplemented with hydrologic data provided by the Data Management Division. External funding has not been sought for any of the above projects (not applicable).

B. The scope of this project is:

1. Upper East Coast and Lower East Coast Surface Water Quality Data Collection. This network was initiated in 1979 and is sampled monthly. The network generates 2,788 laboratory analyses annually.

2. St. Lucie Canal Water Quality Data Collection. This project began in 1988. Its purpose is to collect data that will characterize the water quality of the major inflows and rank the tributaries as to their relative importance to the canals siltation problems.

3. Wet/Dry Precipitation Collection. The primary use of data from this network is to provide data to the Florida Sugar Cane League and the Everglades National Park. Additionally, the network will furnish information for planning and operations. Of particular interest is the determination of rainfall pollutant mass loading to the KOE system.

4. Kissimmee River Structures. This task will provide water quality data to researchers studying the impact of the Kissimmee River Valley BMP monitoring tasks. This program began in 1979.

5. Everglades Agricultural Area Water Quality Data Collection. This project was initiated in August 1990 and will be sampled biweekly dependent upon pumping events. There are initially 12 sites representing the major drainage basins within the Everglades Agricultural Area which will be sampled.

4. SCHEDULE:

FY90-91:

A. Seventeen Upper East Coast and Lower East Coast stations are sampled monthly, dependent upon flow conditions.

B. Biweekly sampling was performed on this project from June 1988 through October 1988. Monthly sampling was performed from November 1988 through October 1989, at which time sampling was performed on a quarterly basis until the present time. Sampling will resume to either biweekly or monthly schedule dependent upon regulatory releases from structure S-80 into the St. Lucie Estuary.

C. All Automatic Precipitation Collectors are serviced and rainwater collected for processing on a biweekly basis. The Florida Sugar Cane League continues to submit samples collected by their personnel from Pump Station 57 and the East Shore Drainage District on a biweekly basis.

D. All six Kissimmee River structures are sampled biweekly, regardless of flow conditions.

E. **Water samples from the twelve selected sites within the Everglades Agricultural Area will be collected biweekly dependent upon flow conditions.**

5. **PROGRESS TO DATE:**

A. **This is a continuing long-term monitoring network which was initiated in 1979.**

B. **Due to a lack of rainfall over the region and no regulatory releases from S-80, sample collection on this project was scaled back to a quarterly basis in October 1989.**

C. **The S-65A station commenced operation in September 1989.**

D. **This is a continuing long-term monitoring project which was initiated in 1979.**

E. **The sampling scheme for this project was developed in July 1990 and project commenced in August 1990.**

6. PRODUCTS:

FY90-91:

A. Upper East Coast and Lower East Coast

1. 3rd Qtr: Upper East Coast and Lower East Coast Quality Assurance Plan.
2. 3rd Qtr: Upper East Coast and Lower East Coast Quality Assurance Systems Audit.

B. St. Lucie Canal Water Quality Data Collection

4th Qtr: St. Lucie Canal Quality Assurance Plan and Quality Assurance Systems Audit.

C. Wet/Dry Precipitation Collection

1. 1st Qtr: Develop quality control procedures for rainfall collection.
2. 4th Qtr: Develop rainfall collection quality assurance plan.
3. 4th Qtr: Conduct rainfall collection quality assurance systems audit.

D. Kissimmee River Structures

1. 4th Qtr: Develop Kissimmee River Structures Quality Assurance Plan.
2. 4th Qtr: Conduct Kissimmee River Structures Quality Assurance Systems Audit.

E. Everglades Agricultural Area Surface Water Quality Data Collectin

1. 1st Qtr: Determine stite locations register station descriptions including latitude and longitude with database manager.
2. 4th Qtr: Produce QA Document

Attachment A

PESTICIDE MONITORING

• District Contact: Richard Pfeuffer

CONTRACT REFERENCE: Organic Analysis Routine Pesticide

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, pesticids data are collected throughout the District at locations selected to determine water quality conditions at the major control points.**

2. **DISTRICT NEED AND USE: This monitoring, which began in 1984, is needed to evaluate the extent of pesticide contamination in the District. Data collected will provide a better understanding of the fate of pesticides in the environment. Data collection is required under the DER's Lake Okeechobee Operating Permit, and the Miccosukee Tribe and Everglades National Park Memoranda of Agreement. The data can be used to assess potential environmental impacts of surface water management decisions.**

3. SCOPE: The monitoring network consists of 27 stations located at Lake Okeechobee and Water Conservation Area inflow and outflow structures and at Caloosahatchee River, and Everglades National Park inflow points. Surface water is collected every two months and sediment samples bi-annually. The set of 63 pesticides, herbicides, and degradation products analyzed 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:

   FY90-91:

   A. 1st Qtr:

      1. Coordinate and conduct second surface water sampling event (November). Compose data summary memorandum and Water Conditions Report section (January).

      2. Begin intensive atrazine monitoring project (November).

   B. 2nd Qtr:

      1. Coordinate and conduct third surface water and sediment sampling event (January). Compose data summary memorandum and Water Conditions Report section (March).

      2. Coordinate and conduct fourth surface water sampling event (March). Compose data summary memorandum and Water Conditions Report section (May).

   C. 3rd Qtr:

      1. Coordinate and conduct fifth surface water sampling event (May). Compose data summary memorandum and Water Conditions Report section (July).

2. Compose pesticide section of Technical Memorandum "Lake Okeechobee Water Quality 1989-1990 Annual Report."

3. Complete intensive atrazine monitoring project.

D. 4th Qtr: Coordinate and conduct sixth surface water and sediment sampling event (July). Compose data summary memorandum and Water Conditions Report section (September).

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:

FY84-85:

3rd Qtr: 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.

FY88-89:

3rd Qtr: Event sampling, data summary memoranda, and Water Conditions Report sections were written during the year, and the pesticide section of the Lake Okeechobee Water Quality Report (1987-88).

FY89-90:

A. 2nd Qtr: A draft Technical Publication, "Pesticide Residue Monitoring in Sediment and Surface Water within the SFWMD, Volume 2" was completed summarizing data from 1984 to 1988.

B. 3rd Qtr: 1988-89 Annual Reports were completed.

6. PRODUCTS:

FY89-90:

A. 1st Qtr: Technical Publication entitled "Pesticide Residue Monitoring in Sediment and Surface Water within the SFWMD, Volume 2" which will summarize 1984-88 results.

B. 2nd Qtr:

1. Data Summary Memoranda

a. January

b. March

2. Water Conditions Report Sections

a. January

b. March

C. 3rd Qtr:

1. Data Summary Memorandum--May
2. Water Conditions Report Sections --May

D. 4th Qtr:

1. Data Summary Memoranda
   a. July
   b. September
2. Water Conditions Report Sections
   a. July
   b. September

Attachment B

TRACE METALS MONITORING

• District Contact: Richard 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 the 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 were obtained throughout the District to evaluate the extent and origins of trace metal contamination. The first round of sampling initially covered ninty-six sites. Metals analyzed included: 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 also had particle size (percent silt and clay), total organic carbon, and calcium carbonate analysis performed. 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. Other areas of research on trace metals were identified to include the: spatial distribution; rates of accumulation; effects of pH and oxidation/reduction reactions and wetting/drying cycles on metal release from peats. A SWIM contract to investigate the latter research subjects as they pertain to Hg in the Everglades may be funded as part of this program.

4. SCHEDULE: Major tasks and schedules are as follows:

   FY90-91:

   A. 1st Qtr: Submit RFP for analytical and experimental work.

   B. 3rd Qtr: Complete draft technical publication summarizing sediment data.

   C. 4th Qtr: Technical Workshop.

5. PROGRESS TO DATE:

   A. FY88-89:

      1. 3rd Qtr: Negotiated contract for laboratory analysis.

      2. 4th Qtr: Sample collection started.

B. FY89-90

1st Qtr:

1. Sample collection finished.
2. Preliminary review of data completed.

6. PRODUCTS:

FY90-91: 4th Qtr: Technical workshop.

DEVELOPMENT OF ATLASES OF SURFACE WATER MANAGEMENT BASINS

• District Contact: Richard Gregg

1. OBJECTIVE: **The objectives of this project are to provide concise, up-to-date information about the size and location of surface water management basins in the District and to describe the location, function, and operation of all District works (i.e. canals, levees, and control structures) located in each basin. Each chapter will describe a single surface water management basin. Chapters will be grouped into atlases by county or other delineating geographic features.**

2. DISTRICT NEED AND USE: **This project is needed in support of the Regulation Department which will use the information in review of surface water management permit applications. The atlases will also be useful to other District staff, local governments, engineering consultants, and state and federal agencies.**

3. SCOPE: **This project will provide hydrologic and hydraulic information about District works by use of reports containing text, maps, and tables of information. These reports will:**

   A. **Locate and define each basin.**

   B. **Locate and describe each of the District works within each basin.**

   C. **Describe and discuss the operation and management of each of the District works.**

   D. **Provide comments on the design and historic operation of District works including the design storm(s) used, significant changes to the basin and its works since construction, and proposals under consideration to redefine the basin or modify its canals to control structures.**

   In addition, the atlas map database will be updated as required.

4. SCHEDULE:

   FY90-91: Q3 Publish an atlas of the Lower Kissimmee River Surface Management Basins.

5. PROGRESS TO DATE: Seven atlases have been published: An Atlas of Eastern Dade County Surface Water Management Basins; An Atlas of Eastern Broward County Surface Water Management Basins; An Atlas of Eastern Palm Beach County Surface Water Management Basins; An Atlas of Martin County Surface Water Management Basins; An Atlas of St. Lucie County Surface Water Management Basins; An Atlas of Everglades Agricultural Area Surface Water Manatement Basins. Two atlases are in their final stages of review: An Atlas of Surface Water Management Basins in the Everglades: The Water Conservation Areas and Everglades National Park, and An Atlas of Upper Kissimmee River Surface Water Management Basins.

6. PRODUCTS: FY90-91:

   A. 3rd Qtr Final document - Tech Memo : Upper Kissimmee River Basin Atlas

   B. 4th Qtr: An Atlas of the Lower Kissimmee River Surface Water Management Basins.

MAINTENANCE & IMPROVEMENT OF EXISTING MODELS

• District Contact: Todd Tisdale

1. **OBJECTIVE: The objectives of this program are**
   - **A. Institute other maintenance changes in existing software code.**
   - **B. Institute improvements, either in algorithm or in usability, in existing software code.**
   - **C. Update input data sets used by models when needed.**
   - **D. Document new software changes to existing software.**
   - **E. Identify and plan for future improvements to existing software code.**
2. DISTRICT NEED AND USE:

   The software developed and maintained under this project is used regularly by entities throughout the District, particularly the Planning Department and the Regulation Department. Documentation of existing models (and changes made thereto) is required in order to facilitate the Division's coordination of model development and application with other departments. Improved computational tools will be required for almost all of the projects in which the Division will be working in FY90-91. This also includes general maintenance items such as debugging and enhancements of existing software.

3 SCOPE:

This project deals primarily with maintaining and improving regional hydrologic models, specifically

- the Upper Kissimmee Chain of Lakes (UKCL) model;
- the South Florida Regional Routing Model (SFRRM);
- Lake Okeechobee stage
- the Projection Model; and
- the South Florida Water Management Model (SFWMM).

Changes to these models are made as deemed necessary by the Water Resources Division, or as requested by other departments/divisions. Other software used by the division is included in this project as well. For example,

- the Multi-Basin Routing (MBR) model;
- the Interactive Seasonal Water Balance Model (ISWAB);
- the SHEET2D model; and
- graphics and computational libraries developed within the division.

This project deals with several models which are used both within and outside the division. There will be participation from the Regulation and Planning departments. The Regulation Department's role will be advisory: Software bug identification, software design information, etc. The role of the Planning Department, is more active. In addition to bug identification and software design information, the Planning Department will make some of their own modifications as necessary for their projects. The Planning Department's participation will be via the recently established "Regional Hydrologic

Modeling Group" - an interdepartmental committee formed to direct the migration and improvement of the regional surface water models (SFRRM, SFWMM, and Projection Model). No external funding has been sought for this project.

4. **SCHEDULE:**

FY90-91:

A. **1st Qtr:. Complete migration of necessary programs and procedures from Cyber to other platforms.**

B. **2nd Qtr:**

1. **Complete pre- and post-processing software for SFRRM, SRWWM and Projection Model**
2. **Modify SFWMM to account for runoff and demand in the Caloosahatchee and St. Lucie River basins**
3. **Port MBR preprocessor to PC**

C. **3rd Qtr:**

1. **Complete calibration and updates for SFRRM, SFWWM, and Projection Model.**
2. **Add a "swail" structure and general curvilinear unit hydrograph to the MBR.**
3. **Document changes to MBR.**

D. **4th Qtr:**

1. **Addition of Upper Kissimmee basin information in the SFRRM, Projection Model, and SFWWM.**
2. **Changes as necessary to the UKCL model for inclusion in SFRRM and Projection Model.**
3. **Document recent changes to UKCL model, SFRRM, Projection Model and SFWWM.**

NOTE: Tasks listed here are tentative. They may be supplemented or replaced by priorities set by the Regional Hydrologic Modeling group.

5. PROGRESS TO DATE:

FY88-89: This is an ongoing project

A. 3rd Qtr: MBR Preprocessor developed for UNIX platforms.

B. 4th Qtr: Port the SFRRM, SFWWM, and Projection Model ported to UNIX platforms (same functionality as on the Cyber).

6. PRODUCTS:

FY90-91:

A. 1st Qtr: Operational versions of the SFRRM, SFWWM, and Projection Model on a UNIX platform.

B. 2nd Qtr: Pre- and post-processing software for the SFRRM, SFWWM, and Projection model.

C. 3rd Qtr: Documentation of MBR.

D. 4th Qtr:

1. Documentation of UKCL model.
2. Documentation of SFRRM, SFWWM, and Projection Model

NOTE: Products listed for the regional models (SFRRM, Projection Model, and SFWMM) are tentative. They may be supplemented, or replaced, by priorities set by the Regional Hydrologic Modeling group.

DATA PROCESSING SOFTWARE SUPPORT

- **District Contact: Brian Turcotte**

CONTRACT REFERENCES:

PREPROCESSING SYSTEM CONVERSION
INVENT/MAINT/MALF DATABASEB DEVELOPMENT CONVERSION
PRODUCT TRACKNG SFTWR DEVELOPMENT CONVERSION
DATA MGT SOFTWARE DEVELOPMENT
DBHYDRO DATABASE CONVERSION
HDPLOT AND GTAR CONVERSION

1. OBJECTIVE: This project provides software support for the processing, storing, and retrieving of hydrologic, meteorologic, and water quality data. This project is a long term comprehensive project involving research, evaluation, planning, development, and implementation of software. 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 (artificial intelligence, natural language interface, etc.); development of software to aid recorder maintenance and inventory; management of software tools for personnel productivity and recorder maintenance/inventory/malfunction reports; flow computation algorithms incorporating data base information.

2. DISTRICT NEED AND USE: The SFWMD needs this project to:

   A. Greatly facilitate access and retrieval of hydrologic data

   B. Convert to an ORACLE Data Base which will enable the sharing of information between District data bases and provide a common platform interfacing with GIS.

3. SCOPE:

   A. General Maintenance/Development

   Develop and maintain a VAX/VMS library for source code used in the preprocessing system. The library will minimize duplication of effort among programmers by providing a centralized location for source code storage and access.

   B. Flow Equations

   Quantification of discharge is necessary to support all elements of the District mission. Determination of nutrient loadings and flood frequency depend upon accurate discharge calculations. The Technical Services production program E034, which has been used since 1985 had outgrown its original scope, became cumbersome to maintain, and required redevelopment. Redevelopment includes a data base interface to reduce maintenance time, improve flexibility, and reduce redundancy of information.

   Restart the Culvert Model Project (formerly let to FAMU). This is a joint project between Water Resources Division and Data Management Division in which Data Management Division will play the minor role.

   C. NOS Conversion to VMS

Cyber to VAX conversion of all required computer programs.

D. Telemetry Rainfall

Operations Division telemetry rainfall data is cumulative in nature and requires different processing techniques than the discrete telemetry data. The District rainfall network is woefully sparse for modeling purposes. Any gains made by processing this data help improve the rainfall data network.

E. Maintenance/Inventory/Recorder Malfunction Data base

The ability to account for all office and field equipment, and data recorders, their malfunctions and maintenance will improve the ability of Data Management to identify problem recorders, poor quality equipment, and repair frequency. This data base will contribute greatly to improved quality control.

F. Graphic Interface

Used to display, modify, and visually verify hydrologic data. One application, known as HDPLOT, is used throughout the District. The District conversion to Oracle will facilitate inclusion of all related data.

G. Solid State Production Environment

Solid state data is best processed by its own application. Such a scheme allows the application to take advantage of all unique aspects of solid state recorder usage.

H. Optical Scanning of Graphic Recording Media

Standardization of the digitization process is accomplished through this project. Technician bias is reduced thus ensuring better consistency of graphic data processing.

I. Productivity Tracking

Receipt of field data for processing is logged in and data status is tracked until archived. Reports are generated to indicate station status, etc.

J. Network Analysis/GIS

Ongoing interdisciplinary/interagency review of the hydrologic data collection network. Includes analysis of a user survey to determine present and future needs, conversion, from Autocad to Arc/Info, of maps of District stage, flow, and rainfall networks, development of criteria for an appropriate analysis scheme, development of a scope of work and schedule for analysis performance and interdisciplinary/interagency review. Minor assistance from department staff and Water Resources Division is involved.

K. Cost Analysis

Unit cost for each monitoring station and what monitoring issues are supported by each recording installation.

L. Intelligent Processing

Ongoing project to develop software to standardize and enhance quality assurance, and automate processing. Involves the introduction of a combination of modern pattern recognition techniques and artificial intelligence technology to enhance the data verification process and

reduce personal bias, judgment, and human error. Minor assistance from department staff and Water Resources Division is involved.

M. Data filling

Provide provision for automatic substitution of alternate station_id upon retrieval of data from archive. An example would be to substitute the graphic data for telemetry at a particular location. The substitution is transparent to the user.

N. Missing data estimation

When data filling fails, gaps remain. Use of autocorrelation, cross-correlation or other statistical techniques would provide a second level of filling.

O. Real Time Monitoring

There has been an increased demand from other Divisions and Departments to access non-telemetry data realtime. These requests have been handled on an ad hoc basis. To prevent this application from becoming unmanageable a proactive position must be taken to plan for future expansion of this computer application. If the number of stations is to increase, then more effort should be expended to optimize the data retrieval operation. No external funding has been sought for this project.

4. SCHEDULE:

A. FY90-91:

1. 1st Qtr:

a. Complete optical scanning development.

b. Complete testing of preprocessing system.

c. Conversion of FORMRUN.

d. Execute contract for GTAR and HDPLOT conversion.

e. Evaluation of optical scanner system for possible enhancements.

f. Productivity reports.

(1) Develop tables to save control information.

(2) Convert productivity report.

(3) Convert Data points archived report.

(4) Days received report.

g. Station Status Reports.

(1) Convert data entry portion of station status data base from Dataflex to Oracle.

(2) Convert late report.

(3) Convert date due report.

(4) Convert gap status report.

(5) Data collection report.

(6) RF collection report.

(7) Priority station status report.

(8) Frequency report.

h. Compile survey information for interdisciplinary review of the hydrologic data network.

i. Build data base tables to be used by data filling algorithms.

j. Convert from FORTRAN to C or develop in C core extraction routines to replace the functionality of RDXSET, RDXNXT, and GXE405. Contractual services.

k. Complete Analysis phase for telemetry rainfall (RF4).

l. Complete Design phase for Recorder Maintenance/Inventory/Malfunction Data Base.

m. Build tables to be used by estimation algorithms.

n. Identify tidal stations with a flag in the station reference table and add project code, and relevant data collection attributes as well.

o. Provide MHT and MLT statistics for tidal stations through the interval value generator. Contingent upon completion and enhancements to Oracle preprocessing system.

p. Distinguish solid state stations as being such and modify applications to incorporate this attribute.

q. Add year to Easylogger output (contract?)

2. 2nd Qtr:

a. Implement preprocessing system.

b. Complete the Strategy, Analysis and Design phases for the Productivity tracking system.

c. Update GIS to contain all known stage, flow, and rainfall networks.

d. Explore the application of stochastic modeling and statistical techniques with the GIS spatial analysis, criteria selection, and polygon overlay capabilities.

e. Complete conversion of cost analysis data base.

f. Analyze current data processing techniques to identify data verification checks with potential for automation.

g. Populate tables to be used by filling algorithms.

h. Award contract for Maintenance/Inventory/Malfunction data base implementation.

i. Complete Design phase for telemetry rainfall (RF4).

j. Populate tables to be used by estimation algorithms.

c. Conduct 1st technical publication coordination/review meetings for flow equation project

3. 3rd Qtr:

   a. Issue RFP for build and implementation phases for Productivity tracking.

   b. Develop and document criteria for completing analyses and providing network maps based on scenarios developed from interdisciplinary criteria to be distributed multiagency-wide for peer review.

   c. Conduct 2nd technical publication coordination/review meetings for flow equation project.

4. 4th Qtr:

   a. Make changes to 'smashing' algorithm to reduce redundant data points in a time series.

   b. Resolve conversion of millimhos to micromhos for conductivity data.

   c. Correct 14 days of telemetry data for February 1989.

   d. Eastern Standard Time for all 6 processing applications.

   e. Complete data base table population with structure reference information for flow equations.

   f. Develop a RFP which will include a set of specifications, the scope of work, and evaluation criteria for a data verification system based on pattern recognition and/or artificial intelligence technology.

   g. Complete Build phase for telemetry rainfall (RF4).

B. FY91-92:

1. 2nd Qtr:

   a. Issue the RFP for intelligent processing routines and allow all potential contractors to submit proposals.

   b. Publish discharge computation technical report.

2. 3rd Qtr:

   Set up an evaluation committee, conduct proposal evaluation, and select the best proposal for intelligent processing routines.

3. 4th Qtr:

   Manage the implementation of the data verification system completion.

5. <u>PROGRESS TO DATE</u>:

FY89-90:

A. 1st Qtr:

1. Strategy Phase completed for Recorder Maintenance/Inventory/Malfunction Data Base.

2. Several stations made available for query and retrieval for real time monitoring.

B. 2nd Qtr:

1. Completed rough conversion of cost analysis data base from Dbase III+ to Oracle RDBMS.
2. Analysis Phase completed Recorder Maintenance / Inventory/ Malfunction Data Base.
3. EASYLOG solid state data reformatting program converted to VAX environment.
4. Rainfall Based Management Plan for Shark River Slough converted to VAX.
5. Interagency meeting with USGS Miami area office.
6. Data base table design completed for data filling.

C. 3rd Qtr:

1. Statement of work developed for graphical interface conversion development.
2. Converted Interval Value Generator program.
3. Implemented object code library on the VAX.
4. Converted manatee program to warn of unsafe gate operations.

D. 4th Qtr:

1. Optical scanning contract completed.
2. Software developed to accommodate Campbell Scientific Inc. storage modules in solid state processing application.
3. First phase of flow equation program completed for VMS and Oracle.
4. Completed contract with Oracle Consulting (#88-444-0845).
5. E071 plotting program converted.
6. Developed driver for plotting procedure directives.
7. Everglades National Park and LWDD data reformat program conversion completed.
8. RFP C90-1336 issued and contractor selected for the GTAR and HDPLOT Graphical Interface Conversion.
9. Network Analysis survey distributed.
10. Convert Handar reformatting program (contingent upon keeping Handars).
11. Convert telemetry tape dump procedure.
12. Convert CPLOT.

6. **PRODUCTS:**

FY90-91:

A. 1st Qtr:

1. Converted and enhanced relational data base based preprocessing system.
2. Improved intra-divisional accountability through productivity tracking.
3. Improved consistency of hydrologic data.
4. Reduced redundancy of hydrologic data.
5. Discharge calculations for all District structures.

B. 2nd Qtr:

GIS softare macros to assist with optimizing the hydrologic data collection network.

C. 3rd Qtr:

Software/database to be used to determine unit costs for District's, contractors and cooperating agencies' data collection costs to assist in determining the most effective means of supporting the hydrologic data collection network.

D. 4th Qtr:

Technical publication describing flow computation algorithms.

HYDROLOGIC DATA BASE

• District Contact: Brian Turcotte

CONTRACT REFERENCE: Stream Gauge/DBHYDRO Software Development

1. **OBJECTIVE: The objectives of this project are to:**

   A. Improve hydrologic data base (DBHYDRO) data quality, availability, and ease of use

   B. Maintain the hydrologic data base.

2. **DISTRICT NEED AND USE: The District and cooperating agencies need this program to facilitate access and retrieval of hydrologic data. The District's conversion to an Oracle Relational Data Base Management System facilitates sharing of information between data bases on different machines and provides a platform to interface with GIS. The efforts of this project benefit nondiscretionary District initiatives such as Operations Division who make use of a graphic data base interface developed by Data Management.**

3. SCOPE:

   A. Intra/Inter-Departmental Support/Cooperation

   Support/Cooperation to other departments and all divisions within the Department of Research and Evaluation to help ensure proper data representation and compatibility. Provide a foundation for a departmental data base to include hydrological, hydrogeological, water quality, and ecological data. Assistance to Planning Department is provided to model information required for Level of Service Reviews.

   B. Maintenance

   An ongoing project to maintain the hydrologic and preprocessing system data bases by verifying and entering exact location of all stations, structure design characteristics, basin linkages, upstream/downstream linkages, land elevations, and other spatial attributes. The addition of new stations to the network is covered here. Maintenance will become more necessary as the external agency interface becomes more complete because the number of stations to be maintained will increase.

   C. Future Development

   Develop entity relationship diagrams for the preprocessing system. Modify entity relationship diagrams for DBHYDRO as implemented in Oracle. Discontinue use of V tag on DBHYDRO...end users only care that the data is missing, they don't care why. Preprocessing system keeps track of why (gap table). DBHYDRO ACCESS program, DBHYDRO load program, DBHYDRO station add/edit/delete program.

   D. Stream Gauging Interface

   Refinement of rating curves to improve flow estimation. Development of applications for stream gauging data inclusion into the hydrologic data base.

E. **Natural Language Interface**

Investigate further the viability of a Natural Language interface to DBHYDRO. A Natural Language interface will allow users to query the data base without any knowledge of any programming language or any knowledge of the data base. Queries are entered in natural English and algorithms based on Artificial Intelligence application of linguistic theory translate queries into the data base language (SQL). All operations are transparent to the user.

F. **External Agency Interface**

Develop better interagency data exchange program with the Corps of Engineers, the USDA Agricultural Research Service, and the USWB to better satisfy requests from other Divisions and external entities. Maintain data exchange with the USGS, ENP, and LWDD.

G. Data Filling

Synthesis of available data and generation of best time series when multiple agencies are reporting. This would require a subjective ranking of summary time series with effective dates. Similar to data filling under Project 3521 but uses DBKEY instead of STATION_ID.

H. Missing Data Estimation

Estimation of summarized data when data is missing (DBHYDRO). Algorithms based on previous work by Van Lent under contract to the District would be incorporated.

No external funding has been sought for project.

4. SCHEDULE:

A. Intra-Departmental Support/Cooperation

FY90-91:

1. 1st Qtr:

   a. Define STATION attributes which are sufficient for all DRE divisions.

   b. Continue interviews with divisions to refine data element lists.

2. 2nd Qtr: Define and normalize, where required, data structure for Water Quality Division data.

B. Maintenance

FY90-91:

1st Qtr: Use GIS land elevation coverage to populate DBHYDRO data base land elevation attribute for all data base stations.

C. Development

FY 90-91:

4th Qtr: Publish Technical Report on Data Management Division data bases.

D. **Stream Gauging Interface**

FY 90-91:

1st Qtr: Develop an Oracle form into which stream gauging results can be entered.

E. **Natural Language Interface**

FY 91-92:

1st Qtr: Vendor demonstrations.

F. **External Agency Interface**

FY90-91:

1. **1st Qtr: Solicit cooperation from COE, USDA ARS.**
2. **2nd Qtr: Develop automated interface to USGS QWDATA data base.**
3. **3rd Qtr: Incorporate USWB Hourly rainfall data in DBHYDRO.**

G. Data Filling

FY 90-91:

1. 1st Qtr:
   a. Build tables to be used by filling program.
   b. Populate tables.
2. 2nd Qtr: Develop data filling program.
3. 3rd Qtr: Test data filling application.
4. 4th Qtr: Implement data filling application.

H. Missing Data Estimation

1st Qtr: Review previous work done by VanLent.

5. <u>PROGRESS TO DATE</u>:

A. Intra/Inter-Departmental Support/Cooperation

FY89-90:

1. 1st Qtr: Attended LIMS for Oracle demonstration by VG instruments.
2. 3rd Qtr:
   a. Gathered data element lists from each Division within DRE to be used to develop departmental data model.
   b. Assisted WQ Division in their efforts to migrate to an Oracle RDBMS based laboratory information management system.
3. 4th Qtr: Developed E-R diagrams for Hydrogeology Division as required for GWZOOM model.

B. **Maintenance**

FY 89-90:

4th Qtr: **Updated county, quad, basin, section, township, and range attributes, using GIS, for all DBHYDRO stations.**

C. **Development**

FY 89-90:

1. **1st Qtr:**
   a. **Entity-relationship diagrams developed for DBHYDRO.**
   b. **DBHYDRO data base tables designed, built, and populated with test data.**
2. **2nd Qtr:** **Statement of Work for applications development completed.**
3. **3rd Qtr:** **RFP issued for DBHYDRO applications.**
4. **4th Qtr:**
   a. **Transferred DBHYDRO data to Oracle.**
   b. **DBHYDRO LOAD program converted to Oracle.**
   c. **Proposal opening and contractor selected for DBHYDRO applications.**

D. Stream Gauging Interface

FY 89-90:

1. 2nd Qtr: Old stream gauging records have been assembled from the last 15 years.
2. 4th Qtr: Data base table design completed for stream gauging data.

E. Natural Language Interface

FY 89-90:

1st Qtr: Attended demonstration of NLI Natural Language Interface product.

F. External Agency Interface

FY 89-90:

1st Qtr:

1. USGS ADAPS data load automated to the point of simply selecting a menu item from the PC. This program collects and loads data to DBHYDRO from the Miami, Orlando, and Tampa subdistrict offices using our dedicated line and the USGS network.
2. ENP data load runs smoothly as we receive diskettes monthly from ENP.

G. Data Filling

FY 89-90:

1. 1st Qtr: DBHYDRO table design for Oracle included provision to rank time series.

2. 4th Qtr: Design tables to be used by filling program.

6. PRODUCTS

FY90-91:

A. 2nd Qtr: End user documentation for DBHYDRO data base.

B. 4th Qtr:

1. Technical Report on Data Management Division Data Bases.

2. A relational data base providing linkages to other relational data bases and serving as a subsystem to GIS.

3. More complete representation on DBHYDRO of data collected in South Florida.

HYDROLOGIC DATA REPORTING - PUBLIC REQUESTS

• District Contact: Robb Startzman/Ernest Gallego

1. OBJECTIVE: The objective of this project is to furnish assistance to local governments and other agencies requesting hydrologic data; provide routine monthly reports to government and cooperating agencies in our data acquisition network and satisfy legal agreements; and provide data and information on request to other departments and divisions.
2. DISTRICT NEED AND USE: This project is needed to meet legislative requirement to the COE, provide local government assistance with data needs for comprehensive planning, and report hydrologic data to the public.
3. SCOPE: This project is composed of six tasks:
   - A: Assistance to Local Governments and Agencies
   - B: Reports to Miscellaneous Outside Requests
   - C: Reports to Consultants
   - D. Reports to Other Departments
   - E. Reports to Other Divisions
   - F. Reports to Legal
4. SCHEDULE:
   - A. Monthly meetings between project manager and Director to review progress and coordinate project tasks.
   - B. Quarterly reports outlining the progress of the projects.
   - C. Monthly data requests to COE and other legal agreements.
   - D. Data reports on a daily basis as requested by the District.
   - E. Data Request Reporting system to report data requests - second quarter FY89-90.
   - F. Enhancement to Data Request Reporting system to project estimated vs. actual time to complete each request - third quarter FY90-91.
   - G. Further enhancement to Data Request system to assess the cost of each data request - fourth quarter.
5. PROGRESS TO DATE: This is a continuing project. Direct computer access has been granted for retrieval of hydrologic data to:
   - A. USGS
   - B. Corps of Engineers
   - C. Orange County
   - D. Dade County
   - E. NASA
   - F. University of Florida
   - G. Cape Coral Utilities

6. PRODUCTS: Various reports of hydrologic and meteorologic data, information about stations and locations, raw and summarized data on computer floppy diskette or magnetic tape. Heavy use of the Hydrologic Data Base is used for this effort. Support in this capacity is primarily to users who are unaccustomed to computer usage or cannot be granted direct access to data bases. Steadily increasing demand for fine time resolution data for complex modeling applications by agencies such as the Corps of Engineers, academic research institutions, private consultants on contract to governmental agencies on internal District applications are being found. This requires a much denser data collection network than is required for utilization of yearly, monthly, or daily data.

A. MONTHLY REPORTS

REQUESTER:		TYPE OF DATA:
1.	City of West Palm Beach	Rainfall
2.	Dept. of Environ. Resources Mgmt, Metro-Dade	Rainfall
3.	Environmental Engineering Science, WPB	Rainfall
4.	Village Engineer, Royal Palm Beach	Rainfall
5.	Polk Co. Water Resources Dept.	Rainfall
6.	So. FL National Wildlife Refuge	Rainfall
7.	St. Johns River WMD	Rainfall
8.	Everglades National Park	Groundwater, rainfall, stage/gate, flow
9.	USGS	Groundwater, rainfall, stage/gate, pump and operations
10.	COE (Legal Mandate)	Groundwater, rainfall, stage/gate, pump and operations
11.	Ghioto Associates (Legal Mandate)	Rainfall, evaporation, water level, flow
12.	Miccosukee Indian Reservation (Legal Mandate)	Rainfall, water levels

B. SPECIAL REPORTS ON DEMAND

A large number of requests for a wide variety of hydrologic information is received from a wide spectrum of users. A sampling of the type of requests serviced recently include: Groundwater, rainfall, stage and flow data, structure characteristics, operating criteria, and flood criteria. This information is frequently requested by agencies and institutions such as Soil Conservation Service, DOT, DERM, University of Miami, University of Florida, and by consulting firms such as Dames and Moore; Gee and Jenson; Environmental Sciences and Engineering; Boyle Engineering Corp.; Biscayne Engineering; Camp, Dresser and McKee, Inc.; Williams, Hatfield and Stoner; Hensley Smith, Inc.; Meco Engineering; Bechamps, Aylward & Assoc., Post, Buckley, Schuh & Jernigan, Inc.

Requests for data and information by the general public have substantially increased to literally hundreds of requests per month.

There is a continual increase in requests for fine time resolution breakpoint data used for mathematical modeling and finer resolution hydrographs; this data can be obtained only from this agency. Requests for other information pertaining to station location, basin boundaries, District structures and operation purposes, land elevations, contours of water table profiles, etc. are steadily increasing.

GENERAL NETWORK HYDROLOGIC INSTRUMENTATION, MAINTENANCE, DATA COLLECTION AND PROCESSING

- **District Contact: N. Davies Mtundu/Jack Hardee**

CONTRACT REFERENCE: **USGS GW Data Collection (Miami)**
USGS SW Data Collection (Miami)
USGS GW Data Collection (Orlando)
USGS SW Data Collection (Orlando)
USGS Computer Lease Line (Miami)
USGS Drought Monitoring

1. OBJECTIVE: The objectives of this project are 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 the 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:

   A. **Department of Land Management**- Hydrologic information for management of SOR lands.

   B. **Department of Regulation** - Criteria development, alternate water supply.

   C. **Department of Research & Evaluation** - Wellfield water conditions report, Water Supply Plans, model calibration and verification, rainfall reports, flood studies, storm reports.

   D. **Department of Operations and Maintenance** - Telemetry and structure operations feedback, documentation of structure operations, water conditions report, structure problem reporting, installation of Telemark gauges.

   E. **Department of Construction Management** - Construction of the Everglades Nutrient Removal Project, construction of bridges and culverts, and other projects.

   F. **NASA** - Cooperative venture to use our present rain gauges and establish additional rain gauges for calibration of radar rainfall measurement.

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

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

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

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

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

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

M. **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. Stations 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.

Charges to this project include general overhead items such as tools, replacement vehicles, inventory, etc which are difficult to distribute to specific areas, as well as charges to support the BASIC NETWORK.

Individual Project Scopes:

A. **Hydrologic Data Collection and Support for Loxahatchee River Basin**

This task covers hydrologic data monitoring for the area tributary to the Loxahatchee River and the estuary system which it feeds. Hydrologic monitoring in these areas is a highly coordinated effort between Data

Management Division, Water Resources Division, Environmental Sciences Division, Department of Operations and Maintenance, 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. Operations and Maintenance 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:

1.	Flow		6 stations
2.	Surface water	Recorders	16 stations (USGS 4)
3.	Gates		2 stations
4.	Rainfall	Recording	3 stations
5.	Wells	Recording	2 stations (USGS 2)

There has been a large volume of hydrologic data of an exploratory nature collected over the last ten years. These 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 task, 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 task are required to compute water quality loading.

Hydrologic monitoring efforts saw significant decreases during FY89-90. Two temporary recorders were installed to support water management efforts in the tributary regions, however, eight were removed for network optimization. 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.

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 task.

B. Hydrologic Data Collection and Support for Upper Kissimmee River Valley (River Restoration)

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

Current instrumentation consists of:

1.	Flow		8 stations (USGS 1)
2.	Surface water		
	a. Recorders		14 stations (USGS 2)
	b. Manual		2 stations
3.	Gates		5 stations
4.	Rainfall		14 stations
5.	Evaporation		1 station
6.	Weather Station	Recording	10 stations
7.	Wells		
	a. Recording		13 stations (USGS 3)
	b. Manual		15 stations (USGS all)

Increases in hydrologic monitoring continues in support of Kissimmee River Restoration efforts. Additional monitoring concentrates 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. Site selection for additional sites has not been finalized and it is likely that several units may be diverted to cover unanticipated needs in other ares. Ten of the units were temporarily installed in Boney Marsh to support a coordinated effort to quantify overland flow resistance through marsh vegetation in FY88-89 and were removed early in FY89-90.

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 FY88-89. This system is still working and allows near realtime data acquisition at this key station.

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

A small amount of backlog processing for shallow groundwater wells was completed in FY88-89.

C. Hydrologic Data Collection and Support for Water Conservation Areas

This task 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:

1.	Flow		32 stations (USGS 8)
2.	Surface water		
	a. Recorders		48 stations (USGS 8)
	b. Manual		25 stations
3.	Gates and pump rpm		68 stations
4.	Rainfall		21 stations
5.	Evaporation		4 stations
6.	Weather Station	Recording	2 stations
7.	Wells	Recording	16 stations
8.	Water Quality	Recording	1 station (telemetry)

The scope of this task 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. A contract has been entered with Hydrologic Associates U.S.A. Inc. for these interior gauges. Two installations were installed near L-28 for the Miccosukee Tribe during FY88-89.

There are 34 structures for which legal requirements as well as hydrologic and water quality requirements exist for detailed hydrologic data. Electronic recorders for S-9 and S-190 were installed in FY89-90 to replace the existing recorders.

There is a moderate amount of backlog associated with inflow stations.

D. Hydrologic Data Collection and Support for Taylor Creek/Nubbin Slough

This task 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:

1.	Flow		4 stations (USGS 3)
2.	Surface water	Recorders	20 stations (USGS 3)
3.	Velocity		27 stations
4.	Gates		2 stations
5.	Rainfall		13 stations(NOAA 1, FFS 1)
6.	Wells		
	a. Recording		6 stations
	b. Manual		7 stations (USGS 7)
7.	Water Quality	Recording	1 station
8.	Evaporation		1 station

A substantial increase in scope was realized for this area in FY88-89 to support water quality monitoring of the dairies. Instrumentation for this task was completed in FY88-89.

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 since FY87-88.

E. Hydrologic Data Collection and Support for Lower Kissimmee Valley

This task 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:

1.	Flow		7 stations (USGS 1)
2.	Surface water	Recorders	28 stations (USGS 2)
3.	Velocity	Recorders	21 stations
4.	Gates and pump rpm		12 stations (5 manual)
5.	Rainfall		15 stations
6.	Evaporation		1 station
7.	Weather Station	Recording	1 station
8.	Wells		
	a. Recording		1 station
	b. Manual		10 stations (USGS 10)
9.	Water Quality	Recording	4 stations

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

Manual well stations by the USGS are biannual 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.

F. Hydrologic Data Collection and Support for Lake Okeechobee

This task 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:

1.	Flow		17 stations (USGS 4)
2.	Surface water		
	a. Recorders		31 stations (USGS 9)
	b. Manual		2 stations
3.	Gates and pump rpm		16 stations
4.	Rainfall		36 stations
5.	Evaporation		2 stations
6.	Weather Station	Recording	3 stations
7.	Water Quality	Recording	2 stations
8.	Well		1 station

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. Replacement electronic recorders for existing recorders are to be installed at S-4 and S-235. S-127 and S-129 will be done in September 1990. S-133 and S-236 are slated for FY90-91.

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 in this area was completed in FY88-89.

G. Hydrologic Data Collection and Support for Everglades National Park

This task 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:

1.	Flow		4 stations (USGS 4)
2.	Surface water		
	a. Recorders		26 stations (USGS 13, ENP 9)
	b. Manual		6 stations
3.	Rainfall		24 stations (NOAA 5,USGS 1, PARK 8)
4.	Wells	Recording	9 stations (USGS 5)
5.	Water Quality		
	a. Manual GW		4 sites (USGS)
	b. Manual SW		1 site (USGS)

The scope of hydrologic monitoring will remain constant in this area during FY89-90, except for replacement of a recorder at S-197 with electronic recorders, which depends on the C-111 Plan implementation. Operations and Maintenance Department 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 data base 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.

H. Hydrologic Data Collection and Support for Calooshatchee River Basin

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

Current instrumentation consists of:

1.	Flow		4 stations (USGS 3)
2.	Surface water		
	a. Recorders		29 stations (USGS 16)
	b. Manual		1 station
3.	Gates		5 stations
4.	Rainfall	Recording	31 stations (FFS 5, NOAA 4)
5.	Evaporation		1 station
6.	Wells		
	a. Recording		35 stations (USGS all)
	b. Manual		128 stations (USGS all)
7.	Water Quality		
	a. USGS SW		2 sites (USGS)
	b. USGS GW		11 sites (USGS)

The magnitude of the effort by Data Management increased substantially in FY88-89 due to instrumentation requirements in Six-Mile Slough, Gator Slough and Corkscrew Wildlife Preserve. Seven recorder installations were installed in Six-Mile Slough, six recorder installations in Corkscrew Marsh, and five in Gator Slough during FY88-89. This instrumentation is primarily for environmental efforts and regional citrus agriculture runoff studies. Surface and groundwater information is handled by the USGS with cooperative funding between the USGS, SFWMD, and the Corps of Engineers. There were two new electronic installations at Culvert 5 and Nicodemus Slough for FY89-90.

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 task 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.

J. Hydrologic Data Collection and Support for Lake Worth

This task 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:

1.	Flow		13 stations(USGS 4)
2.	Surface water	Recorders	47 stations(USGS 22)
3.	Gates and pump rpm		20 stations (7 manual)
4.	Rainfall		38 stations (NOAA 6)
5.	Evaporation		2 stations
6.	Wells		
	a. Recording		45 stations (USGS 45)
	b. Manual		25 stations (all USGS)
7.	Water Quality	Recording	2 stations (telemetry)
	a. Surface		19 sites (USGS)
	b. Wells		60 sites (USGS)

The scope of this task is expected to remain relatively constant. Efforts in connection with POET are quite extensive and the work is done in this geographic area. The new G-57 (Pompano) structure originally slated for telemetry control was instrumented.

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 are collected through our telemetry system in cooperation with Operations and Maintenance 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.

I. Hydrologic Data Collection and Support forIndian Prairie/Harney Pond/Lake Istokpoga

This task 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:

1.	Flow	13 stations (USGS 5)
2.	Surface water	
	a. Recorders	20 stations (USGS 8)
	b. Manual	1 station (USGS 1)
3.	Gates	9 stations
4.	Rainfall	17 stations (NOAA 4, FFS 3)
5.	Wells	
	a. Recording	4 stations (USGS 2)
	b. Manual	41 stations (USGS 4)

The magnitude of the effort by Data Management increased during FY88-89 due to new monitoring of dairies in the Arbuckle Creek area. Three complex installations were completed in FY88-89 for this purpose, and three more were completed in FY89-90. Replacement recorders were installed at S-71, S-72 and S-84 in FY89-90.

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 task is primarily the base network established to document hydrologic status of the Floridian Aquifer.

There is a substantial amount of additional stage, well, flow, and ground water quality 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 noncontributory 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 FY88-89. The remainder will be completed in FY88-89 or FY90-91 depending on work-force availability.

K. Hydrologic Data Collection and Support for Fisheating Creek

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

Current instrumentation consists of:

1.	Rainfall	5 stations (FFS 1)
2.	Wells	
	a. Recording	1 station (USGS 1)
	b. Manual	6 stations (USGS 6)

The scope of this task 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 FY89-90.

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 task. We contribute funding on a cost-share basis to 5 of the biannual well readings on Floridian water levels.

No backlog exists in this area.

L. Hydrologic Data Collection and Support for Upper Chain of Lakes

This task 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:

1.	Flow	17 stations (USGS 6)
2.	Surface water	
	a. Recorders	34 stations (USGS 13)
	b. Manual	2 stations (USGS 2)
3.	Gates	9 stations
4.	Rainfall	49 stations (NOAA 8, ORNG 2)
5.	Evaporation	2 stations (NOAA 1)
6.	Wells	
	a. Recording	20 stations (USGS 7)
	b. Manual	45 stations (USGS 45)

The scope of this task 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.

Operations and Maintenance 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 Floridian Aquifer.

There are 10 structures in this area for which there is a legal as well as hydrologic reason for maintaining detailed records. One new recorder is to be installed during FY89-90 in Lake Kissimmee.

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 noncontributory network.

There is a substantial amount of backlog associated with District structures in this area.

M. Hydrologic Data Collection and Support for Big Cypress Basin

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

Current instrumentation consists of:

1.	Flow		3 stations (USGS 2)
2.	Surface water	Recorders	40 stations (USGS 4)
3.	Rainfall		27 stations(FFS 4) (NOAA 4)
4.	Wells		
	a. Recording		32 stations (USGS32)
	b. Manual		99 stations (USGS all)
5.	Water Quality	Manual	81 well sites (USGS all)

USGS monitoring cost (approximately $6,000) is included in the GENERAL NETWORK account.

The magnitude of the effort by Data Management has been less than during FY87-88. 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 has been 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 at 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 FY89-90. These have been received and slated for installation later in FY89-90. It is likely that these funds will be transferred to Division 704 to allow more efficient purchase agreements. 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 task 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.

O. Hydrologic Data Collection and Support for Indian River

This task 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 task works within St. Lucie County, and the areas associated with the St. Lucie Estuary and Indian River Lagoon.

Current instrumentation consists of:

1.	Flow	5 stations (USGS 1)
2.	Surface water	
	a. Recorders	13 stations (USGS 1)
	b. Manual	6 stations
3.	Gates	6 stations
4.	Rainfall	24 stations (FFS 2, NOAA 2)
5.	Evaporation	5 stations
6.	Wells	
	a. Recording	6 stations (USGS 4)
	b. Manual	36 stations (USGS 36)
7.	Water Quality	1 station

The scope of this task 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 are semiannual 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 tasks and auxiliary gauges has not been processed and is tentatively scheduled for FY90-91. Two new installations were completed for the Dupuis Reserve.

N. Hydrologic Data Collection and Support for Biscayne Bay/Lower East Coast

This task 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:

1.	Flow	38 stations (USGS 2)
2.	Surface water	
	a. Recorders	63 stations (USGS 15)
	b. Manual	23 stations
3.	Gates and pump rpm	48 stations
4.	Rainfall	16 stations (NOAA 5)
5.	Evaporation	2 stations (NOAA 1)
6.	Wells	
	a. Recording	71 stations (USGS 69)
	b. Manual	6 stations (USGS 6)
7.	Water Quality	
	a. Recording	13 stations (telemetry)
	b. Manual SW	4 sites (USGS all)
	c. Manual GW	12 sites (USGS all)

The scope of this task 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 Operations and Maintenance Department. Backup at these critical control structures is through existing graphic recorders which are not normally processed. A new electronic recorder is to be installed at G-93 (Coral Gables)in September 1990, and electronic recorders have replaced existing recorders at S-20, S-165, and S-179.

There is a substantial amount of backlog associated with District structures in the South Dade coastal area.

P. **Hydrologic Data Collection and Support for Everglades Agricultural Area**

This task 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:

1.	Flow	4 stations
2.	Surface water	16 stations(USGS 7)
3.	Gates	6 stations
4.	Rainfall	5 stations (NOAA 2)
5.	Evaporation	1 station

Substantial increases in scope are envisioned for this area in FY89-90 due to implementation of the Holey Land restoration task. Four recorders are budgeted for the Holey Land Area. Current scope seems unnaturally small due to the inclusion of structures at the north end in the Lake Okeechobee Area (SL55) and the structures at the south end in the Conservation Area (SL25)

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

4. TASK 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.

FY89-90:

A. Backlog and Current Data Processing - Completed 770 station years in FY87-88 and 436 by May 1989, when our overfill positions were lost and the Night Shift was decommissioned. Backlog processing has almost completely stopped; processing is performed on an ad hoc basis in response to data requests. Current data processing is proceeding at a rate of 120 station-years per month.

B. Recorder Installation - New instrumentation at 26 sites in FY89-90, primarily for dairy monitoring in the areas of Kissimmee River and Taylor Creek/Nubbin Slough, and in the areas of Arbuckle Creak and the Big Cypress Basin.

C. Network Reduction - 50 recorders eliminated; 25 stations relegated to backup status.

6. PRODUCTS:

FY90-91:

Products provided by this project will include:

A. GENERAL:

1. All data available on data base system within three weeks of collection.

2. Telemetry data processed within one week and data from other Data Management recorders within three weeks from collection; USGS data processed within two months from collection.
3. Monthly data collection trips.
4. Recorders installed and running.
5. Legal documentation of the operation of District structures.

B. SPECIFIC:

1. Backlog - Backlog processing has practically stopped. Approximately 80% of the backlog still remains.
2. Recorder Installation - 220 sensors at 36 sites during FY89-90, replacing many of the multigated structures which presently have graphic recorders, with new electronic recorders.

INSTRUMENT EVALUATION

• District Contact: Jack Hardee

1. OBJECTIVE: The objectives of this project are to evaluate applicability of new instrumentation and sensors to District specific needs and environment, and to evaluate the marketplace for acceptable vendors to identify potential sources for instrumentation.

2. DISTRICT NEED AND USE: This project is needed to improve the efficiency and accuracy of hydrologic data collection and processing.

3. SCOPE: This project 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. Operations Electronics Division, as well as DRE's Water Quality and Environmental Science Divisions, are both consulted and advised as to appropriate instrumentation. Frequent contacts are made with the USGS and NOAA for the purpose of data sharing and non-duplication of efforts. 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. Research literature for developments in state-of-the-art instrumentation, particularly electronic sensors. Attend conferences which showcase new developments in instrumentation. Make contacts with promising vendors and gather information. Bring in vendors for demonstrations on a continuing basis to better evaluate their equipment. Conduct monthly meetings between project manager and Division Director to review progress and coordinate special tasks. Issue quarterly reports outlining the project's progress.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr:

      1. Order weather sensors (RFB).
      2. Install sonic sensors at select sites.
      3. Conduct market survey or RFI to give all potential vendors the opportunity to make their products and services known and to allow the division to issue bid requests in the second quarter for equipment which is best suited to its goals.
      4. Progress report to division director.

   B. 2nd Qtr:

      1. Issue RFB's in response to surveys and RFI.
      2. Install weather sensors for evaluation.
      3. Evaluate sonic sensor data.
      4. Progress report to division director.

C. 3rd Qtr:

1. Evaluate results of weather sensor tests.
2. Purchase sensors.
3. Progress report to division director.

This is an iterative process.

5. PROGRESS TO DATE:

FY89-90:

A. After laboratory and local condition testing, Campbell Scientific's instrumentation is being field tested at a limited number of sites (mainly weather stations) throughout the District.

B. Lundahl's sonic stage sensors, using Polaroid's distance ranging technology, have been tested and found to be superior to the pressure sensors method now being used.

C. Contact has been established with the USGS Hydrologic Instrumentation Facility (HIF) in Bay St. Louis, Miss. In a joint effort to achieve standardization and eliminate the duplication of efforts, they are now supplying the District with their instrumentation evaluation results.

D. In an attempt to lower overall costs, we have identified the required characteristics for a basic datalogger for our less complex sites, and will be forwarding this information to manufacturers and prospective vendors.

E. Based on data gathered from NOAA and our own market survey, several weather sensors have been chosen for evaluation in FY90-91.

6. PRODUCTS:

FY90-91:

A. Accurate data at least possible cost.

B. Functional basic data recorder.

C. Up-to-date knowledge of electronic sensor marketplace.

STREAM GAUGING

- **District Contact: Jack Hardee**

CONTRACT REFERENCE: USGS EAA Continuous Flow Data From Ultrasonic Velocity Meters

1. OBJECTIVE: The objectives of this project are to develop and/or keep current flow profiles and rating curves at structures and select sites throughout the District, and to provide data essential to water supply, flood control and legal issues.

2. DISTRICT NEED AND USE: Legal mandates require that 15 percent of the water in the Istokpoga area go to the Indians. Regular flow measurements are necessary in this sensitive area to assure compliance. In an effort to be proactive regarding future SWIM commitments, measurements are needed at S57, S58, S62, S63A, S60, S61 and S59 weir (downstream). A substantial effort will be required to quantify the effects of the Kissimmee Restoration. There are presently a large number of new and recently modified structures and systems of canals which have never had measurements (e.g., Lake Marion, G136, Nicodemus Slough, ...). It is vital that we do flow measurements subsequent to all significant storms for liability reasons, as well as profile refinement. It is essential for Operations to be aware of how much water is actually moving during times of drought. Steam gauging measurements are necessary as the only source of volume verification. These measurements are necessary input for discharge equations and modeling programs. High discharge rates, structure and canal maintenance, and time--all contribute to changes in flow profiles. In order to validate our modeling assumptions, periodic flow measurements must be made.

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:

   A: Routine Measurements

   B: Special Measurements for Other Projects

   C: Rate District Structures

   D: Storm Event Monitoring

   E: Flow Measurements to Data Base

4. SCHEDULE:

   FY90-91: Hydrologic instrumentation specialists will make two to ten measurements per week. All flow meters will be put on a recalibration (re-rating) schedule. An attempt will be made to model our standard operating procedures (equipment and methodology) after the USGS.

5. PROGRESS TO DATE:

This is a continuing project with an updated scope and schedule. During the first half of this fiscal year, stream gauging crews have been active in: North New River Canal, Indian Prairie (with USGS), Hillsboro Canal, Temporary Operating Permit (TOP), L8 and S352. The major thrust of our third and fourth quarter stream gauging efforts has been directed at both the EAA (with USGS) and structures bordering Lake Okeechobee. As part of our QA/QC program, two Price meters have been recalibrated at the R.P.I. test facilities in Troy, NY.

6. PRODUCTS

FY90-91:

A. Decision making information for Operations

B. Information regarding liability

C. Input for discharge equations

D. Input for modeling programs

E. Structure ratings

HYDROGEOLOGIC DATA BASE SYSTEM DEVELOPMENT

• District Contact: Barbara Dickey

1. OBJECTIVE: The objectives of this project are to: a) develop a data base system for the processing, storage and retrieval of hydrogeologic data and models to support District and Division ground water management goals, and b) to provide computer programming and computer system administration to the Division staff to support modeling activities.

2. DISTRICT NEED AND USE: The information derived from Divisional ground water flow models, data sets and data processors needs to be available for use by District personnel in order to facilitate management of the resource. The hydrogeologic data base generated under this project will be used by the Research/Evaluation, Planning and Regulation Departments. The regional cumulative impact models will be modified with user friendly software developed under this project to facilitate their application into the permit process.

3. SCOPE: This project will be conducted solely by the Hydrogeology Division. During the next fiscal year, emphasis will be placed on: 1) conversion of the data bases to a mini-computer system platform, 2) storage of data using ORACLE to interface with a GIS, 3) development of user friendly software to facilitate the use of regional models for permitting applications, and 4) support for divisional model generation. External funding is not applicable.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Development and completion of ORACLE data tables needed for the ground water models. Provide support to GWZOOM contract execution.

   B. 2nd Qtr: Development of user friendly software, for pre and post processing, needed to interface between ORACLE and hydrogeologic models.

   C. 3rd Qtr: Provide training for the operation of regional models within GWZOOM to Research/Evaluation, Planning, and Regulation Department.

   D. 4th Qtr: Ongoing maintenance and support of data base system.

5. PROGRESS TO DATE:

   FY89-90:

   A. 1st Qtr. Installation of new ground water workstation. On-line operational mode will includes: set up of system administration files, user accounts and application software. Initial development of user-friendly permitting software for Division models has begun.

   B. 2nd Qtr: Spreadsheet format development for the incorporation of model data files from Palm Beach and Lee County has been completed. Conversion of GWMANMOD from Cyber to the ground water workstation is on hold, pending acquisition of the SCA statistical software for the workstation.

C. 3rd Qtr: System has been developed for downloading information from the Mineral Logging System to a media for archiving. Software packages are currently being evaluated for storage, retrieval and presentation of this geophysical data.

6. PRODUCTS:

FY90-91:

A. 1st Qtr:

1. Conversion of data bases to a mini-computer platform.
2. Development of ORACLE data tables.
3. Completing the developed ORACLE data tables.
4. Provide support to GWZOOM contract execution.

B 2nd Qtr:

Development of user-friendly interfaces between GWZOOM and ORACLE data bases.

C. 3rd Qtr:

Provide support for training and operation of the regional models of GWZOOM to Research/Evaluation, Planning and Regulation Department.

D. 4th Qtr:

Continued support for updating, ongoing development, and monitoring the data base system.

H. Artificial Intelligence Application (AI) to Hydrogeologic Information Systems (HIS): Explore the use of a GIS, which will include hydrogeologic data for ground water resource assessment and wellfield protection applications. Develop AI applications for the Broward County HIS to evaluate land use impacts on ground water resources.

I. Ground Water Recharge Classification: Develop criteria for identifying and classifying ground water recharge areas and apply these criteria to generate maps of recharge areas throughout the District.

J. Ground Water Monitor Network Optimization: Criteria will be established and the existing monitor network evaluated in order to yield an optimized multi-objective regional ground water monitor network for Broward County.

K. Osceola Ground Water Reconnaissance: Results from the Osceola drilling program (FY 90) will be incorporated with existing data and the final report will be prepared. The task is not funded this year.

L. Dade County Geochemistry of the Floridan: Examine water resource potential of FAS in Dade County.

M. Aquifer Storage and Recovery: Examine the geochemical interaction of surface water in a brackish water aquifer with respect to potable supplies.

4. SCHEDULE:

A. FY90-91: Completion dates shown represent when a provisional draft will be furnished to District staff. Publication of final reports shall be subject to the USGS technical review process.

1. 2nd Qtr: Salt Water Intrusion Monitoring in Broward County. Assessment of Ground Water Resources, Southern Broward County.

2. 4th Qtr: Simulation of Surface Water/Ground Water Interaction;Okeechobee County Ground Water Reconnaissance Study; Osceola County Ground Water Reconnaissance Study

B. FY 91-92:

1. 2nd Qtr: Ground Water Recharge Classification

2. 3rd Qtr: Water Resources Investigation, Okeechobee County

3. 4th Qtr: Water Resources Investigation, Orlando Metropolitan Area; Ground Water Monitor Network Optimization

5. Other: Ongoing: AI Application to Hydrogeologic Information System (HIS); Regional Aquifer System Analysis.

5. PROGRESS TO DATE:

A. FY89-90: Projects completed to date: Low Velocity Flow Meter Evaluation, ASR Cape Coral, Lake Worth Drainage District Assessment, and Potentiometric Maps (FY 89-90 data). Provisional drafts will be submitted to District by the 2nd quarter FY 90-91.

1. Potentiometric Maps: New monitor wells constructed and surveyed; wet season and dry season measurements made; maps prepared and under review.

USGS COOPERATIVE STUDIES COORDINATION

- **District Contact: Wm. Scott Burns**

CONTRACT REFERENCE: New Contract: SFWMD/U.S. Geological Survey Water Resource Cooperative Program

1. OBJECTIVE: The objective of this project is to provide funding, manpower, services and management oversight to complete all USGS-SFWMD cooperative projects which involve ground water investigations. This project will monitor the ongoing performance of the USGS and will assure that the District is fully informed on the progress and results of all ensuing studies.

2. DISTRICT NEED AND 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 enjoyed a mutually beneficial program of cooperative studies for over 35 years.

3. SCOPE: This project will involve coordination of all technical aspects of current USGS-SFWMD cooperative ground water projects through periodic reviews, meetings, correspondence, and other contacts with the USGS. All ground water and surface water data collection projects are coordinated through Robb Startzman, Director, Data Management Division. All ground water applied research projects and contract administration are coordinated through Scott Burns, Director, Hydrogeology Division. Funding for this project is shared with the USGS and other local governments. The District funds approximately 35% of the total project cost. The cooperative studies for FY 90-91 include:

   A. Surface and Ground Water Monitoring: Stage, flow, and ground water level data recorded District-wide.

   B. Potentiometric Maps, Palm Beach, Martin, St. Lucie Counties: Generate ground water level contour maps for the wet and dry season in the Upper EAst Coast Area (UECPA) counties.

   C. Salt Water Intrusion modeling in Broward County: The location, nature, and movement of the salt water front will be more fully evaluated through the development of a calibrated transport model.

   D. Assessment of Ground Water Resources, Southern Broward County: Development of a 3-dimensional ground water flow model (MODFLOW) for southern Broward County.

   E. Simulation of Surface Water/ Ground Water Interaction: A computer model that will relate the dynamic components of surface water hydrology with those for ground water shall be developed.

   F. Water Resources Investigation, Okeechobee County: Evaluation of the ground water resources of Okeechobee County. SFWMD will provide drilling and aquifer testing services associated with this study.

   G. Water Resources Investigation, Orlando Metropolitan Area: The purpose is to update the 1963 water resource study in the Orlando Metropolitan area; exploring water quality changes and establishing a monitor network. In addition, future problem areas will be identified.

2. Salt Water Intrusion Model: Field drilling and data collection complete. Two-dimensional transport model assembled and calibrated. Begin design of 3-dimensional transport model.
3. Assessment of Ground Water Resources, Southern Broward County: Land use/water use data, and surface and ground water hydraulic data collected and formatted into the model. Preliminary model calibration complete.
4. Surface Water/Ground Water Interaction: Flow data collected and conceptual model developed and documented.
5. Water Resource Investigation, Okeechobee County: Existing data reviewed, new test sites identified and drilling began (two sites of six completed).
6. Water Resources Investigation, Orlando: Existing data compiled; model development underway.
7. GIS Development: Data input and screening complete. GIS used for Broward County 3-D flow model data set development. Also, GIS application incorporating particle tracking and network-design were evaluated and documented.
8. Ground Water Recharge Classification: Criteria generated and documented for defining recharge areas.
9. Lake Worth Drainage District Study: Evaluation of recharge functions and operation completed. First draft of report completed.
10. DCP Telemetry Data Collection System: Surface and ground water sites identified and equipped with data systems.
11. North Kissimmee River Basin, Surface Water Investigations: Project canceled and funds redirected.

6. PRODUCTS:

FY90-91: Products include:

1. Technical reports summarizing the results of the ground water studies.
2. Raw data which is transmitted electronically each month to the SFWMD hydrologic data base.
3. Maps, charts or other interpretation of raw data submitted on a periodic basis.

WELL DRILLING, GEOPHYSICS, HYDROGEOLOGIC FIELD SUPPORT

• District Contact: Martin Braun

1. OBJECTIVE: The objectives of this project are summarized as follows:

   A. Provide well drilling, geophysical logging, aquifer testing, and other field support services to the Hydrogeology Division as well as to other District Divisions.

   B. Provide contract administration and technical support to other Divisions including special contract drilling projects.

2. DISTRICT NEED AND USE: This project provides ground water data for use in resource evaluations which ultimately support management decisions regarding the reasonable and beneficial use of ground water throughout the District.

3. SCOPE: This project is designed to support the Hydrogeology Division's major ground water assessment studies. Well drilling rigs, geophysical logging units, hydrogeologic analysis systems, and other related testing equipment are operated, calibrated and maintained by division field/technical and well drilling personnel. Administrative and technical support of contracts, for drilling and testing services, is provided by the project manager.

4. SCHEDULE: During FY90-91, the following major tasks are scheduled:

   FY90-91:

   A. 1st Qtr: Continue Okeechobee County drilling; begin Floridan (UEC) drilling and pump tests.

   B. 2nd Qtr: Complete Okeechobee County drilling; complete Osceola County drilling; and begin Osceola County pump tests and complete Okeechobee County pump tests.

   C. 3rd Qtr: Begin Glades/Highlands County drilling; complete UEC Floridan drilling and pump tests; complete Osceola County pump tests.

   D. 4th Qtr: Begin Lee County drilling and pump tests; complete Glades/Highland pump tests.

5. PROGRESS TO DATE: Multi-year studies are simultaneously supported by this project. A summary of FY 89/90 products include:

   FY89-90:

   A. 1st Qtr. Drill ten wells, perform two APT's (St. Lucie County); continue monthly water level monitoring - 120 wells ; execute deep well drilling contract; drill 15 wells in Broward, continue specialty drilling contract.

   B. 2nd Qtr: Drill 20 wells in Broward; complete specialty drilling contract; drill 42 VISA wells in Broward, Dade, Martin, and Orange Counties; continue monthly water level monitoring, 120 wells ; start water quality sampling, 30 wells .

   C. 3rd Qtr: Drill three wells (Floridan Aquifer) Okeechobee County; complete water quality sampling, 90 wells ; start deep well

drilling project; continue monthly water level monitoring; develop Osceola and ASR contracts.

D. 4th Qtr: Perform five APT's, Broward County; complete deep well drilling contract, execute Osceola County drilling contract; execute ASR drilling contract; drill three wells in Okeechobee County.

6. PRODUCTS: Products generated under this project include aquifer parameter information, water quality data, and lithologic and geophysical data. In addition, ground water monitor networks are established which provide insight into the long term trends (eg. water level, salinity, etc.) of the resource.

FY90-91:

A. 1st Qtr:

1. Drill ten monitor wells, perform five APT'S Okeechobee County.
2. Drill three monitor wells (Floridan Aquifer).
3. Continue monthly water level monitoring, 50 wells.

B. 2nd Qtr:

1. Drill five wells, perform five APT's, Osceola County.
2. Complete Osceola drilling contract.
3. Begin ASR drilling contract support.
4. Drill three wells (Floridan Aquifer).
5. Continue monthly water level runs (50 wells).
6. Perform five APT's, Okeechobee County.

C. 3rd Qtr:

1. Drill ten wells, Glades/Highlands County.
2. Perform two APT's, Osceola County.
3. Complete three APT's, St. Lucie Floridan.
4. Drill ten monitor wells, VISA Network.

D. 4th Qtr:

1. Drill ten wells, perform 4 APT's, Highland/Glades County.
2. Drill five wells, perform one APT, Lee County.
3. Drill five wells, VISA Network.
4. Continue ASR contract support.

*Other Division/Department support: On an as needed basis when manpower and equipment are available.

GROUND WATER MONITORING NETWORK

• District Contact: Wm. Scott Burns

1. OBJECTIVE: The objective of this project is to develop and implement methodologies to evaluate existing ground water usage, and to forecast future ground water withdrawals based on meteorologic, water use, and ground water level trends.

2. DISTRICT NEED AND USE: One of the District's goals during drought conditions is to determine whether estimated present and anticipated available water supply within any source class will be sufficient to meet anticipated demands (SFWMD Rules; Chapter 40E-21). The methodologies to meet this goal for ground water will be developed under this project.

3. SCOPE: This is an ongoing project which is being solely developed in the Hydrogeology Division. It consists of three elements:

   A. Development of statistical forecast models for employing ground water time series data.

   B. Development of a link between statistical models and a water use data base in order to allow a manager to identify specific users contributing to or impacted by water shortage.

   C. Incorporation of county-wide numerical ground water flow models with statistical models in order to facilitate the evaluation of water restriction options.

   These three elements will be developed on a county-by-county basis for all coastal counties. External funding is not applicable.

4. SCHEDULE: This is the second year of a five year project. Each coastal county will be completed on approximately a yearly schedule.

   A. FY90-91:

      1. 2nd Qtr:

      Rainfall, ground water level, temperature, and water use data sets compiled for Martin, St. Lucie, Palm Beach, Broward, and Lee Counties.

      2. 4th Qtr:

         a. Statistical model for coastal counties (excluding Dade) compiled.

         b. Rainfall, ground water level, temperature, and water use data sets for Dade County complete.

         c. Graphic software/database link complete for Collier County.

         d. Collier County statistical model documentation complete (Technical Publication).

   B. FY 91-92:

      1. 2nd Qtr:

         a. Coastal statistical models calibrated and draft documentation complete. Conduct review meeting regarding draft documentation.

b. Dade County drought model complete.

5. PROGRESS TO DATE: The methodology to be used is derived from the GWMANMOD pilot study completed in FY 88-89.

FY89-90:

A. 1st and 2nd Qtr:

1. Collier County drought model (GWMANMOD) applied during 1990 drought.

2. Documentation of Collier model delayed due to redirection of staff during the drought, rescheduled for FY 90-91.

B. 4th Qtr:

1. Conversion of CMANMOD from Cyber to workstation complete.

2. Ground water level data for coastal counties compiled and completed (except for Dade County).

6. PRODUCTS:

FY90-91:

4th Qtr:

A. Drought forecast model complete for Lee, Broward, Palm Beach, St. Lucie, and Martin Counties.

B. Collier County CMANMOD technical report completed.

AMBIENT GROUND WATER MONITORING NETWORK

• District Contact: Jeffry Herr

CONTRACT REFERENCE: Revenue Contract - DER

1. OBJECTIVE: The three basic goals of the project under the direction of the Florida Department of Environmental Regulation (DER) are as follows:

   A. To detect and predict changes in ground water quality resulting from the effects of various land use activities and potential sources of contamination.

   B. To establish the baseline water quality of the major aquifer systems in the State.

   C. To disseminate to local governments and the public, water quality data generated by the network.

2. DISTRICT NEED AND USE: The District needs to evaluate regional ground water quality as part of its mission. This will be accomplished through the continued evaluation, maintenance, and expansion of the State-wide Ground-Water Quality Monitoring Network throughout South Florida. This network was developed and funded by the DER for the purpose of identifying ambient water quality conditions and changes which occur within the major aquifer systems in South Florida. In continuing support to the DER, the District has collected/analyzed water quality samples and maintained a quality control reporting system over the past five years. Benefits of this program include the following:

   A. Data collected from this network benefits both the District and local governments in terms of monitoring the background quality of ground water throughout the region.

   B. Data collected from this network will be used to address the requirements of the WQAA with respect to resource goals of the State of Florida. Funding for this program is provided by DER.

   C. In the future, through this program, local governments may receive monetary and technical assistance from DER and the District to establish their own ground water quality monitoring program.

3. SCOPE: This project currently consists of water quality sampling, data analysis, and reporting/archiving elements, which are described in the annual revenue contract between the District and DER. This year there are four major categories of work which will be completed under the District contract with FDER. These may be summarized as follows:

   A. Seasonal Variability: This category consists of the acquisition of ground-water quality parameters on a monthly and quarterly basis, in order to ascertain temporal impacts.

B. VISA Sampling: This category pertains to the sampling of several specialized sites which are considered to be potentially impacted by specific land use types.

C. Network Expansion: This category provides refinement of the current network well density and the delineation of areas requiring expansion.

D. Network Maintenance: This category encompasses the repair and maintenance of existing wells throughout the network and includes the continuous updating of all associated project data bases.

Presently, the project administration, data analysis, and reporting responsibilities reside in the Hydrogeology Division. Data collection, QA/QC responsibilities and sample documentation/transmittal are assigned to the Water Quality Division. Coordination of sampling and workflow is the responsibility of the project manager.

During FY 1990/91, District staff will work with the DER to initiate the transfer of portions of the data collection responsibilities to the coastal counties. This will provide benefits to the county governments in developing a knowledge base regarding the quality and availability of local ground water resources. In addition, this will reduce the District's sampling load which can be translated to additional data collection opportunities in the interior counties. External funding for this project is provided by DER.

4. SCHEDULE:

FY90-91:

A. 1st Qtr:

1. Complete field sampling, analysis, and reporting as outlined in DER contract by December 31, 1990.

2. Complete negotiations and execute new contract with FDER for FY 1990-91.

B. 2nd Qtr:

1. Begin water quality sampling and well construction as designated by DER in a new contract.

2. Assist local governments in establishing their own monitoring program.

C. 3rd Qtr: Continue scheduled sampling runs.

D. 4th Qtr: Complete terms of FY 1990-91 contract with FDER.

5. PROGRESS TO DATE: To date, approximately 370 existing wells, located throughout the District, have been sampled on a yearly basis. Current efforts have been directed toward the sampling of selected wells throughout the network (approximately 77) on a monthly and quarterly basis. In addition, attempts have been made to expand the network in a variety of land use areas deemed susceptible to ground-water contamination. Exploratory data analysis of existing data is presently underway. The District and DER are currently working with various local governments (Dade, Broward, Palm Beach, Martin, St. Lucie, Collier, and Lee Counties) to initiate county participation in the sampling of network wells. In the past, this task was conducted by District staff.

6. PRODUCTS:

FY90-91:

A. 1st Qtr:

1. Invoice and final reports/data transmittals for the FY 1989-90 contract.

2. Submit data reports and invoice for first half of FY 1990-91 contract work.

B. 3rd Qtr: Complete contracts with coastal counties to finalize sampling transfer for FY 1991-92

C. 4th Qtr: Submit final invoice for FY 1990-91 contract.

AQUIFER STORAGE AND RECOVERY

• District Contact: Wm. Scott Burns

CONTRACT REFERENCE:

1. **24" ASR Test Production Well Construction Contract for the C-24 Project**
2. **Surface Facility Construction C-24 Pilot Project**
3. **Data collection, analysis, and modeling; USGS at C-24 and Taylor Creek**
4. **Local Cost-Share Agreement for Potable ASR Demonstration Project (East Coast)**
5. **Local Cost-Share Agreement for Potable ASR Demonstration Project (West Coast)**

1. OBJECTIVE: The objective of this project is to evaluate potential applications and initiate implementation of the Aquifer Storage and Recovery technology as a means of water supply augmentation and environmental enhancement.

2. DISTRICT NEED AND USE: The District needs to develop water supply alternatives to reduce the peaks and valleys associated with south Florida's seasonal hydrologic cycle. Above ground water storage basins have been utilized extensively despite drawbacks associated with cost and efficiency. Application of underground storage offers to affordably augment surface storage on a local scale.

3. SCOPE: Application of ASR using both untreated surface water and treated potable water will be examined under this project. The management of this project will reside in the Hydrogeology Division with technical assistance and project oversight being conducted by the Planning Department and the Construction Management Department.

   A. This project will be conducted to evaluate the impacts of under ground water storage on the quality of the recovered water (specifically nutrient uptake and total dissolved solids). The scope of this project will involve backfilling of the existing ASR test well in Okeechobee County and conducting a series of long term injection and recovery tests. The injection/recovery testing and modeling will be conducted by the U. S. Geological Survey.

   B. This project will be conducted to determine the feasibility and design for a regional water supply augmentation system using untreated surface water in the C-24 Basin. Construction of the ASR test well and the surface facilities will be completed during FY 1990/91 by private contractors. Permitting will be completed, and initiation of testing will also begin during FY 1990/91. Testing and reporting will be conducted by the U. S. Geological Survey. Final testing and the design of the full scale regional ASR system will be completed during FY 1991/92.

   C. This project is designed to initiate the implementation of the ASR technology in the public water supply arena in southeast Florida. This project will involve the selection of a cooperating water supply utility or authority and entering into a cost-sharing agreement for the construction of an ASR facility which stores excess treated drinking water generated during the wet season for recovery during the dry season. The District

will provide partial funding for the project and technical support and review throughout the implementation of the project. Engineering, permitting, construction and testing will be the principal responsibility of the cooperator. The estimated duration of the project will be two and one-half years.

D. This project has the same goals, scope, time lines, and funding needs as in item C except this project will be administered on the West Coast.

4. SCHEDULE:

FY90-91:

A. 1st Qtr:

1. Begin permit application process for the C-24 project.
2. Complete construction bid preparation for construction of the C-24 test well.
3. Complete preliminary design of C-24 surface facilities.
4. Develop selection criteria and initiate solicitation for the East and West Coast potable ASR demonstration projects.
5. Initiate testing at the Taylor Creek test well.

B. 2nd Qtr:

1. Complete final surface facility plans and construction bid.
2. Execute contract for well construction contract (C-24).
3. Begin construction of the pilot test well for the C-24 project.
4. Select cooperators for the potable supply projects, complete contracts and draft proposals for engineering services with cooperators.

C. 4th Qtr:

1. Complete testing of the Taylor Creek site.
2. Complete consutrction of the C-24 test site.
3. Initiate testing at the C-24 test site.
4. Provide technical support for permit acquisition and preparation of construction contracts with the potable supply cooperator.

5. PROGRESS TO DATE:

FY89-90:

A. 1st Qtr: Complete initial testing of the Taylor Creek site in Okeechobee.

B. 2nd Qtr: Presented Okeechobee ASR report to Governing Board.

C. 3rd Qtr:

1. Began test well drilling along C-24 Canal to identify a potential storage horizon.
2. Acquired permit extension for long term testing at the Taylor Creek site.

D. 4th Qtr: Developed conceptual plan for the C-24 project and made presentation to the Governing Board.

6. PRODUCTS:

FY90-91:

A. 2nd Qtr: Permits for construction and testing of the C-24 site. Execute agreements with local water supply authorities for the two potable water demonstration contracts.

B. 4th Qtr: Complete construction of the C-24 pilot well site.

AGRICULTURAL DEMAND MANAGEMENT

• District Contact: Vilma Horinkova

CONTRACT REFERENCES:

Irrigation Management Alternatives for Flatwoods Citrus
New: Impact of Mandatory Water Shortage Cutbacks on Yield of Tomatoes and Citrus grown with Micro-irrigation
New: Water Table Effects on Yield and Consumption Use of Flatwoods Citrus

1. OBJECTIVE: The objectives of this project task are:
   A. Provide reliable information on agricultural practices and water use that can be utilized to reduce agricultural water demand to the lowest practical level.
   B. Research of water conserving irrigation practices and technology.
   C. Promote conversion to irrigation techniques and management regimes (BMP's) which conserve water.
   D. Coordinate and communicate with the general agricultural community on field practices, research and technology.
2. DISTRICT NEED AND USE: This task contributes to the objectives of the Demand Management Program by promoting agricultural water conservation. The greatest use of Florida's fresh water resources is for the irrigation of agricultural crops. The conversion to irrigation systems or management practices which conserve water therefore has great potential to reduce total water demand.
3. SCOPE: This project task has two primary activities:
   A Review and communication of current agricultural irrigation research and technology and review and communication of agricultural water demands, and field practices.
   B. Focuses on the documentation of performance and promotion of water conserving irrigation technology, and cost effective water conserving practices. Also, this task involves a documentation of impacts resulting from reduction of agricultural water use by applying cutbacks in water usage and managing the depth of water table. It includes continuation of one contract and initiation of two new ones.
      1. The continued contract is Irrigation Management Alternatives for Flatwoods Citrus, a four year study with FY 1990-91 being the last year.
      2. The two new contracts are:
         a. Impacts of Mandatory Water Shortage Cutbacks on Yield of Tomatoes and Citrus Grown with Micro-irrigation;
         b. Water Table Effects on Yield and Consumptive Use of Flatwoods Citrus.

C. Continue to supply Technical Support to the Regulation Department and to the District Water Supply Planning Task Force and the Demand Management

4. SCHEDULE:

A. FY 90-91:

1. 1st Qtr:

a. Negotiate a contract with IFAS for investigating Impacts of Mandatory Water Shortage Cutbacks on Yield of Tomatoes and Citrus Grown with Micro-irrigation.

b. Negotiate a contract with IFAS on Water Table Effects on Yield and Consumptive Use of Flatwoods Citrus.

c. Continue to manage the contract on Irrigation Management Alternatives for Flatwoods Citrus.

d. Close out of Subsidence Study, which terminated in the fourth quarter of FY 1989-90.

e. Prepare an interim technical analysis of the Mobile Lab Project, for joint publication with IFAS staff

f. Prepare detailed outline of a DRE Technical Publication on Agricultural Water Demand and Irrigation BMP's.

2. 2nd Qtr:

a. Review progress report from contract on Mandatory Water Shortage Cutbacks on Tomatoes and Citrus.

b. Review progress report from contract on Water Table Effects on Flatwoods Citrus.

c. Develop FY 91-92 budget proposals for Agricultural Demand Management.

3. 3rd Qtr:

a. Review progress report from contract on Impacts of Mandatory Water Shortage Cutbacks on Tomatoes and Citrus.

b. Review progress report from contract on Water Table Effects on Flatwoods Citrus.

c. Review final report from contract on Irrigation Management Alternatives for Flatwoods Citrus summarizing data collected during the entire study.

4. 4th Qtr:

a. Submit draft of technical publication.

b. Review first annual report from contract on Impacts of Mandatory Water Shortage Cutbacks on Tomatoes and Citrus.

c. Review first annual report from contract on Water Table Effects on Flatwoods Citrus.

d. Draft Technical Publication

B. FY91-92:

Q1: Submit Technical Publication for Governing Board review.

5. PROGRESS TO DATE:

Demand Management contracts completed:

A. FY88-89:

Semi-closed Irrigation System Promotion: This contract dealt with the design and conversion of open ditch irrigation systems to semi-closed, which represented direct water savings.

B. FY89-90:

1. Subsidence Study - Everglades Agricultural Area: This study is documenting subsidence rate of organic soils in response to environmental changes in the EAA area. It focuses on best management practices to reduce subsidence. Additionally, it provides designs for water management improvements on selected farms. This project will terminate in September 1990.

2. Demonstration of Drip Irrigation System - This three-year study/demonstration evaluated the utilization of drip irrigation versus the conventional seepage system in production of tomatoes and sugarcane. From the results it seems that water conservation through using drip irrigation on tomatoes is economically feasible. The demonstration further showed, that cultivating sugarcane with drip irrigation in Florida sandy soils still leaves some significant, mainly economical, disadvantages unresolved.

3. Mobile Lab - The mobile irrigation lab, originally three year project and scheduled to terminate in the FY 1989-90 has been a very successful undertaking. It is continued in the FY 1990-91, however, it's managed out of the Office of Communication. This project provides evaluations of irrigation systems, focusing on advice for conserving irrigation water and suggesting improvements on irrigation efficiency and scheduling. Most of the evaluated sites are citrus groves, but also a few nurseries. An effort is being made to evaluate golf courses as well. This is done on a voluntary basis.

C. FY90-91:

Irrigation Management Alternatives for Flatwoods Citrus: This four year study focuses on various water management aspects of growing citrus on Flatwood soils: effect of water depletion level and fertilization regimes on tree growth and fruit yield under micro-irrigation. This contract is expected to close out in July 1991.

6. PRODUCTS:

FY90-91:

4th Qtr: Draft Tech Pub: Impacts of Mandatory Water Shortage Cutbacks on Tomatoes and Citrus.

SOR LAND USE PLANNING

• District Contact: Peter David

1. OBJECTIVE: The objectives of this project are to provide input, information and recommendations for managing, preserving, and restoring the natural resources on SOR lands.
2. DISTRICT NEED AND USE: This project is needed to support Save Our Rivers Division, Land Management Department.
3. SCOPE: Conduct environmental assessment, assist with completion of operational management plans, develop wetland and hydroperiod restoration plans and provide recommendations for management of SOR land acquisitions. Funding support for this project is available through SOR. Support from Water Resources Division and Operations and Maintenance Department are required for consultation purposes.
4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Coordinate installation of water control structures at Godochik II.

   B. 2nd Qtr: Initiate environmental assessment of Shingle Creek.

   C. 3rd Qtr: Complete first draft of Shingle Creek assessment.

   D. 4th Qtr: Complete final draft.
5. PROGRESS TO DATE:

   A. FY88-89:

      1. 1st Qtr: Completed Godochik I environmental assessment.
      2. 4th Qtr: Completed Godochik II assessment.

   B. FY89-90:

      1. 2nd Qtr: Initiated field work for McArthur assessment.
      2. 3rd Qtr: Completed scope of work for Godochik II interim restoration project.
      3. 4th Qtr: Completion of McArthur Environmental Assessment.
6. PRODUCTS: SOR planning documents as required by SOR Division.

   FY 90-91:

   1st Qtr: Environmental assessment of McArthur Property.

UPPER EAST COAST

LOXAHATCHEE ESTUARY ENVIRONMENTAL ASSESSMENT

• District Contact: Robert Chamberlain

1. OBJECTIVE: The objectives of this project are:
   A. To assess the environmental influence of various flow volumes.
   B. To provide insight (based on the above assessment) regarding the environmental impacts on the estuary caused by changing basin water management practices and increasing the flows to the Northwest Fork.
   C. To provide support (primarily conductivity and flow data), as necessary for the completion of the mathematical hydrodynamic/salinity model for the Northwest Fork.
2. DISTRICT NEED AND USE: Increasing the average base flows to the Northwest Fork, to protect and enhance its natural environmental qualities, has long been the primary objective of the Loxahatchee River Restoration effort. However, the impacts of increasing flows are unknown. The Loxahatchee River and Estuary are extremely valuable for their aesthetic and recreational values, as well as for the wildlife and urban development potential. The Loxahatchee River is one of the last natural riverine swamp systems in Florida which supports a diverse native population of freshwater flora, typified by the bald cypress. However, the environmental conditions necessary to support this system is changing to a more saline habitat. This change is the result of basin development that has reduced the inflows to the river, and salt water pushing farther up the river due to permanent opening and maintenance of Jupiter Inlet and related channels. As a result of this environmental threat, the District, along with other agencies and interested parties, took steps resulting in the designation of The Loxahatchee River as a National Wild and Scenic River, and development of a Loxahatchee River Management Plan to direct restoration which the District has been the principal leader. The goals of the District regarding the restoration effort has been to increase the duration and volume of freshwater flow to the Northwest Fork by restoring the functional role of the Loxahatchee Slough, and reduce the discharge to the Estuary through S-46. This project is needed to help assess the estuarine impacts caused by changes in basin water management practices to fulfill the District's river restoration goals. Project activities will directly support the Government Assistance Division in the Planning Department, which is responsible for the restoration project. Support for this task comes from District funds.
3. SCOPE: Routine (monthly) and some event sampling was conducted for two years in the Loxahatchee Estuary, which included water quality, zooplankton and ichthyoplankton, benthic invertebrate, and seagrass. The results from the analysis is scheduled to be reported in a District Technical Publication intended to provide information needed for the river restoration effort.
4. SCHEDULE:
   A. FY90-91:
      1. 1st Qtr:
         a. Complete initial data analysis.
         b. Begin literature review.

2. 2nd Qtr:
   a. Complete literature review.
   b. Complete final data analysis.
   c. Present seminar on status and findings of project.
3. 4th Qtr:
   a. Initiate review process.
   b. Possibly complete review process and begin final draft preparation.
   c. Interface with modelling effort by supplying conductivity data, flow information, and minor field support for additional information gathering.
   d. Assist in Technical Publication preparation.
   e. Complete first draft of technical publication.

B. FY 91-92:
   1. 2nd Qtr. Complete the environmental assessment technical publication for this project.
   2. 2nd Qtr and remainder of FY:

      Discuss results with District staff. Present results in District seminars, outside symposiums and professional journals.

5. PROGRESS TO DATE:

A. FY88-89:
   1. 1st Qtr: Additional sampling occurred to evaluate tropical storm event.
   2. 2nd Qtr: All sampling terminated.
   3. 3rd Qtr: Continued sample identification and data base loading.

B. FY89-90: Approximately one year delay in progress due to loss of staff and change in priorities (additional responsibilities) as a result of department reorganization.
   1. 1st Qtr: Began initial data analysis. Information support.
   2. 2nd Qtr: Same as 1st Qtr.
   3. 3rd Qtr: No progress due to other projects' requirements.
   4. 4th Qtr: Some analysis of data support.

6. PRODUCTS:

FY90-91:

4th Qtr: First draft of Technical Publication

Attachment A

MANAGEMENT OF REESE LANDS

• District Contact: Peter David

1. OBJECTIVE: The objectives of this project are to restore Reese property wetlands and provide additional flow for Loxahatchee River restoration.
2. DISTRICT NEED AND USE: This project is needed to support Land Management Department in Loxahatchee restoration efforts and provide technical assistance in related land management activities.
3. SCOPE: Provide environmental input and recommendations in coordinating with other District departments to accomplish restoration goals. Assist in negotiations with county planners regarding future recreational development of the property. Construction Management will be providing additional funding.
4. SCHEDULE:

   FY-90-91:

   A. 1st Qtr: Completion of topographic survey.

   B. 2nd Qtr: Maintain support function to Land Management.

   C. 4th Qtr: Maintain support function to Land Management.
5. PROGRESS TO DATE:

   FY89-90:

   1st Qtr: Reviewed project scope of work.
6. PRODUCTS:

   FY90-91:

   Topographic survey of property.

ESTUARINE STUDIES NE FLORIDA BAY

- **District Contact: Robert Chamberlain**

CONTRACT REFERENCE:

Tidal Salinity Monitoring of NE Florida Bay
Florida Bay/Barnes Sound Water Quality

1. OBJECTIVE: The objective of this project is to evaluate water management practices and their impacts on NE Florida Bay.

2. DISTRICT NEED AND USE: This project is needed to fulfill the recommendations for monitoring and assessment of water management practices on NE Florida Bay as identified in the Everglades Swim Plan. The District is responsible for implementation of these recommendations. The products from this project's contracts and studies will be used to improve water management in the region for the environmental benefit of NE Florida Bay.

3. SCOPE: The NE Florida Bay region alternately experiences large pulses of fresh water during the wet season and hyper-saline conditions during the dry season. Basic information concerning the base flow requirements and salinity gradients is lacking for this region. The contracts referenced above will be administered under this program to gather information concerning water quality, spatial distribution of important habitats and seasonal salinity gradients. Cooperative studies with other agencies such as ENP, DNR and NMFS will be explored and detailed scopes of work may be developed jointly with the ENP and NMFS (contingent on SWIM funding and approval). District staff may participate in the collection and analysis of data if time permits. The two contracts were developed in support of the SWIM Plan objective for the Everglades.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr through 4th: Coordinate deliverables for the two existing contracts.

   B. 3rd Qtr: Develop Scope of Work for the additional contract (Habitat Study) if SWIM funds are available.

5. PROGRESS TO DATE:

   FY89-90:

   1. Interagency and in-house coordination to address the SWIM Plan recommendations.
   2. Development of the scope of work for above referenced contracts.
   3. Execution of the these two contracts.

6. PRODUCTS:

   FY90-91: Contractor reports will constitute the products for this project which will be used as guidelines for improving water management practices.

ESTUARINE NUTRIENT IMPACTS

• District Contact: Robert Chamberlain

CONTRACT REFERENCE:

Estuarine Nutrient Impact Assessment Study Design
C-43 Nutrient and Toxin Loading Assessment

1. OBJECTIVE: The objectives of this project are:

   A. Develop a general study design as a first phase to assess the impacts of nutrients entering the St. Lucie Estuary. As a second phase, begin a multi-year field study or contractual service that implements the study design.

   B. Assist the Water Quality Division in the development and management of a multi-year contract to: ascertain nutrient loading to the freshwater portion of the Caloosahatchee River (C-43), identify pesticide and heavy metal problem areas, determine the contributing land uses, and develop management recommendations for the basin and sub-basins (including BMP's) to reduce the pollution of the river and estuary.

2. DISTRICT NEED AND USE: This project is needed to evaluate recommendations, including LOTAC's, to divert nutrient laden runoff toward downstream estuaries in order to improve the water quality of inland water bodies. Diversions of this nature could have significant impacts on the trophic status of local rivers and estuaries. In addition, coastal basin development throughout the District continues to add nutrients to estuaries without understanding the environmental impacts on estuarine water quality and biota. Current information does not adequately address the present health of District estuaries related to nutrients and the ability of any estuary to assimilated additional loading. This program additionally supports other SWIM activities for the Upper East Coast as required by the Planning Department.

3. SCOPE:

   A. The first phase includes a contract to be executed in FY90-91 and scheduled for completion in FY91-92, that will evaluate nutrient assessment methodologies currently used in estuaries nationally, determine the best suite of methods which meets the District's needs, and develop a study design and procedure to guide future District estuarine research. This contract is supported solely by District funds and contract management is the responsibility of Environmental Sciences staff. Application of this study design is desirable in the St. Lucie Estuary where a good historical data base of environmental information exists and on-going SWIM water quality monitoring efforts are attempting to evaluate nutrient related problems. Water Resources Division staff will be required to assist in reviews to provide insight into contract requirements and evaluations.

   B. Concurrently, a multi-year contract will be executed in FY90-91 by the Water Quality Division which will ascertain nutrient and toxin loading to C-43 and estuary as a first phase investigation and evaluation of LOTAC recommended diversion. Details of this task are described separately in

Attachment A. Follow-up application of the estuarine nutrient assessment study design in the Caloosahatchee Estuary is desirable. Support for this contract in FY 90-91 comes from District funds. SWIM funding also may be available during FY 90-91 and 91-92. The request to develop and manage this contract came from the Planning Department. Development and evaluation of the contract progress will continue to be a cooperative effort between DRE and Planning Department with contract management the responsibility of DRE. Obtaining future SWIM or District funding is the responsibility of the Planning Dept.

4. SCHEDULE:

A. FY90-91:

1. 1st Qtr:

a. Develop estuarine nutrient assessment design contract.

b. Assist in development of C-43 contract.

2. 2nd Qtr:

a. Execute estuarine nutrient assessment design contract.

b. Assist in the development and negotation of the C-43 contract.

3. 3rd Qtr:

a. Manage estuarine nutrient assessment design contract.

b. Assist in the execution of the C-43 contract.

c. Begin development of 2nd phase contract for nutrient assessment (2nd contract-implementation phase).

4. 4th Qtr:

a. Continue to manage and review deliverables of the nutrient assessment design contract.

b. Execute contract that implements study design for nutrient assessment application in the St. Lucie which will require additional contractual services (2nd phase contract).

c. Assist the C-43 contract by reviewing deliverables.

5. Other:

Provide technical support and information as needed to other divisions and agencies, including Charlotte Harbor and Indian River SWIM Programs. These projects will require cooperation with Planning Department.

B. FY91-92: Continue the same tasks described in 4th Qtr. FY90-91 for a time period yet to be determined.

5. PROGRESS TO DATE:

A. FY88-89:

1. 3rd Qtr: Recognized need for estuarine study design based on LOTAC recommendation and began project planning and development.

2. 4th Qtr: Began contract scope of work development and RFP process.

B. FY89-90:

1. 1st Qtr: Advertised estuarine study design RFP, began negotiations. Desired contractor provided a preliminary study design prior to execution of contract to insure proper approach.

2. 2nd Qtr: Submitted preliminary proposal to experts in the field for review and comments.

3. 3rd Qtr:

a. Received experts opinions. District committee and contractor reviewed comments.

b. Accepted Planning Department's request to develop and manage C-43 contract.

4. 4th Qtr: Advertised RFP for C-43 contract.

6. PRODUCTS FY90-91:

A. 2nd Qtr: Executed contract for nutrient study design development.

B. 2nd Qtr: Assist selection of contractor, negotation and execution of C-43 Basin contract.

C. 3rd Qtr: Review phase reports for C-43 Basin contract and nutrient assessment design contract.

D. 4th Qtr:

1. Execute 2nd phase contract that implements nutrient assessment study design.

2. Phase reports for C-43 Basin contract and nutrient assessment design contract.

Attachment A

C-43 NUTRIENT AND TOXIN LOADING ASSESSMENT

- **District Contact: Kim O'Dell**

CONTRACT REFERENCE: Caloosahatchee River Basin Assessment

1. OBJECTIVE: Manage a multi-year contract to:
   A. ascertain nutrient loading to the freshwater portion of the Caloosahatchee River (C-43);
   B. identify pesticide and heavy metal problem areas;
   C. determine the contributing land uses; and
   D. develop management recommendations for the basin and sub-basins (including BMP's) to reduce the pollution of the river and estuary.
2. DISTRICT NEED AND USE: This project is needed to evaluate recommendations, including LOTAC's, to divert nutrient laden runoff toward downstream estuaries in order to improve the water quality of inland water bodies. Diversions of this nature could have significant impacts on the trophic status of local rivers and estuaries. In addition, coastal basin development throughout the District continues to add nutrients to estuaries without understanding the environmental impacts on estuarine water quality and biota. Current information does not adequately address the present health of District estuaries related to nutrients and the ability of any estuary to assimilated additional loading. This program additionally supports other SWIM activities for the Lower West Coast as required by the Planning Department.
3. SCOPE: A multi-year contract will be executed in FY90-91 which will ascertain nutrient and toxin loading to C-43 and estuary as a first phase investigation and evaluation of LOTAC recommended diversion. Support for this contract in FY89-90 came from District funds. SWIM funding is anticipated during FY90-91 and FY91-92. The request to develop and manage this contract came from the Planning Department. Development and evaluation of the contract progress will continue to be a cooperative effort between DRE and Planning Department with contract management the responsibility of DRE. Obtaining future SWIM funding is the responsibility of the Planning Department.
4. SCHEDULE:
   A. FY90-91:
      1. 2nd Qtr: Execute and manage C-43 contract.
      2. 4th Qtr: Manage the C-43 contract.
   B. FY91-92: Continue the same tasks described in 4th Qtr, FY90-91 for a time period yet to be determined.

5. PROGRESS TO DATE:

A. FY88-89:

3rd Qtr: Accepted Planning Department's request to develop and manage C-43 contract.

B. FY89-90:

4th Qtr: Advertised RFP for C-43 contract.

6. PRODUCTS:

FY90-91:

A. 2nd Qtr: Phase report for C-43 basin contract.

B. 3rd Qtr: Phase report for C-43 basin contract.

C. 4th Qtr: Phase report for C-43 basin contract.

LOXAHATCHEE ESTUARY DYNAMICS

• District Contact: Todd Tisdale

1. OBJECTIVE: Develop and apply a hydrodynamic/salinity model to the Northwest Fork of the Loxahatchee River estuary that will be used for environmental assessment.

2. DISTRICT NEED AND USE: This project is needed to develop a Management Plan for the Loxahatchee estuary to minimize the effects of surface water discharges.

3. SCOPE: This project will develop and implement a hydrodynamics/salinity model for the Northwest Fork of the Loxahatchee River estuary. It will be used to finalize management plans for the Loxahatchee River basin and to provide computer modeling support for the Loxahatchee River Restoration project (0203). The Water Resources and Environmental Sciences divisions, DRE, are conducting this project. No external funding has been sought.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Calibrate and verify hydrodynamic component of model for Loxahatchee River estuary.

   B. 2nd Qtr:

      1. Calibrate and verify salinity component of model for the Loxahatchee River estuary.

      2. Complete first draft of model documentation.

   C. 4th Qtr: Complete technical publication and user's manual.

5. PROGRESS TO DATE:

   FY89-90: This is a continuing program.

   A. 1st Qtr. Assembled physical data of river system to be used by model.

   B. 2nd Qtr: Analyzed availability and quality of stage and discharge data to be used for calibration and verification of hydrodynamic component of model.

   C. 3rd Qtr: Analyzed availability and quality of stage and discharge data to be used for calibration and verification of hydrodynamic component of model.

   D. 4th Qtr: Acquired stage and discharge data.

6. PRODUCTS

   FY90-91:

   A. 1st Qtr: Calibrated hydrodynamics model

   B. 2nd Qtr: Calibrated salinity model

   C. 3rd Qtr: Calibrated salinity model

   D. 4th Qtr: Final report on model documentation.

ST. LUCIE ESTUARINE STUDIES

• District Contact: Robert Chamberlain

CONTRACT REFERENCE: Estuarine Collection Identification

1. OBJECTIVE: The objectives of this project are to:
   A. Complete identification, data management, and preliminary analysis of samples taken during April through July, 1990, as part of the final field test of the St. Lucie Management Plan (SLEMP).
   B. Evaluate the utility of pulse releases from Lake Okeechobee.
   C. Initiate and collect water quality samples in the St. Lucie Estuary in support of Indian River Lagoon (IRL) SWIM Plan.
2. DISTRICT NEED AND USE: Because of the District's mission to protect and enhance the water quality within its jurisdiction,this project is needed to:
   A. Test the theory of pulse releases as an environmentally sensitive option for regulating the lake level. This effort will help determine new lake and structure operation criteria which is currently being evaluated by Water Resources Division (DRE) and the Planning Department.
   B. Field test and modify/improve the criteria for SLEMP implementation. SLEMP was designed to protect and enhance estuarine productivity. The success of the plan depends on cooperation by the Corp of Engineers, as well as several DRE divisions (Water Resources, Data Management) and departments within the District (Planning Department, Operations and Maintenance Department).
   C. Support of IRL SWIM Plan in cooperation with SFWMD and FDNR. This work was originally managed through a contract, but reduced SWIM funding requires the work now be conducted in-house.
3. SCOPE: The original research completed under this project provided an environmental assessment of the St. Lucie Estuary and addressed the estuarine impacts of regulatory releases from Lake Okeechobee. Based on this work:
   A. Pulse releases from Lake Okeechobee were proposed as an environmentally sensitive method to regulate water level in the lake by avoiding large discharges lasting for extended periods. Pulse releases were employed during the 1987 and 1988, winter-spring season, when regulatory releases were required to lower lake levels. Intense field sampling of estuarine biota and water quality was conducted during this time. As an outgrowth of the pulse release study, the St. Lucie Estary Management Plan (SLEMP) was developed as a three year program to address environmental problems associated with reduced runoff to the estuary during the spring. SLEMP provides a water management strategy to increase estuarine productivity during this critical time period by augmenting inflow to the estuary when substantial rainfall occurs, but salinity remains too high. Two years of background data have been completed. A third and final field effort was completed without SLEMP flow augmentation during April-July, 1990, in order to compare and determine actual benefits. The above referenced contract will continue to be managed by this project which provides identification of organisms

collected during sampling. In FY 1990-91, this project is responsible for data management, preliminary analysis, and assisting the Planning Department in the report (technical publication) write-up for both pulse releases and SLEMP. This is a SWIM related project that depends on District funds.

B. A water quality monitoring program was developed for the Indian River Lagoon including the St. Lucie Estuary. The Indian River Lagoon is a priority water body under the State's SWIM program. In cooperation with the SJWMD, FDNR, Brevard County and Volusa County, the Planning Department administered a contract for the collection and analysis of water quality samples. Due to a reduction in SWIM funds, the bi-weekly water collection formerly conducted under contract is being done in-house. Sampling design will be completed prior to 1st Qtr. FY90-91 when sampling will begin. The resulting data will be given to SJWMD for analysis and inclusion into the SWIM program. The project will also provide information to the NMFS, under contract to the District to determine the relation between turbidity standards and photosynthetic active radiation. Although this is a SWIM related project, financial support is the responsibility of the District. This project depends on the continuing cooperation established with the above agencies and the Water Quality Division, Chemistry Laboratory Division, and the Planning Department.

4. SCHEDULE:

A. FY90-91:

1. 1st Qtr:

   a. Manage contract providing identifications.

   b. Manage/store SLEMP/pulse data and begin preliminary evaluations.

   c. Initiate IRL/St. Lucie Estuary SWIM water quality collection and data management effort.

2. 2nd Qtr:

   a. Complete the sample identifications.

   b. Continue to manage/store SLEMP pulse data and carry out evaluations above while interfacing with Planning Department staff responsible for write-up.

   c. Continue water quality collection efforts.

3. 3rd Qtr:

   a. Continue 2.b. above as needed by Planning staff.

   b. Continue water quality collection efforts.

4. 4th Qtr:

   a. Assist Planning staff as needed for technical publication preparation on SLEMP/pulse releases.

   b. Continue water quality monitoring and evaluate the need to continue.

5. Other:

   a. Provide information support effort to develop a study design for assessing trophic impacts of nutrients in estuaries, using the St. Lucie Estuary as a test case.

   b. Technical support, as needed, for Lake Okeechobee regulation decisions and St. Lucie River basin management.

B. FY91-92:

1. If determined as necessary, continue water quality sampling efforts in St. Lucie for SWIM support.

2. If not finished during last FY, then complete obligations to assist Planning Department staff in SLEMP technical publication write-up according to Planning Department schedule.

5. PROGRESS TO DATE:

A. FY88-89:

1. 1st Qtr: Completed identifications from April-July, 1988 sampling.

2. 2nd Qtr: Continued data management/storage and began preliminary data analysis.

3. 3rd Qtr: Continued preliminary data analysis as time permitted.

4. Other: Department reorganization delayed this project because it was unclear who and what department would be responsible for it's management.

B. FY89-90:

1. 1st Qtr. No work done because uncertain of project future after reorganization.

2. 2nd Qtr: Determined project manager and cooperative method for the departments to proceed with project. DRE accepted Planning Department request to conduct field work for final SLEMP field test. Sampling preparation and study design was completed to perform work.

3. 3rd Qtr:

   a. Field sampling for SLEMP conducted. Samples submitted for identification under contract #708. Data management/storage begun.

   b. Received Planning Department request to assume responsibility for the Indian River Lagoon SWIM water quality sampling.

4. 4th Qtr:

   a. Completed field sampling. Continued sample identification and data management/storage.

b. Developed study design for Indian River Lagoon sampling and completed field preparation for start-up during 1st. Qtr. FY90-91.

6. PRODUCTS:

FY90-91:

The results and evaluation of SLEMP sampling will be reported in a technical publication produced by the Planning Department staff. The water chemistry and hydrologic information collected during the SWIM sampling in the Indian River Lagoon/St. Lucie Estuary will be compiled for District files and possibly used in follow-up work associated with the Estuarine Nutrient Impact Assessment Study Design.

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

• District Contact: Don G. J. Padgett

1. OBJECTIVE: The objectives of this project are as follows:

   A. Perform a hydrogeologic assessment of the Surficial Aquifer System in St. Lucie County,

   B. Develop a three-dimensional ground water flow model of that system, which will be capable of producing the effects of current uses and predicting future water uses in order to efficiently manage the water resources of the county.

   C. Document the ground water resources of St. Lucie County and the manner in which the model was developed in a technical publication.

2. DISTRICT NEED AND USE: The District needs to develop a three-dimensional ground-water flow model in St. Lucie County in order to determine long-term ground water availability and to regulate development of the resources. The model will be used to perform cumulative water use impact assessments for water use permitting and the production of water use management plans.

3. SCOPE: This project will be conducted solely by the Hydrogeology Division and will proceed in two phases which include: 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, evaluation of selected water use information, 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. Final reports documenting the flow model and presenting the results of the hydrogeologic reconnaissance will be the ultimate products of this project. External funding is not applicable.

4. SCHEDULE:

   A: FY90-91:

   1. 1st Qtr: Transient calibration of three-dimensional model.
   2. 2nd Qtr: Prepare first draft of reconnaissance study/model development technical publication.
   3. 3rd Qtr: Revise/edit draft report

B. FY91-92:

2nd Qtr: Complete technical publication of the St. Lucie ground water reconnaissance and model development study.

5. PROGRESS TO DATE:

A. FY88-89:

1. 1st Qtr: Defined model boundaries. Inventoried existing data. Began selection of drilling sites.
2. 2nd Qtr: Developed APT sites 1 and 2 and five monitor well sites.
3. 3rd Qtr: Performed APT 1 and 2; developed five monitor wells and final APT site.
4. 4th Qtr: Performed APT 4; developed five monitor well sites.

B. FY89-90:

1. 1st Qtr: Completed remaining APT's and analyzed test results. Completed specialty drilling and subsequent data interpretation at 6 sites. Reanalyzed consultant and USGS APT data.
2. 2nd Qtr: Completed definition of regional hydrogeology. Completed model discretization. Compiled hydrologic and land use data. Digitized water use facility locations. Generated recharge model data sets.
3. 3rd Qtr: Plotted monthly water level data. Assembled model, set model basic, well, recharge, ET, general head river packages.
4. 4th Qtr: Calibrate model to steady state conditions.

6. PRODUCTS

A. FY90-91:

1st Qtr: Working three-dimensional ground water flow model of St. Lucie County. Multi-zone water level monitoring network.

B. FY91-92

2nd Qtr: Technical publication of the St. Lucie ground water reconnaissance and model development study.

OSCEOLA GROUND WATER RECONNAISSANCE STUDY

• District Contact: David Butler

CONTRACT REFERENCE: Specialized drilling services will be contracted out to aid in data collection

1. OBJECTIVE: The objective of this project is to conduct a ground water reconnaissance study of Osceola County in order to identify the occurrence and characteristics of the ground water resources within the county. This study will provide information to be applied in a future water supply modeling project, which will begin in FY 91.

2. DISTRICT NEED AND USE:

   A. The District was mandated by the legislature to assess the availability of ground water in Osceola County as part of the Brevard/Osceola inter-District transfer project. This study, in combination with the future generation of a county-wide model, will serve to meet this request.

   B. The information generated from this project will be useful for the District's regulatory and planning functions as prescribed in the Water Use Management and Planning Initiative.

3. SCOPE: This project is being completed jointly with the USGS. The District, through a private contractor, will construct wells at seven test sites in the county Well construction at the eighth test site will be completed by District staff. Eight aquifer performance tests (APT's) are proposed. Each APT site will consist of a minimum of one test well, one deep monitoring well, and one shallow monitoring well. District staff will provide the USGS with the data from the test program. The USGS will combine the data with other hydrogeologic and land use information and produce a final report.

   The responsibilities of the Hydrogeology Division in this project include the following:

   A. Provide technical expertise to the USGS in the analysis and evaluation of the ground water resources of Osceola County;

   B. Administer all subcontracts and oversee the construction of the test and monitoring wells;

   C. Describe the lithology of the new wells;

   D. Conduct aquifer performance tests and analyze the results;

   E. Review and comment on the final and draft reports; and

   F. Initiate a ground water level monitoring program which will be conducted by the USGS.

4. SCHEDULE:

   A. FY90-91:

      1. 1st Qtr:

         a. Complete drilling and specific capacity tests for one APT site;

         b. Geophysically log the pilot hole at the APT site; and

c. Describe cuttings from pilot hole.

2. 2nd Qtr:

a. Complete drilling and specific capacity tests at one APT site;

b. Geophysically log the pilot hole at the APT site; and

c. Describe cuttings from pilot hole.

3. 3rd Qtr:

a. Complete drilling and specific capacity tests at two more APT sites;

b: Geophysically log the pilot holes at the APT sites;

c. Describe cuttings from pilot holes;

d. Conduct two APT's and analyze the results; and

e. Begin geophysical logging of existing Floridan wells in Osceola County.

4. 4th Qtr:

a. Complete drilling and specific capacity tests at two more APT sites;

b: Geophysically log the pilot holes at the APT sites;

c. Describe cuttings from pilot holes;

d. Conduct two APT's and analyze the results; and

e. Continue geophysical logging of existing Floridan wells in Osceola County.

B. FY91-92:

1. 1st Qtr:

a. Complete drilling and specific capacity tests at two more APT sites;

b: Geophysically log the pilot holes at the APT sites;

c. Describe cuttings from pilot holes;

d. Conduct two APT's and analyze the results; and

e. Continue geophysical logging of existing Floridan wells in Osceola County; and

f. Begin a water level monitoring program.

2. 2nd Qtr:

a. Complete any remaining drilling activities;

b. Complete geophysical logging program;

c. Complete remaining APT's and analyze results;

d. Prepare draft data reports for delivery to USGS staff; and

e. Continue water level monitoring program.

5. PROGRESS TO DATE: Test drilling in Osceola County began in February 1988. However, due to an injunction placed on field work by the City of St. Cloud, the test drilling was terminated. Prior to the injunction, well construction at the C-31 test site was almost completed. In addition, most of the work at the Holopaw site has been completed. However, the production well at the Holopaw site needs to be installed.

   In anticipation of the lifting of the injunction, staff has coordinated with the USGS to identify seven (7) new test sites. During the 1989-90 fiscal year, staff has either completed or initiated the following:

   A. Completed an RFB and selected a contractor for drilling services:

   B. Commenced a review of the hydrogeologic literature for Osceola County;

   C. Coordinated with the USGS to achieve proposed drill sites in Osceola County; and

   D. Applied to St. Johns River Water Management District for Water Use Permits for two proposed drill sites.

6. PRODUCTS:

   FY90-91:

   A. 1st Qtr: Water Use Permits from St. Johns River Water Management District.

   D. 4th Qtr: Summary of lithologic geophysical and hydraulic data from six test sites.

   FY91-92:

   A. 3rd Qtr: Draft data reports.

   B. 4th Qtr: Final report (USGS)

MARTIN COUNTY SURFICIAL AQUIFER SYSTEM THREE-DIMENSIONAL FLOW MODEL

• District Contact: Karin M. Adams

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 District needs the assessment and three-dimensional ground water flow model for the following reasons:

   A. Evaluate the condition of the ground water resources in Martin County, in order to determine long-term availability of the resources, and thereby regulate development of the resources,

   B. Perform cumulative water use impact assessments for water use permitting, and

   C. Provide support to the District's water supply planning activities in the determination of impacts from future water demands.

3. SCOPE: This project is being conducted solely by the Hydrogeology Division and will entail the completion of the following items:

   A. Gather data on existing ground water use.

   B. Describe cuttings from new wells drilled for the USGS water level network in order to determine hydrogeologic setting.

   C. Administer Wellfield vs. Wetland contract and incorporate information into data sets for the North Martin County Wetland Impact Model.

   D. Update data from existing two-dimensional flow model (Martin County Water Resource Assessment, 1987).

   E. Re-evaluate aquifer test data from various sources (private, USGS, SFWMD).

   F. Run three Aquifer Performance Tests. Wells constructed by SFWMD.

   G. Discretize hydrogeologic system data into model layers.

   H. Calibrate and validate regional model.

   I. Create model for No. Martin County area in conjunction with "wellfields vs. wetlands" study.

   J. Prepare technical report documenting results of study.

   No external funding is planned for this project.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Complete calibration and sensitivity analysis of regional model. Coordination/review workshop scheduled.

   B. 2nd Qtr: Complete first draft of report.

   C. 3rd Qtr: Complete figures for report, send for outside review, and complete final draft.

   D. 4th Qtr: Draft review of report. (Final scheduled for 91-92 Q1).

5. PROGRESS TO DATE:

A. FY88-89:

1. 1st Qtr: Completed literature review; water use permit review.
2. 2nd Qtr: Reviewed water level network; aquifer performance test reports.
3. 3rd Qtr: Completed cuttings descriptions; lithologic discretization.
4. 4th Qtr: Commence with APT site selection; computer processing program documentation; drill three APT sites; complete three-step drawdown tests; complete one constant-rate test; describe cuttings; complete irrigation spreadsheet.

B. FY89-90:

1. 1st Qtr: North Martin County Model: Model data sets generated and model assembled. Regional model: complete two constant rate tests; analyze results; complete general permit spreadsheet; begin canal research.
2. 2nd Qtr: North Martin County model calibration complete. Regional model: complete coring at two sites; complete public water supply spreadsheet; complete canal research; obtain data on rainfall, soils, land use.
3. 3rd Qtr: North Martin County Model: first draft of report prepared. Regional model: complete domestic self supply spreadsheet; agricultural pumpage research; complete horizontal and vertical model discretization; block centered flow package.
4. 4th Qtr: Complete all model input packages; begin running and calibrating model.

6. PRODUCTS:

FY90-91:

1st Qtr: Complete three-dimensional ground water flow model and documentation.

2nd Qtr: Provide internal draft of the technical publication summarizing model results.

4th Qtr: Draft Technical publication

UPPER EAST COAST FLORIDAN AQUIFER RESOURCE ASSESSMENT

• District Contact: John Lukasiewicz

1. OBJECTIVE: The objective of this project is to develop a three-dimensional ground water flow model for the Floridan aquifer incorporating Martin, St. Lucie, and eastern Okeechobee Counties.

2. DISTRICT NEED AND USE: The District needs a three-dimensional ground water flow model to evaluate the condition of water resources in the Floridan Aquifer System in the Upper East Coast, and to determine long-term availability of the resources in order 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. In particular, this model will be used to evaluate the prohibition or use of pumps on Floridan wells, in Martin and St. Lucie Counties, in more detail than can be done with the existing two-dimensional model.

3. SCOPE: This project is being conducted solely by the Hydrogeology Division and will entail the completion of the following items:

   A. Review all geophysical and geologic logs of Floridan wells in the three county area.

   B. Update data from the existing two-dimensional flow model (SFWMD Publication entitled "Permittable water use estimates of the Floridan Aquifer System in the Upper East Coast Planning Area, 1988").

   C. Gather all pertinent water use data from the permit files, digitize that data for direct use in the Floridan Aquifer and St. Lucie County Surficial Aquifer models.

   D. Expand the existing monitor well network to provide the needed definition and proper resolution of the potentiometric surface (Floridan Aquifer System) for model calibration.

   E. Design and supervise the construction of two Floridan deep wells in St. Lucie County. Both a private drilling firm and the District drilling crew will be employed for the construction of multi-zone aquifer test wells. Evaluate the data from the aquifer performance tests and incorporate this information in the development of the three dimensional model.

   F. Discretize the Upper Floridan Aquifer System using results obtained in items A and D listed above.

   F. Assemble and calibrate the model.

   G. Prepare a draft technical publication documenting the model as well as summarizing the results of study.

4. SCHEDULE:

   FY90-91:

   1. 1st Qtr: Complete compilation of public water supply and agricultural pumpage reports for Indian River and St. Lucie Counties. Develop wells package based on pumpage reports and the Questionnaire responses. Complete construction of monitor

wells to be used in aquifer performance test number 2; conduct aquifer performance test number 2.

2. 2nd Qtr: Incorporate data from APT #2 into block centered flow package, complete model calibration.

3. 3rd Qtr: Complete model validation and sensitivity analysis. Begin draft report.

4. 4th Qtr: Continue documenting the model as well as summarizing the results of study for technical publication. Conduct review meeting regarding draft publication.

5. PROGRESS TO DATE:

A. FY88-89:

1. 1st Qtr: Literature reviewed. Located all available geophysical data; compiled spreadsheet.

2. 2nd Qtr: Analyzed and compiled structural data from all existing electric logs and lithologic descriptions.

3. 3rd Qtr: Created structure contour maps from data generated in second quarter. Began vertical discretization of model. Completed horizontal model discretization.

4. 4th Qtr: Designed and implemented water level network for UEC area. Engaged survey crew and well abandonment crew in collecting data for wells on network. Contracted for deep well drilling services in St. Lucie County.

5. Other:

a. Completed preliminary vertical discretization of model.

b. Completed preliminary Basic Package for model.

B. FY89-90:

1. 1st Qtr: Ran initial predevelopment steady-state model, compiled agricultural water use spreadsheet, plotted permitted well locations on quads.

2. 2nd Qtr: Completed Floridan Aquifer agricultural water use spreadsheet for four-county study area. This data base includes St. Lucie County Surficial Aquifer data and digitized well locations for all permitted wells.

3. 3rd Qtr: Compiled agricultural pumpage reports for use in Wells Package. Processed water use spreadsheets for use in Wells Package. Completed and mailed 400 agricultural water use questionnaires. Started constructing first of two wells needed for APT 1.

4. 4th Qtr: Completing construction and testing of the contracted deep wells in St. Lucie County.

5. Other: Assist staff in developing three-dimensional ground water flow model packages.

6. PRODUCTS

FY90-91:

A. 1st Qtr: Complete white paper report on results of the agricultural water use practices in the UEC Floridan Aquifer.

B. 3rd Qtr: Calibrated model complete for use by Planning Department.

C. 4th Qtr: Draft report for review.

KISSIMMEE BASIN

ENVIRONMENTAL STUDIES OF THE KISSIMMEE RIVER

• District Contact: Louis A. Toth

CONTRACT REFERENCE: Kissimmee River Macroinvertebrate Identification

1. OBJECTIVE: The objective of this project is to conduct comprehensive studies of the ecological structure and functioning of the Kissimmee River ecosystem.

2. DISTRICT NEED AND USE: This project is needed to:

   A. Provide technical/scientific support for acquisition of required permits.

   B. Monitor restoration efforts.

   C. Improve understanding of the ecology of aquatic resources of South Florida landscape.

   Project provides direct support to Planning Department and Construction Management as required to meet permit criteria for restoration plan.

3. SCOPE: This project will coordinate with the restoration efforts of the Kissimmee River Restoration Division (Planning Department). The scope of this project will be dependent partly upon the District's role as local sponsor of a proposed federal/state cost sharing restoration project. The District's responsibilities will be specified in the Local Cooperative Agreement (LCA). The scope of the District's environmental monitoring studies also may be determined by anticipated cooperative efforts by other federal and/or state agencies, particularly the Florida Game and Freshwater Fish Commission. A Memorandum of Agreement (MOA) similar to that executed for The Kissimmee River Demonstration Project monitoring may be possible.

   Because of these factors, the scope of the District's environmental studies on the Kissimmee River cannot be defined precisely at present. However, to avoid delays in implementing restoration efforts and/or risk having inadequate information to evaluate these efforts, there is a high priority need to begin collecting baseline data in the section of river and floodplain that will be affected by Part 1 of the adopted Level II Backfilling Plan. This area will include most of Pools A, B and C. Two to three years of pre-construction studies, followed by limited monitoring during construction, and three years of post-construction studies are needed The projected date for initiation of construction is estimated to be the beginning of FY 92-93.

   Restoration monitoring, like the restoration approach, must have an ecosystem perspective. The significance and value of Kissimmee River restoration will be determined largely by the quality and rigor of the ecological studies and monitoring program that are conducted in association with the restoration project. The following elements are essential monitoring components of a comprehensive Kissimmee River restoration program:

   A. Wading Bird and Waterfowl Monitoring: Wading bird and waterfowl monitoring efforts should provide distribution data reflecting spatial and temporal patterns of usage of different floodplain habitats. Census data needs to be collected and evaluated in context of wading bird and waterfowl population dynamics in the south/central Florida landscape (Kissimmee-Okeechobee-Everglades system). Census information should

be related to monitoring of wading bird and waterfowl food production in the range of floodplain habitats (i.e., the floodplain mosaic).

B. Fisheries Monitoring: The scope of this monitoring effort should include long-term studies of population dynamics, recruitment, and habitat utilization (including floodplain) of primary game fish species. Recommended features include radiotelemetry analyses to monitor game fish distributions and habitat utilization, and periodic creel surveys to assess resource exploitation and user (fisherman) perceptions of restoration benefits.

C. Fish Community Analysis: In addition to monitoring of game fish populations, comprehensive surveys of fish community structure, dynamics and habitat utilization also are required. Application of the recently developed "Index of Biological Integrity" would provide a quantitative measure of the success of restoration efforts.

D. Habitat Monitoring: The following data are needed to complement biological studies: (1) mapping of vegetation community composition of the floodplain, littoral and submergent zones of river channels, including remote sensing applications; (2) floodplain hydrologic monitoring using an extensive network of stage recorders to precisely define floodplain inundation characteristics; (3) measurements of river channel habitat parameters, including depth, flow and substrate characteristics.

E. Water Quality Monitoring: The scope of water quality studies should include routine nutrient monitoring, analysis of effects of the project on river channel dissolved oxygen regimes, a detailed river/floodplain oxygen budget study, and extensive suspended solids and turbidity monitoring.

F. Ecosystem Function Studies: To thoroughly evaluate the success of an "ecosystem" restoration program, detailed investigations of system productivity, ecological processes, and energy flow are required. Productivity should be monitored to evaluate functional values of different river and floodplain habitats, including evaluations of seed production (e.g., for waterfowl), invertebrate and small fish production, associated floodplain vegetation communities, and invertebrate production in littoral and submerged river vegetation. Energy flow studies should include investigations of energy (e.g., fish food organisms) transfer from the floodplain to river channel, and vice versa, importance of riparian and floodplain litter inputs to the river food web, and evaluations of the role of invertebrate drift (downstream flow of invertebrates in a flowing channel). Expanded ecosystem monitoring may be incorporated as the program develops.

In addition to these studies there is an anticipated need for a synthesis of environmental data and information in support of required state and federal permits.

At present, there are no external sources of funding for this project.

4. SCHEDULE: The following schedule is contingent upon execution of an LCA with the Corps by the end of 1990, acquisition of required permits for implementation of the proposed Part 1 project, and initiation of this first phase of construction by the end of 1992. Any significant deviation from this schedule will require revision of the monitoring schedule.

A. FY90-91:

1. 1st Qtr:

   a. Refine scope of District's environmental monitoring and ecological studies program.

   b. Develop sampling methodology, sample site selection and QA plans.

   c. Peer review of program objectives and design.

2. 2nd Qtr:

   a. Technical support for permit applications.

   b. Initiate pre-construction monitoring and ecological studies.

   c. Preparation of RFP for invertebrate identification contract.

3. 3rd Qtr:

   a. Pre-construction monitoring and ecological studies.

   b. Evaluate RFPs and select contractor.

4. 4th Qtr:

   a. Pre-construction monitoring and ecological studies.

   b. Develop sampling methodology, sample site selection and QA plans for new (expanded) studies.

B. FY91-92:

Pre-construction monitoring and ecological studies.

C. FY92-93:

1. Construction monitoring.

2. Data analysis and report preparation

D. FY93-94/FY94-95/FY95-96:

Post-construction monitoring and ecological studies.

5. PROGRESS TO DATE: This is a continuation and expansion of monitoring activities that were initiated under the Kissimmee Demonstration Project.

6. PRODUCTS:

FY90-91:

A. 1st Qtr: Detailed plans of District's environmental monitoring and ecological studies program including QA.

B. 2nd Qtr: RFP for invertebrate identification contract.

C. 3rd Qtr: Invertebrate identification contract.

D. 4th Qtr: Detailed plans for expanded ecological studies (if any) including QA.

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

- **District Contact: Kim O'Dell**

CONTRACT REFERENCE: New - Duckweed Demo. Contract

1. OBJECTIVE: To provide research and demonstration support to identify BMPs which can limit the load of nutrients (phosphorus) reaching Lake Okeechobee.

2. DISTRICT NEED AND USE: Reductions in nutrient loads to Lake Okeechobee are required by the 1987 SWIM act. In addition, nutrient loads to the ENP also may need to be reduced in order to ensure the integrity of the native flora and fauna. The District has provided research and demonstration support to identify BMPs that can limit nutrient loading to sensitive waters. BMPs are being, or have been, implemented on dairy farms in areas tributary to Lake Okeechobee under cooperative or regulatory projects. 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, specifically the use of duckweed, is a viable method of further reducing nutrient loadings.

3. SCOPE: This task will be conducted by contractual agreement. Projects conducted by the SFWMD indicated that certain macrophytes, or combinations of macrophytes, were efficient in reducing nutrient concentrations in combined dairy waste and stormwater runoff. This demonstration seeks to monitor and evaluate in a full-scale operational mode, the nutrient uptake capabilities of a mono- or poly-culture duckweed based system on a functional dairy in the Lake Okeechobee Basin.

4. SCHEDULE:

   A. FY90-91:

      1. 1st Qtr:

         a. Governing Board Approval of Contract and Contractor selection.

         b. Secure dairy and begin construction of demonstration project.

      2. 2nd Qtr: Begin 15-month monitoring period of demonstration, upon FDER approval of QA/QC Plan.

   B. FY91-92: 3rd Qtr: Complete demonstration and provide results in a comprehensive Final Report.

5. PROGRESS TO DATE: RFP has been completed and under review within PROCAD and Legal Departments. Contractor selection committee is being formed to review the proposals and secure a contractor.

6. PRODUCTS:

   FY90-91:

   A. 1st Qtr: Preliminary engineering report on the system design

B. 2nd Qtr:

1. Monthly data summaries and nutrient budgets for the duckweed demonstration project will be provided.
2. FDER approved QA/QC plan.

C. 3rd Qtr: Monthly data summaries and nutrient budgets for the duckweed demonstration project.

D. 4th Qtr: Monthly data summaries and nutrient budgets for the duckweed demonstration project.

BONEY MARSH MANAGEMENT TECHNIQUE EVALUATION

- **District Contact: Nancy Urban**

CONTRACT REFERENCE: Soil and Plant Laboratory Analysis

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: This project is needed to:
   A. Plan projects involving wetland management for water quality improvement.
   B. Develop criteria for management of protected wetlands.
   C. Support Everglades SWIM planning objectives and other long term planning needs in the Kissimmee River Basin as required by the Planning Department.
3. SCOPE: The Boney Marsh is a 100 acre diked marsh area on the Kissimmee River floodplain in which water level and flow can be experimentally manipulated. It provides an opportunity to evaluate wetland nutrient uptake and management techniques. A decade of previous research in the Boney Marsh indicated that nutrient supply from inflowing river water resulted in a progressive vegetation change and loss in nutrient uptake efficiency. A sequence of three management techniques were tested over a three year period: (a) spring drawdown with gradual reflooding and delayed outflow, (b) drawdown with rapid reflooding and outflow, and (c) drawdown with marsh burning. Field work was completed in FY 88-89. Data analysis and preparation of a Technical Publication are scheduled. Due to other demands within the Division, manpower allocated to this project will remain at a very low level effort. Costs for this project are funded by the District and no additional resources outside the Division are required.
4. SCHEDULE:

   FY90-91: 3rd Qtr:

   1. Complete data analysis.
   2. Present seminar on major findings prior to production of 1st draft.

   FY91-92: 2nd Qtr: Complete technical publication on marsh nutrient uptake.
5. PROGRESS TO DATE:

   A. FY88-89:

   1. 2nd Qtr: Field work completed.
   2. Other: Ongoing chemical analyses of soil and plant samples by Flowers Chemical Laboratories.

   FY89-90: Other: Ongoing chemical analyses of soil and plant samples by Flowers Chemical Laboratories.
6. PRODUCTS:

   FY91-92: 2nd Qtr: Draft Technical Publication on marsh nutrient uptake.

TAYLOR CREEK NUBBIN SLOUGH BMP MONITORING

• District Contact: Greg Sawka

CONTRACT REFERENCE: ARS/SFWMD Coop Agreement

1. OBJECTIVE: To determine the effectiveness of the FDER mandated BMPs in reducing the phosphorus concentrations at the dairies and phosphorus loads entering Lake Okeechobee from major tributaries in the Taylor Creek/Nubbin Slough Basin.

2. DISTRICT NEED AND USE: This information will be used to evaluate the operation and maintenance of the Florida Department of Environmental Regulation's (DER) Dairy Rule and other BMPs designed for the S-191 basin on a farm by farm basis. In support of the missions and goals of the Research and Evaluation Department, the results of this project will be used by the District's Water Quality Division, Planning and Regulation Departments and FDER to determine if additional practices will be needed to achieve further reductions in phosphorus loads to the lake at S-191. 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 projects.

3. SCOPE: Three levels of activity have been developed to support the missions and goals of the Research and Evaluation Department.

   A. Level I: Water quality assessment and inventory at each dairy and selected non-dairy land use activities to support information dissemination between the District's Planning and Regulation Departments and FDER.

   B. Level II: Phosphorus loading modeling, assessment and forecasting in support of the District's Planning Department.

   C. Level III: Evaluation of specific BMP components.

   This is a multi-year intensive monitoring project utilizing a combination of grab and automatic sampler monitoring stations located at the discharge points of individual dairy operations and tributary channels to Taylor Creek/Nubbin Slough. Flows from each site will be measured as estimated through modeling.

   Electronic data loggers will be used to facilitate data processing and control of water quality samplers.

   Hydrologic and meteorologic data are being collected and processed to support this project.

   The Data Management and Chemistry Lab Divisions will provide equipment maintenance and analytical chemistry support, respectively.

4. SCHEDULE:

FY90-91:

1st Qtr:

A. Data Analysis Report for Rural Clean Water Program

B. Monthly Governing Board updates to Water Conditions Report.

C. Monthly water quality reports to dairy farmers.

4th Qtr:

Submit QA Plan for DER approval

5. PROGRESS TO DATE: Weekly grab samples have been collected at 45 stations. This data has been used to evaluate dairy discharge phosphorus concentrations. Due to BMP construction, dairy discharge locations will be reevaluated at six farms that are near completion of their Dairy Rule Plan. Structure and tributary autosampler data will be used to evaluate basin and sub-basin changes in water quality.

6. PRODUCTS:

FY90-91:

A. QA/Data Analysis Protocol Report (pending DER approval)

B. Monthly Governing Board updates to Water Conditions Report.

C. Monthly water quality reports to dairy farmers.

D. Input to regulatory projects (monthly or as required)

E. 1st Qtr: Annual Rural Clean Water Project Report.

LOWER KISSIMMEE RIVER WATER QUALITY MONITORING

• District Contact: Boyd Gunsalus

1. OBJECTIVE: To determine the effectiveness of the Florida Department of REgulation (DER) mandated BMPs in reducing the phosphorus concentrations at the dairies and phosphorus loads entering Lake Okeechobee from major tributaries in the Lower Kissimmee Basin. The results will be used to determine if additional practices or regulatory enforcement will be needed to achieve desired phosphorus loads to the lake.

2. DISTRICT NEED AND USE: This information will be used to evaluate the operation and maintenance of the Department of Environmental Regulation's (DER) Dairy Rule and other BMPs designed for the Lower Kissimmee Basin on a farm by farm basis. In support of the missions and goals of the Research and Evaluation Department, the results of this project will be used by the District's Water Quality Division, Planning and Regulation Departments and FDER to determine if additional practices will be needed to achieve further reductions in phosphorus loads to the lake from the Lower Kissimmee Basin. 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 projects.

3. SCOPE: Three levels of activity have been developed to support the missions and goals of the Research and Evaluation Department.

   A. Level I: Water quality assessment and inventory at each dairy and selected non-dairy land use activities to support information dissemination between the District's Planning and Regulation Departments and DER.

   B. Level II: Phosphorus loading modeling, assessment and forecasting in support of the District's Planning Department.

   C. Level III: Evaluation of specific BMP components.

   This is a multi-year intensive monitoring project utilizing a combination of grab and automatic sampler monitoring stations located at the discharge points of individual dairy operations and tributary channels to Lower Kissimmee Basin. Flows from each site will be measured as estimated through modeling.

   Electronic data loggers will be used to facilitate data processing and control of water quality samplers.

   Hydrologic and meteorologic data are being collected and processed to support this project.

   The Data Management and Chemistry Lab Divisions will provide equipment maintenance and analytical chemistry support, respectively.

4. SCHEDULE:

FY90-91:

1st Qtr:

A. Complete QA Plan and obtain DER approval.

A. Data Analysis Report for RCWP.

B. Monthly Governing Board updates to Water Conditions Report.

C. Monthly water quality reports to dairy farmers.

D. Complete Upper Kissimmee Water Quality Report and hold appropriate workshops.

4th Qtr: Complete Final LKR QA Plan

5. PROGRESS TO DATE: Weekly grab samples have been collected at 61 stations. This data has been used to evaluate dairy discharge phosphorus concentrations. Due to BMP construction, dairy discharge locations will be reevaluated at six farms that are near completion of their Dairy Rule Plan. Structure and tributary autosampler data will be used to evaluate basin and sub-basin changes in water quality.

6. PRODUCTS:

FY90-91:

A. QA Plan (pending FDER approval)

B. Monthly Governing Board updates to Water Conditions Report.

C. Monthly water quality reports to dairy farmers.

D. Input to regulatory projects (monthly or as required)

E. 1st Qtr: Annual RCWP Report.

KISSIMMEE CHAIN OF LAKES WATER QUALITY MONITORING AND MODELING

- **District Contact: Senior Environmentalist**

1. OBJECTIVES: The main objectives of this project are to determine the nutrient assimilation capabilities of 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 project will also provide information necessary to determine the impact that land use changes in their basins will have on the lakes, as well as downstream resources including Lake Okeechobee.

2. DISTRICT NEED AND USE:

   A. Information generated by this project will be furnished to District managers for use in assessing water quality, and the environmental impacts of lake and basin management strategies in the Upper Kissimmee Chain of Lakes Basin. A SWIM plan developed for these lakes would rely on information generated in this study.

   B. The information currently collected through the field project is needed by the District to:

      1. 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.

      2. Determine the best practical approach to nutrient control by understanding the relative importance of nutrient loading sources.

      3. Contribute to the development of reference standards for the response of Florida lakes to nutrient loads.

      4. Generate information that 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.

      5. Provide data for calibration and validation of models built to predict the impact that development in these lakes' drainage basins may have on the lakes as well as downstream resources.

3. SCOPE: This project has two aspects: field sampling and modeling.

   A. 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.

   B. 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.

C. Models will be constructed to predict long-term trends and will use the water quality data for calibration and verification purposes. Once verified, the models can be used to explore the effects that changes in basin management might have on the trophic status of the lakes. Models will be useful for determining nutrient assimilation capacities of the lakes and the time it takes to reach steady state input-output nutrient dynamics.

4. SCHEDULE:

FY90-91:

A. 1st Qtr: Advertise and fill Senior Environmentalist Position

B. 2nd Qtr: Continue field sampling and model development.

C. 3rd Qtr: Continue field sampling and model development.

D. 4th Qtr: Continue field sampling and model development.

5. PROGRESS TO DATE:

FY89-90:

A. Nutrient budgets for East Lake and Lake Tohopekaliga have been completed.

B. Routine monthly sampling continues.

FY90-91:

1st Qtr:

A. Final Report on the water quality of East Lake Tohopekaliga.

B. Final Report - Shingle Creek Water Quality Study.

6. PRODUCTS:

FY92-93: Separate final reports will be completed for each of the five lakes in the chain, summarizing the water quality of the tributaries and lakes and modeling.

1st Qtr: Report on Lake Cypress and Lake Hatchineha

DAIRY MONITORING - ARBUCKLE CREEK

• District Contact: Greg Sawka

1. OBJECTIVE: To determine the effectiveness of the Florida Department of Environmental Regulation (DER) mandated BMPs in reducing the phosphorus concentrations at the dairies and phosphorus loads entering Lake Okeechobee from major tributaries in the Arbuckle Creek Basin.

2. DISTRICT NEED AND USE: This information will be used to evaluate the operation and maintenance of DER's Dairy Rule and other BMPs designed for the Arbuckle Creek Basin on a farm by farm basis. In support of the missions and goals of the Research and Evaluation Department, the results of this project will be used by the District's Water Quality Division, Planning and Regulation Departments and FDER to determine if additional practices will be needed to achieve further reductions in phosphorus loads to the lake from the Arbuckle Creek Basin. 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 projects.

3. SCOPE: Three levels of activity have been developed to support the missions and goals of the Research and Evaluation Department.

   A. Level I: Water quality assessment and inventory at each dairy and selected non-dairy land use activities to support information dissemination between the District's Planning and Regulation Departments and DER.

   B. Level II: Phosphorus loading modeling, assessment and forecasting in support of the District's Planning Department.

   C. Level III: Evaluation of specific BMP components.

   This is a multi-year intensive monitoring project utilizing a combination of grab and automatic sampler monitoring stations located at the discharge points of individual dairy operations and tributary channels to Arbuckle Creek Slough. Flows from each site will be measured as estimated through modeling.

   Electronic data loggers will be used to facilitate data processing and control of water quality samplers.

   Hydrologic and meteorologic data are being collected and processed to support this project.

   The Data Management and Chemistry Lab Divisions will provide equipment maintenance and analytical chemistry support, respectively.

4. SCHEDULE:

FY90-91:

1st Qtr:

A. Submit QA Plan for DER approval.

B. Prepare Data Analysis Report for Rural Clean Water Program.

C. Monthly Governing Board updates to Water Conditions Report.

D. Monthly water quality reports to dairy farmers.

5. PROGRESS TO DATE: Weekly grab samples have been collected at 11 stations. This data has been used to evaluate dairy discharge phosphorus concentrations. Due to BMP construction, dairy discharge locations will be reevaluated at six farms that are near completion of their Dairy Rule Plan. Structure and tributary autosampler data will be used to evaluate basin and sub-basin changes in water quality.

6. PRODUCTS:

FY90-91:

A. Monthly Governing Board updates to Water Conditions Report.

B. Monthly water quality reports to dairy farmers.

C. Input to regulatory projects (monthly or as required)

D. 1st Qtr: Annual Rural Clean Water Program Report.

E. QA Plan (Q4 - pending DER approval)

LAKE ISTOKPOGA HYDROLOGIC PROJECT

• District Contact: Jorge Marban

1. OBJECTIVE: The objectives of this project are to provide hydrologic analysis needed to improve flood control, water supply, and recreational benefits for Lake Istokpoga and the Indian Prairie basin.

2. DISTRICT NEED AND USE: This project is needed to complete the Lake Istokpoga Management Plan initiated in 1988.

3. SCOPE: Analysis of flood control problems in the Lake Istokpoga/Indian Prairie basin is required due to design deficiencies in the outlet structures on the downstream of the lake. The U. S. Corps of Engineers office in Jacksonville is presently evaluating design improvement alternatives. A reevaluation of the flood control system is necessary in lieu of the Florida Game and Fresh Water Fish Commission's request to raise the upper level of the existing lake regulation schedule. Coordination with both Planning and Construction Management departments has been established.

4. SCHEDULE:

   A. FY90-91: Flood analysis under different storm events with proposed higher levels in the regulation schedule. Additional survey of properties adjacent to the lake may require coordination with the Corps of Engineers as alternatives are developed for additional flood protection for the basin.

   B. FY91-92: Continue evaluation of flood protection alternatives.

5. PROGRESS TO DATE: Changes in the lake regulation schedule were approved by the Corps of Engineers, Jacksonville. Pump station G-207 was completed and construction for pump station G-208 initiated.

6. PRODUCTS: Flood analysis of areas surrounding Lake Istokpoga under proposed changes in the lake regulation schedule. This analysis will include areas of inundation and their frequency.

Attachment A

LAKE ISTOKPOGA AND INDIAN PRAIRIE BASIN WATER QUALITY

• District Contact: Kim O'Dell

1. OBJECTIVE: To provide hydrologic assessment needed in the development of a plan to improve flood control, water supply, water quality and recreational benefits for the Lake Istokpoga/Indian Prairie Basin.

2. DISTRICT NEED AND USE: The Istokpoga Basin has a history of water shortages and flood related problems due to design deficiencies of Structures S-68, S-82, and S-83. A management proposal to address those problems was developed in FY88-89. The plan involved changing the regulation schedule, constructing weirs downstream of the above mentioned structures, and building water supply pumps at S-71 and S-72 to supplement the lower Indian Prairie Basin from Lake Okeechobee. Additional hydrologic assessment is needed to investigate the feasibility of increasing the lake regulation schedule and improving flood protection in the basin. The feasibility of improving the capacity of the structure in the Istokpoga Canal needs to be investigated. This is a joint program of the Water Resources and Water Quality Divisions with no external funding provided.

   A. Hydrologic Services: To conduct hydrologic analysis to provide information required to produce a plan that will improve flood control, water supply, and recreational benefits for the Lake Istokpoga/Indian Prairie Basin.

   B. Environmental Services: The purpose of this task is to document the general water quality of the lake, determine water quality trends, and establish an acceptable nutrient loading limit to prevent accelerated eutrophication.

3. SCOPE:

   A. Hydrologic Services:

      1. Assessment of the effects of changing the present regulation schedule to higher water levels.

      2. Development of water shortage guidelines for Lake Istokpoga.

      3. Assessment of the need to replace the G-85 in the Istokpoga Canal structure with a more permanent one capable of passing higher flows.

      4. Document and update rationale for the existing water management plan.

   B. Environmental Services:

      1. Monthly water quality monitoring will be 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.

      2. Nutrient concentrations will be combined with discharge data collected under the Water Use Management Plan to construct nutrient budgets for the lake.

3. Eutrophication models will be used to establish acceptable nutrient loading limits. The final product of this task will be a technical publication summarizing the findings the recommending nutrient loading limits.

4. SCHEDULE:

A. FY90-91:

1. 2nd Qtr: Water shortage guidelines for Lake Istokpoga.

2. 4th Qtr: Water management plan documentation update.

B. FY91-92:

1st Qtr: 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:

A. Hydrologic Services: This project was begun in FY88. A management plan was developed which includes a change in the regulation schedule, installation of water supply pumps adjacent to S-71 and S-72 to bring additional water from Lake Okeechobee, flood control improvements and water quality improvements. A change in the regulation schedule and the installation of the pumps is underway.

B. Environmental Services:

1. This project begin in FY88. The project design was completed in January 1988 and water quality monitoring was initiated in February. A preliminary evaluation of initial water quality results was written, and a task Quality Assurance Plan was completed in April 1988.

2. Monthly lake station monitoring was increased to bi-weekly in December 1988 to document lake water quality changes that might be associated with the intensive sonar[R] treatment of the submersed aquatic weed, hydrilla.

6. PRODUCTS: Flood analysis of areas surrounding Lake Istokpoga under proposed changes in the lake regulation schedule. This analysis will include areas of inundation and their frequency.

GLADES/HIGHLANDS COUNTIES GROUND WATER RESOURCE ASSESSMENT

• District Contact: Karin M. Adams

1. OBJECTIVE: The objectives of this project are summarized as follows:

   A. To obtain lithologic and hydraulic data on the Surficial and upper Floridan Aquifer Systems in Glades and Highlands Counties.

   B. To develop a three-dimensional ground water flow model of the Surficial and upper Floridan Aquifer Systems in Glades and Highlands Counties.

2. DISTRICT NEED AND USE: This project is deemed necessary for the following reasons:

   A. Evaluate the availability and condition of the ground water resources for use in regulating its development.

   B. Collect data in order to develop a model which will be used to perform cumulative water use impact assessments for water use permitting.

   C. Provide support to the District's water supply planning activities in the determination of impacts from future water demands.

3. SCOPE: This project will be conducted solely by the Hydrogeology Division and will entail the completion of the following items:

   A. Gather existing lithologic, climatic and water use data. May need assistance from Regulation Department with permit information.

   B. Construct exploratory wells for lithologic and hydraulic information.

   C. Establish a water level monitoring network.

   D. Run pump tests on exploratory wells.

   E. Use lithologic, water use, climatic, surface water features, and water level data to create input packages for the three-dimensional flow model. Some information will need to be retrieved from the GIS system by the appropriate computer personnel.

   F. Calibrate and validate regional flow model.

   G. Prepare technical report documenting results of the study. Will use Print Shop Graphics group for creating report figures. In-house review by professionals in Regulation and Planning Departments is scheduled.

   This program is slated for completion in three years. No external funding is planned for this project.

4. SCHEDULE:

   FY90-91:

   1st Qtr: Review existing literature. Coordination/review workshop.

   2nd Qtr: Determine drill sites. Begin field work.

   3rd Qtr: Continue field work.

   4th Qtr: Continue field work.

5. PROGRESS TO DATE: N/A (new project)

6. PRODUCTS:

FY92-93:

A. 1st/2nd/3rd/4th Qtr: Ongoing collection and reduction of field data.

B. 4th Qtr: Technical report

LAKE OKEECHOBEE, EVERGLADES AGRICULTURAL AREA, AND LOWER EAST COAST

EVERGLADES NUTRIENT REMOVAL PROJECT (ENR)

• District Contact: Steve Davis/Marguerite Koch

CONTRACT REFERENCE: Knight's Farm Nutrient Study
Vegetation Planting ENR Project

1. OBJECTIVE: The objectives of this project are:

   A. To create a biological nutrient uptake system which will reduce loading of nutrients from agricultural runoff into WCA's.

   B. To test and monitor the success of the Phase III Design implementation through a research and monitoring program.

   C. To collect preliminary data on the soil nutrient, pesticide, and trace metal content of the soil.

   D. Develop an understanding of the geochemical processes on site that would affect the marshes potential to retain nutrients.

2. DISTRICT NEED AND USE: This project is needed to:

   A. To implement and test a nutrient uptake flow-way system which will support the utilization of water management areas (WMA) in the future.

   B. Provide the District with data to show the potential of using wetlands as nutrient uptake systems.

   C. To provide the District with baseline data on the status of nutrients and pesticides on site which would provide information for management decisions.

   D. An understanding of the soil processes controlling nutrient retention and release on site will be important for managing this area to maximize nutrient uptake and limit rerelease of sequestered nutrients.

   This project directly supports Everglades SWIM objectives and other initiatives by the Planning Department. Additional support is provided by Water Resources, Data Management and Water Quality Divisions.

3. SCOPE:

   The ENR project is a multi-faceted program which encompasses construction, research, and monitoring tasks.

   The research component is being addressed by in-house studies of pre-flooding and post-flooding nutrient and pesticide status in the soils and surface water. The University of Florida's Soil Science Department has been contracted to conduct a more detailed study on nutrient cycling at the ENR site. Investigations include the following 5 Tasks: 1) Spatial variability and fractionation of organic and inorganic forms of phosphorus. 2) Phosphorus retention characteristics of organic soils. 3) Phosphorus exchange between sediment and overlying water. 4) Organic phosphorus mineralization. 5) Assess the interaction of soil properties and water management on P loading.

   The major construction components are being initiated through the District's Construction Management Department. Phase III of the project includes the internal biological treatment system which is in the conceptual design phase. This design is being developed by a consultant with technical advice from the

Environmental Sciences Division. In addition, a nursery is being constructed by a consultant on site to provide the plant material for transplantation when the entire 3,740 acre area is available.

Funds for this project will be provided through SWIM, FPL mitigation, EAA and State Preservation 2000 initiative.

4. SCHEDULE:

A. FY90-91:

1. 1st Qtr:

a. Complete in-house field sampling of soil and water nutrients.

b. Monitor vegetation regrowth after disking.

c. Bi-monthly surface water quality monitoring program initiated.

2. 2nd Qtr:

a. Monitor vegetation regrowth after disking.

b. Data analysis and preparation of a seminar on results of in-house soil and water nutrient status.

c. Preparation of Technical Publication on soil and water nutrient status of ENR Project (Draft).

3. 3rd Qtr:

a. Monitor vegetation regrowth after disking.

b. Bi-monthly surface water quality monitoring.

4. 4th Qtr:

a. Monitor vegetation regrowth after disking.

b. Technical Publication on soil and water nutrient status of ENR Project (Final).

B. FY91-92:

1. 1st Qtr.

a. Plant vegetation on the 3,742 acres and flood entire system according to hydrological schedule.

b. Develop a monitoring program for the ENR project and get QA approval.

2. 2nd Qtr: Install water quality monitoring equipment and begin water quality sampling.

3. 3rd Qtr: Monitor water quality, soil chemistry and vegetation.

4. 4th Qtr: Monitor water quality, soil chemistry and vegetation.

5. PROGRESS TO DATE:

FY88-89:

4th Qtr:

A. In-house study on soil and water nutrient status initiated.

B. Disk under agricultural fields with sugar cane still standing to promote more wetland vegetation growth.

C. Initiate contract to plant nursery on 40 acres to provide vegetation for planting.

FY89-90:

4th Qtr: Task 1 completed University of Florida contract.

6. PRODUCTS:

FY90-91:

A. 2nd Qtr:

1. Task 1 report University of Florida contract.
2. Task 2 report University of Florida contract.
3. Complete first draft Technical Publication on soil and water nutrient status.

B. 3rd Qtr:

1. Task 3 report University of Florida contract.
2. Task 4 report University of Florida contract.
3. Task 5 report University of Florida contract.

C. 4th Qtr:

1. Final report University of Florida contract.
2. Technical Publication on soil and water nutrient status (Final).

C-51 WEST FLOOD CONTROL

• District Contact: Shawn Sculley

1. OBJECTIVE: To provide management and engineering support for the federal flood control plan for the Western C-51 basin.

2. DISTRICT NEED AND USE: The District is fulfilling its role as local sponsor of a federally-authorized flood control project for the entire West Plam Beach Canal (C-51) basin. The flood control plan for the Western C-51 basin is in the final phase of the project which began in the 1960s.

3. SCOPE: The local sponsor responsibilities include permit acquisition and certification of lands required by the plan. Technical coordination with the Jacksonville District of the U. S. Army Corps of Engineers, state and local permitting agencies, local governments, and the general public will also be required. The Water Resources Division will provide engineering and project management coordination with staff from the Construction Management, Land Management, Operations and Maintenance, and Planning departments. This project has an estimated total cost of over $53 million. The District, as local sponsor, will contribute approximately one-third of this amount.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Provide input to Environmental Impact Statement.

   B. 4th Qtr:

      1. Obtain necessary permits from FDER and Palm Beach County.

      2. Obtain necessary rights of entry for project.

   FY 91-92: Acquire necessary lands for project

5. PROGRESS TO DATE:

   FY89-90: This is a continuing project.

   A. 1st Qtr. Permit application filed jointly to FDER and Palm Beach County Dept. of Environmental Resources Management.

   B. 2nd Qtr: Corps of Engineers' Issue Resolution Conference held, SFWMD staff participated.

6. PRODUCTS:

   FY90-91: During 4th quarter dredge and fill permit for project.

C-111 INTERIM PLAN

- **District Contact: Robert Chamberlain**

CONTRACT REFERENCE:
Monitoring Discharges and Marsh Water Levels in C-111
Manatee Bay/Barnes Sound Continuous Monitoring Network

1. OBJECTIVE: The objective of this project is to conduct environmental monitoring in NE Florida Bay area associated with the C-111 discharges through S-197, as required in the DER permit.

2. DISTRICT NEED AND USE: The District has obtained a DER permit to proceed with the C-111 interim plan to add culverts to S-197 and change operation criteria of this structure as well as other components of the C-111 system. The permit requires the District conduct environmental monitoring of the NE Florida Bay area influenced directly and indirectly by changing operation of the C-111.

   This project is needed to fulfill the environmental monitoring requirements stipulated in the DER permit approval to restructure and change operation criteria of S-197 and C-111. Project directly supports Construction Management Division through collection of monitoring data required by the permit and Planning Department initiatives in the Everglades SWIM process.

3. SCOPE: Initial efforts will be made to establish a water quality and hydrologic monitoring plan for the areas near the S-197 discharge point. Monitoring will consist of a combination of both routine and event oriented sampling. Financial support for this project is provided solely by District funds. The Water Resources Division will assist in hydrologic analysis. Project coordination with the Environmental Planning Division, Planning Department will continue to provide support of the Everglades SWIM Plan.

4. SCHEDULE:

   A. FY90-91:

      1. 1st Qtr and remainder of year: Begin and continue physiochemical monitoring in Manatee Bay.

      2. 4th Qtr: Provide summary report of monitoring data to DER as required under permit.

      3. Other:

         a. Interface and provide information as needed to other C-111 project elements and staff.

         b. Provide support and exchange of information as needed with other state and local agencies also conducting work related to this C-111 project and permit.

         c. Coordinate deliverables on contracts.

   B. FY 91-92: same as FY90-91.

5. PROGRESS TO DATE:

FY89-90:

4th Qtr: Developed study plan and obtained agency approvals for monitoring plan.

6. PRODUCTS:

A. FY90-91: Summary and field reports required for field effort and permit demands.

1. 1st Qtr: Quarterly monitoring data from above contracts.
2. 2nd Qtr: Status report and quarterly monitoring data from above contracts.
3. 3rd Qtr: Quarterly monitoring data from above contracts.
4. 4th Qtr: Annual report and quarterly monitoring data from above contracts.

HYDROPERIOD RESTORATION ON DUPUIS RESERVE

• District Contact: Peter David

1. OBJECTIVE: The objectives of this project are to restore and preserve native wetland communities on Dupuis Reserve by reestablishing a more natural hydroperiod.

2. DISTRICT NEED AND USE: This project is needed to accomplish goals as set forth in Chapter 373.59 Florida Statutes which mandates that SOR lands be managed with the intent to "restore and protect the natural state and condition." Program directly supports the Land Management Department and provides technical support for other activities.

3. SCOPE: A wetland and hydroperiod restoration plan will be completed to make recommendations for meeting program objectives. Direct coordination between various District departments will be needed to complete hydrological analysis, design and construction of water control structures, and monitoring of restoration progress.

4. SCHEDULE:

   A. FY90-91:

      1. 1st Qtr: Completion of hydrological analysis. Continued installation of ditch plugs. Complete scope of work for Dupuis Reserve hydroperiod restoration.

      2. 2nd Qtr: Vegetation sampling. Completion of weir design for L-8 marsh restoration

      3. 3rd Qtr:

         a. Installation of water level recorders.

         b. Complete Operational Management Plan.

      4. 4th Qtr:

         a. Additional biological sampling.

         b. Monthly collecting of water level recorder data.

         c. Vegetation sampling.

         d. Present seminar on scope and status of restoration efforts.

   B. FY 91-92:

      1. 4th Qtr:. Additional biological sampling.

      2. Other: Monthly collection of water level recorder data.

5. PROGRESS TO DATE:

   A. FY88-89:

      1. 2nd Qtr: Installation of initial ditch plugs.

      2. 4th Qtr: Completion of wetland and hydroperiod restoration plan.

B. FY89-90:

1. 1st Qtr: Completion of Dupuis Environmental Assessment.
2. 2nd Qtr: Installation of additional ditch plugs. Backfilling of drainage ditches completed
3. Other: Topographic survey of the majority of project area was completed during this time.

6. PRODUCTS:

FY90-91: Annual status report.

1st Qtr: Operational Management Plan for Dupuis Reserve hydroperiod restoration.

WADING BIRD STUDIES

- **District Contact: Peter David**

CONTRACT REFERENCE: Roseate Spoonbill, Everglades National Park
Wading Birds National Audobon Society

1. OBJECTIVE: The objectives of this project are to:
   A. Document utilization by wading birds of the Water Conservation Areas, C-111 Basin, and Lake Okeechobee, and relate amount, timing and distribution of wading bird use to water conditions and water management strategies.
   B. Examine the relationships between hydrological conditions and quantity and quality of wetland foraging habitat.
2. DISTRICT NEED AND USE: This project is needed to:
   A. Assess the effectiveness of alternative water management practices.
   B. Assist in proposing management recommendations which meet habitat needs of declining wading bird populations in south Florida.
   C. Project additionally supports Everglades SWIM objectives and provides direct support to Planning Department and other agencies.
3. SCOPE: The District, Game and Freshwater Fish Commission and Everglades National Park have cooperatively established a Systematic Reconnaissance Flight (SRF) technique for determining species composition and distribution of wading bird utilizing all wetland habitats in South Florida. National Audubon Society (NAS) has been contracted to conduct SRF surveys in the Water Conservation Areas during the dry season nesting period (December-June) and one wet season survey (August). In addition, NAS will initiate the third year of a four year study, funded by South Florida Water Management District and Everglades National Park, on the biology of the Roseate Spoonbill in the C-111 Basin. In addition, a technical publication will be generated from Lake Okeechobee wading bird SRF data accumulated for years 1977 to 1988.
4. SCHEDULE:
   A. FY90-91:
      1. 1st Qtr:
         a. Review 1990 annual report.
         b. Complete data analysis for Lake Okeechobee wading bird technical publication.
      2. 2nd Qtr:
         a. Process monthly data submitted by NAS.
         b. Review quarterly report.
         c. Present seminar on data analysis for Lake Okeechobee wading bird technical publication.
      3. 3rd Qtr:
         a. Process monthly data submitted by NAS.

b. Review quarterly report.

c. Review six month report).

4. 4th Qtr:

a. Process monthly data submitted by NAS.

b. Review annual report.

B. FY91-92:

1. 1st Qtr: Review 1991 annual report.

2. 2nd Qtr:

a. Process monthly data submitted by NAS.

b. Review quarterly report.

3. 3rd Qtr:

a. Process monthly data submitted by NAS.

b. Review quarterly report.

c. Review six month progress report.

4. 4th Qtr:

a. Process monthly data submitted by NAS.

b. Review quarterly report.

c. Review annual report.

5. PROGRESS TO DATE:

A. FY88-89: Completion of the fourth year of a contractual agreement with NAS for SRF surveys and the initial year of a four year roseate spoonbill study. A comprehensive report on the 1986-1988 SRF flights is being completed by cooperating agencies (ENP, GFC, SFWMD)

B. FY89-90:

1. 1st Qtr. Received annual report.

2. 2nd Qtr: Received six month progress report.

3. 3rd Qtr: Received 1986-1988 comprehensive report.

4. 4th Qtr: Received annual report.

5. Other: All monthly data sets and quarterly reports were submitted by NAS.

6. PRODUCTS:

FY90-91:

1. 1st Qtr: 1989 SRF annual report.

2. 3rd Qtr: Complete rough draft of Lake Okeechobee wading bird publication.

3. 4th Qtr: Complete final draft of Lake Okeechobee wading bird publication.

PHOSPHORUS DYNAMICS AND CIRCULATION STUDY

• District Contact: Brad Jones

CONTRACT REFERENCE: Phosphorous 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 sediment types in the lake will be characterized and mapped. The phosphorus assimilation capacity of different types of sediments will be determined. Sedimentation rates of phosphorus will be determined for recent and geological time. The influence of major inflows on phosphorus assimilation rates in sediments will be determined. The internal phosphorus loading process, including the role of lake stage will be determined. A model will be developed to predict the effect of external phosphorus loading reductions on in-lake concentrations. The Data Management Division and the Chemistry Lab have done occasional field and analytical work for this program, and the Environmental Sciences and Environmental Planning Divisions have reviewed deliverables. No other departments or divisions besides the Water Quality Division are involved. No external funding has been sought for this program.

4. SCHEDULE:

   A. FY87-88: 3rd Qtr: Evaluate sediment mapping methodologies.

   B. FY88-89: 2nd Qtr: Complete sediment mapping and physical characterization.

   C. FY90-91:

      1. 1st Qtr:

         a. Determine the capacity of different types of Lake Okeechobee sediments to assimilate phosphorus from the water.

         b. Determine phosphorus accumulation rates in the sediments and compare them to accumulation rates in the geologic past.

         c. Evaluate the influence of major lake inflows on phosphorus assimilation and accumulation rates in the sediments.

2. 2nd Qtr:
   a. Quantitatively determine the annual phosphorus loading to the lake from sediments, including the influence of sediment type and lake stage on phosphorus cycling.
   b. Assess the role of aquatic macrophytes as a source or sink in phosphorus exchanges between the littoral and open water zones in Lake Okeechobee.
   c. Quantitatively determine the impact of external phosphorus loading reductions on ambient lake phosphorus concentrations.
3. 3rd Qtr:
   a. Complete final report for the task, integrating all tasks listed above.
   b. Provide documentation and training to SFWMD personnel for all models developed as part of this research.

5. PROGRESS TO DATE: Field work and most data analyses have been completed and final reports are being received. Semi-annual progress reports have been received and the investigators have made presentations to District staff.

6. PRODUCTS:

A. FY88-89: 2ND Qtr: Sediment characterization and distribution maps.

B. FY90-91:
   1. 1st Qtr: Final Report integrating results from all tasks.
   2. 2nd Qtr:
      a. Final reports for tasks listed above.
      b. Predictive model for in-lake phosphorus concentrations based upon external and internal loadings.

WCA IMPACTS, MONITORING, AND NUTRIENT THRESHOLDS

• District Contact: Steve Davis

1. OBJECTIVE: The objective of this project is to monitor and evaluate dynamic interactions between biotic and abiotic factors that influence ecology of the Everglades.
2. DISTRICT NEED AND USE: Interaction of hydroperiod and water quality on the flora and fauna in the Everglades are complex and influence the ecology of the marsh on a variety of scales. This program provides a framework to coordinate research activities that will define how environmental processes are modified by water management practices. Resulting information will be used to improve management of the system and provide a basis to measure effectiveness of SWIM programs to restore or maintain Everglades habitat.
3. SCOPE: Program scope is composed of several major task elements as listed below. A full description of these tasks are attached. For activites by Data Management.
   A. Cattail expansion in WCA2A.
   B. Factors influencing Everglades marsh sustainability.
   C. Surface water quality monitoring in WCA2A.
   D. Vegetation mapping of Water Conservation Areas.
   E. Sawgrass-cattail transpiration study.
   F. Hydrologic data collection.
4. SCHEDULE: See individual task descriptions.
5. PROGRESS TO DATE: See individual task descriptions.
6. PRODUCTS: See individual task descriptions.

Attachment A

CATTAIL EXPANSION IN WCA2A

• District Contact: Nancy Urban

1. OBJECTIVE: The objectives of this project are:
   A. Quantify rates of expansion of cattail in relation to nutrient supply and monitor cattail populations.
   B. Monitor surface water quality at the study sites.
2. DISTRICT NEED AND USE: This project is needed to:
   A. Monitor vegetation change as it relates to surface water quality in WCA2A.
   B. Provide support for the Everglades SWIM Plan.
3. SCOPE: This study quantifies rates of cattail expansion in WCA2A and relates these expansion rates to surface 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. Surface water samples are collected bi-weekly from each site for phosphorus and nitrogen analyses. Costs for this project are funded by the District. Sample analysis will be performed byChemistry Laboratory Division. Results of study will be made available to Planning Department for required revisions to SWIM plans.
4. SCHEDULE:
   A. FY90-91:
      1. 1st Qtr:
         a. Initiate consultation with outside statistical experts to review study design.
         b. Maintain bi-weekly collection of surface water samples.
      2. 2nd Qtr:
         a. Present seminar on study design approach and modifications.
         b. Implement study changes.
         c. Maintain bi-weekly collection of surface water samples.
      3. 3rd Qtr:
         a. Maintain bi-weekly collection of surface water samples.
         b. Present seminar on analysis of invertebrate colonization technical publication.
      4. 4th Qtr:
         a. Maintain bi-weekly collection of surface water samples.
         b. Complete draft technical publication on invertebrate colonization.
         c. Complete draft technical publication on cattail expansion in WCA2A.

B. FY 91-92:

1. 1st Qtr:

   Maintain bi-weekly collection of surface water samples.

2. 2nd Qtr:

   Maintain bi-weekly collection of surface water samples.

3. 3rd Qtr:

   Maintain bi-weekly collection of surface water samples.

4. 4th Qtr:

   a. Maintain bi-weekly collection of surface water samples.

   b. Present summary report on previous year's collection efforts.

5. PROGRESS TO DATE:

A. FY88-89:

1. 4th Qtr: Annual data collection of sawgrass and cattail counts.

2. Other: Collection of bi-weekly surface water samples.

B. FY89-90:

1. 4th Qtr: Annual data collection of sawgrass and cattail counts.

2. Other: Collection of bi-weekly surface water samples.

C. FY90-91:

4th Qtr: Draft Technical Memorandum on cattail expansion in WCA2A.

6. PRODUCTS:

FY90-91:

3rd Qtr: Invertebrate colonization of Peatlands Technical Publication.

Attachment C

SURFACE WATER QUALITY MONITORING IN WCA2A

• District Contact: Nancy Urban

CONTRACT REFERENCE: Float Helicopter Rental

1. OBJECTIVE: The objectives of this project are:
   A. Develop a comprehensive sampling scheme in WCA2A for a long-term monitoring program.
   B. Take monthly surface water samples for nutrient analyses.
   C. Document nutrient penetration into the marsh.
2. DISTRICT NEED AND USE: This project is needed to:
   A. Document nutrient penetration in WCA2A.
   B. Provide support and information for the Everglades SWIM plan and will be coordinated with the DRE, Water Quality Division. Data collected will be used by other state agencies, as well.
3. SCOPE: Currently, surface water quality monitoring is being done at the six cattail expansion sites on a bi-weekly basis. Additional sites will be added in WCA2A to more closely monitor nutrient penetration into the marsh. Transects will be set up along the nutrient gradient south of the S-10 inflow gates. Samples will be taken monthly and during special events. This project will be coordinated with the Water Quality Division. Sample analysis will be performed in-house by the Chemistry Laboratory Division. Costs are funded by the District and reimbursible through SWIM.
4. SCHEDULE:
   A. FY90-91: Monthly trips by helicopter to take surface water samples.
      1. 1st QTR:
         a. Develop QA field sampling procedures.
         b. Present seminar on sampling design in conjunction with input from Water Quality Division.
         c. Have study design reviewed by outside statistical experts.
         d. Develop scope of work for helicopter contract services.
      2. 2nd QTR: Implement monthly trips.
   B. FY91-92: Monthly trips by helicopter to take surface water samples.
5. PROGRESS TO DATE:

   FY89-90:

   4th Qtr: Preliminary network of stations selected.

VEGETATION MAPPING BY REMOTE SENSING APPLICATIONS

• District Contact: Ken Rutchey

1. OBJECTIVE: To monitor and quantify vegetation changes in Everglades wetlands utilizing remote sensing applications.

2. DISTRICT NEED AND USE: Vegetation is often used as the key biological health indicator for an environment. This work enables the District to monitor the effects of restoration, hydroperiod manipulations, exotic species proliferation, and nutrient influx on vegetation patterns in the Water Conservation Areas, Holeyland, ENR project and Everglades National Park. Data collected through remote sensing efforts will be used by the Planning, Land Management and Construction Management Departments (particularly in support of SWIM planning activities).

3. SCOPE: This project will be supported by District funds and will document environmental trends through vegetation monitoring. The monitoring area will include or document parts of the Everglades SWIM planning area and include in order of priority the regions as listed below.

A. Water Conservation Areas - Produce a wetlands vegetation map of Water Conservation Areas for 1991/1992 (Dependent upon available data). The information gained from this would then be used to construct historic maps of the same area for 1987/1988. This will be an ongoing effort, with maps being produced periodically to monitor any changes in vegetation patterns due to nutrient influx or hydroperiod. This is one of the objectives of the Everglades SWIM Plan.

B. Holeyland - Produce a wetlands vegetation map of Holeyland for 1991/1992 (Dependent upon available data). The information gained from this would then be used to construct an historical map for the same area for 1990. This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns due to Holeyland project. This is one of the objectives of the Holeyland project.

C. Everglades National Park - Produce a vegetation map of Everglades National Park for 1991/1992 (Dependent upon available data). The information gained from this would then be used to construct an historical map for the same area for 1987/88. This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns due to any modifications in current water deliveries to the Park. This effort would include C-111, Taylor Slough, Northeast Shark River Slough, and TPL Lands. This is one of the objectives of the Everglades SWIM Plan.

D. ENR Project - Produce a vegetation map of ENR project area for 1991/1992 (Dependent upon available data). This will be an ongoing effort, with a map being produced periodically to monitor any changes in vegetation patterns due to ENR project. This is one of the objectives of the ENR project.

4. SCHEDULE: Completion dates are dependent upon availability of manpower and equipment.

FY90-91:

A. 1st Qtr:

1. Purchase Global Positioning System (GPS).
2. Research principles and procedures for application of hand held radiometer.

B. 2nd Qtr:

1. Set up GPS system and test.
2. Purchase hand held radiometer and test.
3. Identify gaps in color infra-red photography coverage and coordinate contract for aerial photography as needed.

C. 3rd Qtr:

1. Acquire satellite data (Spring 1991 - either SPOT or LandSat if available) for Water Conservation Areas, Holeyland, Everglades National Park or ENR project area.
2. Ground truth acquired satellite data using GPS technology.
3. Geo-reference acquired satellite data for Water Conservation Areas, Holeyland, ENR project area or Everglades National Park to USGS map projection system; perform unsupervised classification.

D. 4th Qtr:

1. Train classification areas for acquired Water Conservation Areas, Holeyland, ENR project area or Everglades National Park data.

5. PROGRESS TO DATE:

FY89-90:

1. Water Conservation Area 3 was warped to a UTM map projection and an unsupervised classification was performed. Upon further inspection of this image it was found to be defective and was sent back to SPOT Image Corporation. We currently have a complete scene for December 1987; processing of this data has been delayed due to other commitments and equipment problems.
2. A final supervised classification map of Conservation Area 2A has been completed using a SPOT satellite scene (4/4/87).

6. PRODUCTS:

FY90-91:

4th Qtr: Final vegetation map for Water Conservation Area 2A and Holeyland.

Attachment E

SAWGRASS-CATTAIL TRANSPIRATION STUDY

• District Contact: Marguerite Koch

CONTRACT REFERENCE: Amendment for soil analysis in WCA2A

1. OBJECTIVE: The objectives of this project are:

   A. To determine the transpiration rates of sawgrass vs cattail utilizing two different techniques, one as an in-house study and another study conducted by an outside consultant.

   B. To investigate the extent of the nutrient front in WCA2A in terms of soil nutrient status, interstitial nutrient concentrations, and plant nutrient status.

2. DISTRICT NEED AND USE: This project is needed to:

   A. Determine the effects of cattail invasion in WCA 2A on transpiration water loss from the Water Conservation Area.

   B. The District needs background soil nutrient data to determine the extent of the P which is currently loaded into WCA2A. This will identify the area which needs to be managed for nutrient retention to minimize the movement of this nutrient front further into WCA2A and potentially to other Everglades marsh areas.

3. SCOPE:

   A. Two transpiration studies are being conducted, one by the University of Miami using the lysimeter technique and two, an in-house District transpiration study using a steady state porometer technique. Different soil moisture levels and nutrient concentrations are being investigated along with the differences in transpiration rates between cattail and sawgrass.

   B. Approximately 100 soil cores will be taken from WCA2A from a grid over the entire area to survey the soil phosphorus and nitrogen content and the depth distribution of these nutrients. Soil P fractionations will also be conducted to determine the form of P stored in WCA2A. Soil water equilibrators will be inserted into the soil and surface water to determine the intersitial soil nutrient levels and diffusion rates on a quarterly basis from three sites along the nutrient gradient.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr:

      1. Task 3 report completed for University of Miami transpiration study.

      2. Soil cores will be collected by contracting WCA2A for Task 2b and 2c as part of the amendment.

B. 2nd Qtr:

1. Final report complete for University of Miami transpiration study.
2. Field sampling complete for in-house transpiration study WCA2A.

C. 3rd Qtr:

1. Data analysis and Technical Publication writing for the in-house transpiration study.
2. Final report submitted from University of Florida, Soil Science Department on soil nutrient status in WCA2A.

5. PROGRESS TO DATE:

FY88-89:

A. 1st Qtr:

1. Initiation of in-house transpiration study in WCA2A.
2. Contract initiation for Sawgrass-cattail transpiration study, with the University of Miami.
3. Report on Task 1 submitted by the University of Miami.

B. 3rd Qtr: Report on Task 2 submitted by the University of Miami.

6. PRODUCTS:

FY90-91:

A. 1st Qtr: Report on task 3 from the University of Miami.

B. 2nd Qtr: Report on task 4 from the University of Miami and a final report on the University of Miami transpiration study.

C. 3rd Qtr: Final report from University of Florida on the soil nutrient status of WCA2A.

D. 4th Qtr: In-house technical publication on transpiration study in WCA2A.

Attachment B

FACTORS INFLUENCING EVERGLADES MARSH SUSTAINABILITY

• District Contact: Marguerite Koch

1. OBJECTIVE: The objectives of this project are:

   A. A new research program will be developed to determine a nutrient threshold level for non-degradation of Everglades marsh community and the interaction of nutrients with other factors including hydrology and fire.

   B. A new research program will be developed to identify the most important factors controlling nutrient cycling in WCA2A and determine mechanisms which release and bind P in the system.

2. DISTRICT NEED AND USE: This project is needed to:

   A. A lack of understanding nutrient levels which can be released into the Water Conservation Areas without environmental degradation has led to difficulty in policy decisions. A better understanding of the level of nutrients which are degradational to Everglades communities and how hydrology affects these levels will allow the District to better manage the Water Conservation Areas which are presently not "nutrient enriched". In addition, information on the ability of the Everglades vegetation to sustain various hydroperiods needs to be investigated such that the District can better define water schedules which will be in concert with the District's mission of environmental enhancement and non-degradation.

   B. Presently some information exists on the phosphorus content in the Everglades soils, however, the processes controlling the cycling of phosphorus and nitrogen in this system is not well understood. The District needs to understand the geochemistry of the soils in the Water Conservation Areas in terms of nutrient cycling and effects of various hydrological scenarios on the rerelease of nutrients, i.e., remineralization and adsorption-desorption processes. This information will assist the District in better management of the nutrients currently stored in the system and maximize the storage capacity of the system.

   C. This task directly supports Planning Department initiatives in the Everglades SWIM planning process.

3. SCOPE:

   A. A nutrient threshold level for degradation of Everglades marsh community will be determined. The interaction of nutrients and other factors including hydrology and fire on sawgrass vs cattail communities will be quantified. The only system which reduces nutrient levels to 0.03 to 0.01 mg/l is the natural sawgrass marsh with it's associated co-precipitating periphyton. Therefore, we must attain information on the concentration and loading capacity of this system, under different hydrological regimes, which is sustainable. These data are imperative for the development of ENRP and WMA's and the District's management of Everglades.

B. Identify soil processes which reduce P-levels in WCA2A surface waters to 0.03-0.01 mg/l. This critical information will be used to manage the ENRP and WMA's in the future to achieve the District's goal of non-degradation nutrient levels. Identify the sources of nutrients in the surface waters of WCA2A below the S-10 structures which cannot be explained by loading i.e. remineralization under aerobic (dry conditions) and anaerobic (flooded). This information will be used to better manage the ENRP and WMA's to control for rerelease of nutrients stored in the soils and limit the impact of nutrients presently stored in WCA2A such that the nutrient front remains stationary minimizing impacts to other WCA's and ENP.

4. SCHEDULE:

FY90-91:

A. 2nd Qtr:

1. Literature review for the development of a research proposal to investigate nutrient levels and hydrological condition which support natural Everglades vegetation communities in the WCAs.

2. Literature review for the development of a research program to investigate geochemical cycling and soil nutrient processes in WCA2A.

B. 3rd Qtr:

1. Development of QA/QC plans for the new research programs described in 2. c and d above

C. 4th Qtr:

1. Award contracts for the research to investigate nutrient levels and hydrological factors affecting Everglades vegetation.

2. Award contracts for the research to investigate geochemical and nutrient cycling in the WCAs.

5. PROGRESS TO DATE: This is a new program. Implementation of the above efforts are contingent on availability of SWIM funds to initiate studies.

WATER QUALITY MONITORING

Attachment F

- **District Contact: Larry Grosser**

1. OBJECTIVE: The objective of this task is to collect surface water quality data for the inflows and outflows of the Water Conservation Areas. This task 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: The monitoring consists of sampling 35 WCA inflows and outflows. 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 long and short term trends. Hydrologic data are collected at most of the sampling sites and is provided by the Data Management Division. Chemical analyses are provided by the Chemistry Laboratory Division. No external funding has been sought for this task (not applicable).

4. SCHEDULE: The Water Conservation Area inflow/outflows are sampled at least monthly and every two weeks during periods of flow.

5. PROGRESS TO DATE: Monitoring was initiated in 1978. A water quality data base for WCA inflows and outflows goes back to that year. An automatic precipitation collector was installed at pump station 140 in June 1989.

6. PRODUCTS: All data available on both LIMS and Britton Lee data base systems.

FY90-91:

A. 1st Qtr: Develop Water Conservation Area Quality Assurance Plan.

B. 2nd Qtr: Conduct Water Conservation Area Quality Assurance Systems Audit.

LAKE OKEECHOBEE ECOSYSTEM STUDY

• District Contact: Peter B. Rhoads

CONTRACT REFERENCE: Lake Ecosystem Study

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 asses 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 II. The Florida Legislature has mandated that phosphorus loading be reduced by 40%. Assessment is necessary to evaluate the success of this anticipated reduction. This project directly supports Planning Department initiatives in the Lake Okeechobee SWIM process.

3. SCOPE: This is a five year multi-disciplinary field research project. Continuation of a third year study (FY 90) is proposed under contract by the University of Florida (UF) and the U. S. Fish and Wildlife 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 sediment, weather, water chemistry, aquatic macrophyte, phytoplankton, periphyton, zooplankton, wading bird and larval fish data. The Ecosystem Study is funded under SWIM. Obtaining future SWIM funding is the responsibility of the Planning Department. Portions of the study are coordinated with the DRE Water Quality, Data Management, and Water Resources Divisions. These Divisions provide minor technical support and review of contract deliverables. Data is also exchanged between cooperating members in the phosphorus dynamics study, administered by the Water Quality Division.

   Specific tasks for this project to be completed during FY 90-91 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. Identify critical nursery habitats of larval and juvenile fish and determine temporal spawning patterns in relation to lake stage.

F. Determine phosphorus flux from the emergent littoral zone.

G. Develop a model of trophic interactions, analyze data, and write final report.

H. Complete a habitat inventory map of Lake Okeechobee.

4. SCHEDULE:

FY90-91:

A. 1st Qtr: Complete scientific literature review; complete QA Plan, complete contract for 3rd year of ecosystem study.

B. 2nd Qtr: Complete habitat inventory.

C. 4th Qtr:

1. Monitor algal bloom events.
2. Complete evaluation of factors regulating the abundance of larval and juvenile fish.
3. Complete trophic community analysis.
4. Develop models, analyze data, and write final report.

5. PROGRESS TO DATE:

A. FY87-88:

1. 2nd Qtr: Completion of the scope of work (1st year) by the project manager.

B. 2. 3rd Qtr:

a. Contract implementation.

b. Complete a Memorandum of Understanding (MOU) between the District and the Game and Fish Commission.

c. Sampling locations were selected and field studies began.

C. FY89-90: 4th Qtr: Second annual report submitted and revision requested before final acceptance.

6. PRODUCTS:

FY 90-91:

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 89-90 include:

1. Quarterly programs report due each quarter.
2. Annual report (third year).
3. For future FY's, reports will be received on the same annual cycle.
4. A final five-year report is due on July 1, 1993

S236 MONITORING

- **District Contact: Barbara Welch**

CONTRACT REFERENCE: Water Quality Monitoring

1. OBJECTIVE: The objective of this program is to collect surface water quality data required by the Department of Environmental Regulation's Temporary Operating Permit (TOP) and to evaluate alternatives for reducing the nutrient loading from S236 to Lake Okeechobee. Data collection and alternatives evaluation are conducted through contract.

2. DISTRICT NEED AND USE: The District is a co-permittee with the South Florida Conservancy District (SFCD) for discharging into Lake Okeechobee via S236. 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 program to support efforts to obtain either an extension of the old permit, or to apply for a new permit.

3. SCOPE: This is an ongoing program that is concerned with water quality monitoring and alternatives evaluation for the S236 pump station. The SFCD has contracted sampling out to CH2M Hill of Deerfield Beach, Florida. The District partially funds at 35%, sampling through interlocal agreement with the SFCD to meet the requirements of the S236 TOP.

4. TASK SCHEDULE: Continue water quality monitoring through contract as required in modifications to be made to the TOP.

   FY90-91: 1st Qtr: Contract renewed to continue water quality monitoring.

5. PROGRESS TO DATE:

   A. FY87-88: 1st Qtr: A draft report entitled Analysis of Control Strategies for Reduction of Phosphorus Loads to Lake Okeechobee from the Special Drainage Districts was delivered to DER for review.

   B. FY88-89: 2nd Qtr: The first year of water quality collection was completed.

6. PRODUCTS:

   A. FY87-88: Monthly water quality data reports.

   B. FY88-89: Monthly water quality data reports.

   C. FY89-90 Monthly water quality data reports.

Attachment A

LAKE OKEECHOBEE WATER CLASS I AND II

• District Contact: Richard Pfeuffer

1. OBJECTIVE: The objective of this project is to collect water quality information to identify and quantify the extent and impacts of specific basins and specific parameters that exceed FAC 17-3 Class I and/or Class III water quality standards.

2. DISTRICT NEED AND USE: This project is needed to fulfill the request of Department of Environmental Regulation. The data can be used to assess potential environmental impacts of surface water management decisions.

3. SCOPE: Expand the current monitoring efforts in and around Lake Okeechobee to assess the extent of violations of Class I and/or Class III water quality standards in the Lake and at the inflows. This monitoring was initiated in May 1990. Parameters which are sampled bi-weekly include: alkalinity, ammonium, nitrate, nitrite, total Kjeldahl nitrogen, color, chloride, dissolved oxygen, total phosphorus, ortho phosphorus, pH, specific conductance, temperature, total suspended solids, and turbidity. Parameters which are sampled quarterly include: sulfate, silica, total dissolved solids, calcium, magnesium, sodium, potassium, and total metals (arsenic, cadmium, copper, iron, mercury, lead and zinc). Pesticides are sampled every two months at six inflows to the lake.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Coordinate and conduct surface water sampling events.

   B. 2nd Qtr: Coordinate and conduct surface water sampling events.

   C. 3rd Qtr: Coordinate and conduct surface water sampling events.

   D. 4th Qtr: Coordinate and conduct surface water sampling events.

5. PROGRESS TO DATE: Additional quarterly sampling parameters (total dissolved solids and total metals) were included in May 1990. A water quality data base for those parameters at the monitoring stations goes back to that year.

6. PRODUCTS: This is a new project which began in May 1990.

   FY90-91:

   A. 1st Qtr: Data summary.

   B. 2nd Qtr: Data summary.

   C. 3rd Qtr: Data summary.

   D. 4th Qtr: Data summary.

WATER QUALITY EVALUATION OF HERBICIDE SPRAY PROGRAMS

• District Contact: Richard Pfeuffer

CONTRACT REFERENCE: Adjuvant Study and Herbicide Analysis

1. OBJECTIVE: The objective of this project is to determine the concentration and persistence of herbicides (and adjuvants if believed to be of concern) applied by the District as part of its aquatic weed management projects. An evaluation will be made of the potential water quality and environmental impacts from using the targeted herbicide.

2. DISTRICT NEED AND USE: The District utilizes significant quantities of herbicides, of which some have not been studied in the South Florida environment. This project 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 potential water quality and wildlife impacts from using the targeted herbicide.

3. SCOPE: This project is mostly concerned with research on herbicides applied in Lake Okeechobee, although some studies will be expanded to other lakes or environments when necessary. As topics of research are identified, an appropriate monitoring project is developed to answer the questions or areas of concern. The approach taken is to track the movement and concentration of herbicides or degradation products in water and/or soil after application has taken place. Possible studies include an evaluation of the leaching potential of Arsenal(R), the aquatic fate of Velpar(R), and the water and sediment dosage rate from a metered delivery system. Since Arsenal(R) has been used by the District, it has not been reviewed by the Herbicide Review Committee. Since new herbicides with similar characteristics as Arsenal(R) have had their use restricted by the Review Committee, Arsenal(R) should be evaluated in a field application. Velpar(R) is in the process of a label change for aquatic uses. The environmental fate of Velpar(R) in an aquatic setting should be evaluated. The metered delivery system has been effective for weed control in flowing canals. However, the dosage rate has not been monitored to determine if water or sediment residues have exceeded appropriate levels. Coordination with personnel from Operations and Maintenance and the appropriate field station is essential. No external funding is used for the project unless the task is SWIM related.

4. SCHEDULE: Major tasks and schedules are as follows:

   FY90-91:

   A. 1st Qtr: Complete technical publication "Herbicide Monitoring Program for Fluridone and N-Methyl Formamide."

   B. 2nd Qtr:

      1. Complete field work for Tebuthiuron Application Study.
      2. Complete contract for Adjuvant Study.
      3. Implement monitoring program(s) for FY90-91.

5. PROGRESS TO DATE:

FY87-88:

A. 2nd Qtr: Technical Publication 88-1, "Herbicide Monitoring Program for the Active Ingredient Glyphosate," received Governing Board approval in February 1988.

B. 4th Qtr: Technical Publication 88-8, "Herbicide Monitoring Program for the Active Ingredient Fluridone [Sonar(R)]", received Governing Board approval in July 1988.

Completed draft of Technical Memorandum "Herbicide Monitoring Program for Fluridone and N-Methyl Formamide."

6. PRODUCTS:

FY90-91:

A. 1st Qtr: Technical Memorandum "Herbicide Monitoring Program for Fluridone and N-Methyl Formamide."

B. 2nd Qtr: Technical Workshop for Tebuthiuron Application Study

WATER QUALITY OF INFLOWS TO EVERGLADES NATIONAL PARK

• District Contact: Larry Grosser

1. OBJECTIVE: The objective of this task is to collect surface water quality data at the Everglades National Park (ENP) inflows and to provide the primary water chemistry database required under the terms of the ENP/Corps of Engineers (COE) District Memorandum of Understanding (MOU).

2. DISTRICT NEED AND USE:

   A. It will provide water quality data for the monthly Governing Board water conditions report.

   B. It will provide the Department of Operations and Maintenance with a telemetry interface and structure operations information.

   C. It will supply the Water Resources Division with hydrologic data for use in water supply alternative evaluations, etc.

   D. It will assist the ENP and the COE by providing data support as part of the MOU.

3. SCOPE: All monitoring data (except for pesticides) required by the ENP MOU will be collected as part of this task. Field samples will be taken at inflows to the ENP; monthly data reports will be transferred to the ENP. Hydrological data collection is a cooperative effort between Data Management, Operations and Maintenance, ENP, USGS, COE, and this division. Parameters measured include flow, surface water level, ground water level, rainfall, and evaporation. External funding has not been sought for this project (not applicable).

4. SCHEDULE:

   A. Seven inflow stations to the ENP are sampled every two weeks during flow. An annual meeting is held among the COE , ENP, and District to discuss water quality results under the ENP MOU.

   B. Trace metals analyses are performed on the seven inflow stations once a month regardless of flows.

5. PROGRESS TO DATE: This is an ongoing task that was initiated in 1979 by the COE and was taken over by the District in 1983.

6. PRODUCTS:

   FY90-91:

   A. 2nd Qtr: ENP Quality Assurance Plan.

   B. 3rd Qtr: ENP Quality Assurance Systems Audit.

   C. Other

      1. Results of sampling are presented monthly in the Water Conditions Report.

      2. Monthly data transmittals to the ENP and COE.

      3. Legal documentation of the operation of District structures on a continuous basis.

HOLEY LAND STUDY

• District Contact: Marguerite Koch

1. OBJECTIVE: The objectives of this project are:

   A. To assess the impacts of diverting Miami canal water through the Holeyland tract in terms of surface water quality and soil nutrient status.

   B. Baseline data collected in this monitoring study will be used to manage the area by the District in the future.

2. DISTRICT NEED AND USE:

   A. The District needs this baseline data in order to determine the success of the water diversion project into the Holeyland in terms of environmental enhancement without degradational affects.

   B. The acquisition of these data are also part of a larger program of understanding the uptake, assimilation, accumulation, and recycling of nutrients in the Everglades System.

   C. Support Everglades SWIM efforts and other long range planning efforts in the Planning Department and to support Construction Management permit requirements.

3. SCOPE:

   A. Surface water samples will be taken from 36 stations on a grid in the Holeyland marsh once a month. When surface water is available, water is sampled by helicopter at all 36 sites. This sampling is being conducted as an in-house study and is ongoing. Water samples are analyzed by the Chemistry Laboratory Division for nitrate, nitrite, total kjeldahl nitrogen, ammonium, total phosphate, ortho-phosphate, total dissolved phosphate, chloride, calcium, magnesium, sodium, and potassium.

   B. Soil cores will be taken annually from each of the above 36 stations and analyzed for selected physico-chemical characteristics of the soil and the fractionated forms of phosphorus. Parameters to be measured include:

      1. Water soluble P, extractable NO_3^- & NH_4^+
      2. Total P, C, & N
      3. Ash content & bulk density
      4. pH
      5. Extractable Ca, Mg, Fe, and Al
      6. Phosphorus fractionation
         a. Exchangeable P
         b. Fe/Al-P
         c. Hydrolyzable organic P
         d. Ca-P
         e. Organic-P

   C. This is a SWIM funded project and future SWIM funding is the responsibility of the Planning Department.

4. SCHEDULE:

A. FY90-91:

1. 1st Qtr:

a. Maintain monthly water quality sampling program.

b. Develop QA field sampling documentation.

2. 2nd Qtr:

a. Maintain monthly water quality sampling program.

b. Review and approve U. of FL report.

c. Present seminar on preliminary finds of report.

3. 3rd Qtr:

a. Maintain monthly water quality sampling program.

b. Data analysis and writing for the technical publication on the first year and a half of data collection and analysis of surface water and soil nutrient status.

4. 4th Qtr:

a. Maintain monthly water quality sampling program.

b. Contract initiation to sample soil nutrients for 90-91 yearly monitoring program.

B. FY 91-92:

1. 1st Qtr. Maintain monthly water quality sampling program.

2. 2nd Qtr: Maintain monthly water quality sampling program.

3. 3rd Qtr: Maintain monthly water quality sampling program.

4. 4th Qtr: Maintain monthly water quality sampling program.

5. PROGRESS TO DATE:

A. FY88-89:

4th Qtr: Initiation of in-house surface water sampling program.

B. FY89-90:

3rd Qtr: Contract amendment initiation for the Holeyland soil nutrient analysis C90-1168-A1.

6. PRODUCTS:

FY90-91:

A. 2nd Qtr: Final report by University of Florida, Soil Science Department on the soil nutrient analysis.

B. 4th Qtr: Technical publication on the in-house surface water and soil data collected from 1988-1990.

Attachment A

HOLEY LAND WATER AND SEDIMENT QUALITY EVALUATION PROJECT

- **District Contact: Richard Pfeuffer**

CONTRACT REFERENCE: Organic and Trace Metal Water Samples Holey Land Water Quality Evaluation

1. OBJECTIVE: The objective of this task is to collect surface water and sediment quality data as required by Department of Environmental Regulations' Operating Permit.
2. DISTRICT NEED AND USE: This information is needed to fulfill specific conditions of the DER Operating Permit (No. 500809209), which requires specific water and sediment monitoring data. The data can be used to assess potential environmental impacts of surface water management decisions.
3. SCOPE: The monitoring consists of quarterly surface water sampling at seven stations located at the inflow and outflow structures. Sediment samples are collected bi-annually at four interior sites. Inorganic, trace metal, and organic parameters are evaluated in both matrices. The monitoring was initiated in July 1989. SWIM funding is used to support this project task.
4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Coordinate and conduct surface water sampling event (October).

   B. 2nd Qtr: Coordinate and conduct surface water and sediment sampling event (January).

   C. 3rd Qtr: Coordinate and conduct surface water sampling event (April).

   D. 4th Qtr: Coordinate and conduct surface water and sediment sampling event (July).
5. PROGRESS TO DATE:

   FY89-90: 4th Qtr: The first year of data collection has been completed.
6. PRODUCTS:

   FY90-91: 1st Qtr: Data compilation for FY89-90 sent to DER.

NORTH BROWARD COUNTY BISCAYNE AQUIFER THREE-DIMENSIONAL FLOW MODEL

• District Contact: Jorge Restrepo

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. This model will serve as the basis for evaluating ground water availability and development potential in the County.

2. DISTRICT NEED AND USE: The District will apply the three-dimensional ground water flow model to evaluate the condition of the ground water resources in Broward County, to determine long-term availability of the resources, and to regulate development of the resources. It is foreseen that the model will be utilized by the following departments/agencies:

   A. The Planning Department - in the development of water supply plans,

   B. The Regulation Department - as a water use cumulative impacts model for permit evaluations, and

   C. Broward County - as a model for analyzing future development and water supply scenarios.

3. SCOPE: This project is being conducted solely by the Hydrogeology Division. To accomplish the project, it will first be necessary to review and evaluate existing hydrogeologic data and information. Subsequently, the hydrogeologic information data base will be updated, and aquifer characteristics will be reevaluated. Test wells will be constructed, and up to six aquifer tests will be 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 project. External funding is not applicable.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Complete calibration and verification of transient three-dimensional model; complete sensitivity analysis; collect ground water quality sampling for the wet period.

   B. 2nd Qtr: Begin writing and preparing diagrams for technical review.

   C. 3rd Qtr:

      1. Conduct review meeting prior to draft publication completion.

      2. Internal and external technical publication review.

   D. 4th Qtr: Complete technical publication .

5. PROGRESS TO DATE:

   A. FY88-89:

      1. 3rd Qtr: Completed redefinition of study area, literature review, collection of information about existing aquifer tests

(APT's), reanalyses of APT data, and site selection for new well for APT.

2. 4th Qtr: Updated canal/lake maps, prepared land use and soil maps, horizontal discretization. Established schedule with USGS for south Broward model development.

B. FY89-90:

1. 1st Qtr. Completed rainfall and temperature data bases, collected sea water levels, and collected conservation area water levels.

2. 2nd Qtr: Reviewed water use permits; prepared public and agricultural water use spreadsheet for Broward. Began field work (drilling,logging and pump tests).

3. 3rd Qtr: Collected surface water data for District's drainage, regionalized aquifer characteristics, completed horizontal discretization. Defined canal/river network; began model discretization. Collected and analyzed ground water quality samples for one dry period.

4. 4th Qtr: Run the precipitation-recharge model, began creating input files for individual MODFLOW packages, started steady-state model calibration and sensitivity analysis for the model. Once steady-state calibration is complete, start transient model calibration.

6. PRODUCTS:

FY90-91:

A. 1st Qtr:

1. An agricultural and public water supply/water use data base.

2. Surface water spreadsheet.

3. Soil and aquifer characteristics maps.

4. A calibrated multi-layer ground water flow model which incorporates cumulative impacts of demands from several fresh water aquifers.

B. 2nd Qtr:

First draft of report documenting model development and hydrogeologic regime.

C. 3rd Qtr:

Updated drafts of the report documenting model development and hydrogeologic regime.

D. 4th Qtr:

Final technical publication.

LAKE OKEECHOBEE SEPTIC TANK STUDY

- **District Contact: Greg Sawka**

CONTRACT REFERENCE: Lake Okeechobee Septic Tank Study

1. OBJECTIVE: Survey existing septic tanks on the northern periphery of Lake Okeechobee, document and quantify nutrient loading (particularly phosphorus) into Lake Okeechobee from septic tanks and provide recommendations for phosphorus loading reduction.
2. DISTRICT NEED AND USE: In support of the SWIM Plan for Lake Okeechobee, this project is needed to assess the extent to which septic tanks contribute nutrients, especially phosphorus, into Lake Okeechobee. Septic tanks located in the drainage basin to Lake Okeechobee could represent a significant source of nutrient loading to the lake. In addition, septic tank effluent that reaches canals directly or through slow seepage may be responsible for localized water quality problems such as low dissolved oxygen, fish kills, etc. This project should develop useful information for SWIM planning.
3. SCOPE: A two-year contract is planned that consists of conducting sanitary surveys, well installations, monitoring for water quality data, and report writing. The study is planned as a joint HRS/DER District effort.
4. TASK SCHEDULE:

   FY90-91:

   A. 1st Qtr:
      1. Complete evaluation of proposals by interagency selection committee.
      2. HRS to award and execute contract with selected vendor.
      3. Begin preliminary work including sanitary survey and acquisition of sampling location.

   B. 2nd Qtr:
      1. Complete sanitary survey report including final survey results.
      2. Implement data collection and monitoring program.

   C. 3rd Qtr:
      1. Continue data collection and monitoring.
      2. Provide monthly and bi-annual reports.

   D. 4th Qtr:
      1. Continue data collection and monitoring.
      2. Provide monthly and first-year reports.

5. PROGRESS TO DATE:

FY89-90:

A. 3rd Qtr:

1. District Board approval of project.
2. Executed contract with FDHRS.
3. Meeting of interagency selection committee.

B. 4th Qtr:

1. Advertisement of project RFP by FDHRS.
2. Responses to RFP received and begin review process by selection committee.

6. PRODUCTS:

FY90-91: 1st year report on septic tank study.

EVERGLADES SYMPOSIUM

• District Contact: Steve Davis

Contract Reference: Adapotive Management Model

1. OBJECTIVE: The objectives of this project are to develop scientifically-based guidelines to protect and restore the remaining Everglades ecosystem.
2. DISTRICT NEED AND USE: This project is needed to provide a comprehensive and integrated overview of Everglades ecology in order to develop regional-scale ecosystem-level guidelines for Everglades ecological management and restoration.
3. SCOPE: Phase II of the symposium process is committed to the preparation, editing, and publication of the Everglades Symposium Proceedings Volume. Manuscripts will reflect central themes agreed upon by the steering committee: (1) Spatial/temporal patterns of ecosystem driving forces and biological responses, (2) the relationship of these patterns to persistence, and (3) implications concerning ecosystem restoration. Funding to augment publication costs has been sought through Fish and Wildlife Foundation, but has not yet been confirmed.
4. SCHEDULE: Completion dates are dependent on availability of manpower and equipment.
   A. FY90-91:
      1. 1st Qtr: Review process.
      2. 2nd Qtr: Manuscript revision.
      3. 4th Qtr: Final Manuscripts.
   B. FY91-92:
      1. 1st Qtr: Organization of manuscripts for publication.
      2. 2nd Qtr: Manuscript organization for publication of Everglades Symposium proceedings volume.
5. PROGRESS TO DATE:
   A. FY88-89:
      1. 2nd Qtr: Steering committee meeting to develop symposium themes.
      2. 3rd Qtr: Ecosystem modelling workshop.

      3rd Qtr: Contracts signed with Sheraton Key Largo and Everglades National Park.
   B. FY89-90
      1. 1st Qtr: Everglades Symposium held Oct. 22-27 in Key Largo.
      2. 2nd Qtr: Manuscript preparation.
      3. 3rd Qtr: Manuscript preparation.
      4. 4th Qtr: Steering committee meeting; creation of editorial board, organization of editing process.

6. PRODUCTS:

A. FY 89-90

Video of Everglades Symposium.

A. FY90-91:

1. 1st Qtr: 1st draft of Symposium manuscripts.
2. 3rd Qtr: Revised manuscripts.
3. 4th Qtr: Final Manuscripts for publication.

COMPLIANCE MONITORING, WORKS OF THE DISTRICT

- **District Contact: Greg Sawka**

CONTRACT REFERENCE: Sample analysis - $70,000

1. OBJECTIVE: This monitoring effort is to provide routine water quality sampling in support of the Lake Okeechobee SWIM, Works of the District Rule 40E-61. The target basins for this monitoring effort are S-71(C-41), S-72 (C-40), S-127 (L-48) and Industrial Canal (Clewiston). In addition, sampling results will aid in the assessment of runoff water quality in the target basins.

2. DISTRICT NEED AND USE: The results will be used to determine if permitted agricultural operators are in compliance with SWIM standards. If surface water quality standards are not achieved on permitted parcels, results will be used as a tool to get operators in compliance. In addition, results will be used to build cases for regulatory enforcement action as defined in Rule 40E-61 and in support of regulatory projects, for permits processed in the C-40, C-41, L-48 and Industrial Canal Basins. The project will help District management determine the impact that agricultural lands have on water quality entering Lake Okeechobee from these target basins.

3. SCOPE: This program will involve the collection of routine surface water grab samples, at permitted agricultural parcels, as identified by the District's Regulatory Department, Field Engineering Division. This is a multi-year water quality sampling effort in support of the District's Regulation Department and their implementation of the Works of the District SWIM Rule 40E-61. In addition, results of this sampling effort will support the District's Research and Evaluation and Planning Departments in their assessment of the quality of water entering Lake Okeechobee and the development of alternative management strategies to improve water quality in the target basins. The Chemistry Laboratory Division and the Florida Department of Environmental Regulation (DER) will provide analytical chemistry support. External funding will come from state SWIM funds for equipment to implement this monitoring program.

4. SCHEDULE: Water quality samples will be collected biweekly at stations identified in the target basins C-41, C-40, L-48 and Industrial Canal. Four Caloosahatchee River water quality stations will also be sampled over eight weeks at the upstream sides of S-78, S-79, S-235, and S-47D.

5. PROGRESS TO DATE: Water quality sampling will begin in the 1st Quarter of FY 90-91 in November 1990. Water quality sampling and number of sites will be dependent on the number of permits processed by the Field Engineering Division.

6. PRODUCTS:

   FY 90-91: Water quality data.

LOWER WEST COAST

NICODEMUS SLOUGH

• District Contact: Peter David

1. OBJECTIVE: The objectives of this project are to monitor efforts to restore wetland vegetation in the slough.

2. DISTRICT NEED AND USE: This project is needed to meet DER permit requirements, and to evaluate the success of District efforts to restore natural conditions on lands purchased under the Save Our Rivers initiative, through the Land Management Department.

3. SCOPE: Approximately 2200 acres were acquired in the SOR program to accommodate higher regulation schedules proposed for Lake Okeechobee. Installation of a new water control structure at S-5 and modifications to the C-19/L-41/42 system will enable the retention and manipulation of flood waters to restore slough wetlands. DER permit was issued for dredge and fill activities occurring in the construction phase. Restoration of wetlands in the slough will meet DER mitigation requirements. District will install vegetation transects and annually monitor changes in plant communities in relation to restored hydroperiod. Annual reports, summarizing the monitoring project, will be submitted to DER.

4. SCHEDULE:

   A. FY90-91:

      1. 1st Qtr: Submit annual report to DER.

      2. 2nd Qtr: Collect vegetation data.

      4. 4th Qtr: Collect vegetation data.

   B. FY 91-92:

      1. 1st Qtr: Submit annual report to DER.

      2. 2nd Qtr: Collect vegetation data.

5. PROGRESS TO DATE:

   FY89-90:

   A. 2nd Qtr: Completed survey of Indian mounds.

   B. 3rd Qtr: Installed one series of three vegetation transects. Completed collection of baseline data.

6. PRODUCTS:

   FY90-91:

   1st Qtr: Annual report to DER.

CALOOSAHATCHEE ESTUARY MODELING

• District Contact: Todd Tisdale

1. OBJECTIVE: The objectives of this project are to develop a mathematical model to simulate salinity dynamics in the Caloosahatchee River estuary that will be used to predict salinity conditions resulting from freshwater discharges associated with regulatory releases from Lake Okeechobee.

2. DISTRICT NEED AND USE: This project is needed to:

   A. Examine impacts of additional freshwater inflows to the Caloosahatchee River estuary caused by changes in upstream hydrologic regime.

   B. Provide salinity information in suport of project SL22.

3. SCOPE: This project will develop and implement a salinity dynamics model for the Caloosahatchee River estuary and interface it with an existing hydrodynamics model. The resulting hydrodynamics/salinity model will be used to examine the impacts of freshwater discharges on the estuary's salinity regime and will provide salinity information to support project SL22. The Water Resources and Environmental Sciences divisions, DRE, are conducting this project. No external funding has been sought.

4. TASK SCHEDULE:

   A. FY90-91:

      1. 1st Qtr: Verify that the existing hydrodynamics model adequately simulates hydrodynamics for the Caloosahatchee River estuary.

      2. 2nd Qtr: Collect and organize data needed for modeling salinity.

      3. 3rd Qtr: Calibrate and verify salinity model.

      4. 4th Qtr: Identify freshwater discharge scenarios required for optimal salinity conditions for estuaries biotic components.

   B. FY91-92:

      1. 1st Qtr. Complete first draft of technical publication.

      2. 2nd Qtr: Complete technical publication and users manual of model

5. PROGRESS TO DATE:

   FY88-89:

   A. 1st Qtr: An initial data set for modeling salinity has been collected and organized.

   B. 2nd Qtr:

      1. Examination of adequacy of existing hydrodynamics model for simulating Caloosahatchee River estuarine hydrodynamics begun.

      2. Preliminary calibration of salinity model performed.

6. PRODUCTS:

FY90-91:

A. 3rd Qtr: Calibrated and verified salinity model for Caloosahatchee River estuary.

B. 4th Qtr: Identification of freshwater discharge scenarios required for optimal salinity conditions.

CALOOSAHATCHEE ESTUARINE STUDIES

• District Contact: Robert Chamberlain

CONTRACT REFERENCE:

Estuarine Collection Identification
Caloosahatchee Estuary Remote Hydrologic Sensing

1. OBJECTIVE: The objectives of this project are to develop an environmentally sensitive estuarine management plan which will address the impacts of freshwater releases from S-79 which have historically occurred, in part, for the purpose of regulating the water level in Lake Okeechobee by: (a) defining a 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, and (b) providing information necessary for predicting estuarine health when considering a change in water management (real time management capability).

2. DISTRICT NEED AND USE: Alteration in basin flow combined with regulatory releases from Lake Okeechobee have resulted in downstream impacts on the Caloosahatchee Estuary. This project is needed to:

   A. Comply with the District's mission statement to protect and enhance water quality by: (1) assessing the current environmental condition of the estuary and developing a management plan to maintain and improve that condition, and (2) providing instantaneous conductivity information, in combination with information gained from the environmental assessment, to make "real time management decisions" when regulatory releases are required.

   B. Provide information useful for evaluating the impacts associated with: (1) LOTAC diversion recommendations for the S-4 Basin, (2) recommendation that may result from a contract scheduled for start-up in FY90-91 that will evaluate the current loading of nutrients and toxins to C-43, (3) recommendations that result from SWIM activities in the Charlotte Harbor area.

   This is a SWIM funded project. Support for both contracts come solely from District funds. Development and evaluation of Contract C90-1320 has been a cooperative effort between Environmental Sciences, Data Management, and the Electronic Division in the Resource Operations Department.

3. SCOPE: The program scope includes components to provide better information concerning the environmental impacts on the estuary when considering: (1) regulatory discharges, (2) changes in basin water management practices, and (3) recommendations resulting from the current and future SWIM activities in the Charlotte Harbor area.

   A. SL22 required more than three years of environmental sampling of estuarine flora, fauna and water quality to evaluate the environmental influence of various discharge volumes. A District technical publication is planned that evaluates the environmental condition of the estuary related to the parameters sampled and the discharges that occurred.

B. The Caloosahatchee Estuary hydrodynamic/salinity model being verified and calibrated, is important to the completion of the environmental assessment technical publication. The model will allow prediction of salinity conditions within the estuary for various discharge volumes. SL22 continues to provide staff time and information necessary for model completion.

C. A RFP has been advertised and is scheduled for execution during 4th Qtr FY89-90 or the 1st Qtr FY90-91. This contract seeks to install conductivity sensors with remote link-up to the District's West Palm Beach headquarters to monitor conductivity/discharge responses in the Caloosahtchee River. There will also be periodic retrieval and archive of the data by the Data Management Division. Installation of sensors and link-up completion is tentatively planned for 1st Qtr. FY91-92. The contract will require maintenance of the system for possibly three years.

D. A Caloosahatchee Estuary Management Plan will be developed in cooperation with the Planning Department which will employee the results and information provided by the above three components.

4. SCHEDULE:

A. FY90-91:

1. 1st Qtr:

a. Continue sample identification and data management/storage.

b. Continue preliminary data analysis.

c. Execute contract and begin.

2. 2nd Qtr:

a. Complete sample identification.

b. Continue data management/storage and preliminary analysis.

c. Negotiate transfer of contract to Electronics Division.

d. Begin literature review.

3. 3rd Qtr:

a. Same as 5b. and c. above.

b. Complete literature review.

c. Continue support for contract management.

4. 4th Qtr:

a. Complete literature review.

b. Begin data analysis.

c. Continue support for contract management.

d. Assist in the technical publication write up of the model which is tentative scheduled for this Qtr.

5. Other:

   a. Provide information and staff time in support of modelling effort.

   b. Provide information as needed regarding Charlotte Harbor SWIM, Lake Okeechobee regulatory releases and basin water management.

B. FY91-92:

1. 1st Qtr:

   a. Complete data analysis.

   b. Present seminar on results of study.

   c. Verify that remote sensors are operating successfully and continue contract management for maintenance.

2. 2nd Qtr:

   a. Complete first draft of technical publication and submit for review.

   b. Continue contact management.

   c. Complete the technical publication for environmental assessment.

3. 3rd Qtr:

   a. Synthesize the reviews and begin the final draft of the technical publication.

   b. Begin the development and write-up of the Caloosahatchee Estuary Management Plan (CEMP) technical publication.

4. 4th Qtr:

   Continue preparation of the first draft of the CEMP technical publication planned for completion at end of 1st Qtr. FY92-93 c. continue contract management d. Continue contract management.

5. Other:

   a. Same as 5.b for FY90-91.

   b. Discuss results of environmental assessment with District staff. Present results in District seminars, interagency meetings (eg. SWIM), outside symposiums and professional journals.

5. <u>PROGRESS TO DATE</u>:

A. FY88-89:

1. 1st & 2nd Qtr:

   a. Continued routine sampling.

   b. Managed contract providing identification of sample organisms.

2. 3rd Qtr:
   a. Terminated sampling.
   b. Same as 1.b. above.
3. 4th Qtr:

   Manage contract providing identifications.
4. Other:

   Provided support information regarding:
   a. Modelling efforts.
   b. LOTAC recommendations.
   c. Basin water management.

B. FY89-90: Progress on SL22 did not proceed as quickly as scheduled because of loss of staff and additional responsibility due to department reorganization.

1. 1st & 2nd Qtr:
   a. Provided data set to calibrate model.
   b. Data management and storage.
   c. Managed contract providing identifications.
   d. Began development of RFP for contract which required interdivision and cross-department cooperation to insure technical accuracy.
2. 2nd Qtr: Began preliminary data analysis.
3. 3rd Qtr:
   a. Contract management providing identification.
   b. Submitted RFP scope of work for contract.
   c. Data management/storage.
4. 4th Qtr:
   a. Select contractor, negotiate price and execute contract if no problems arise.
   b. Continue data management/storage.
   c. Continue preliminary analysis.
   d. Continue contract management providing identifications.
5. Other:

   Provide support information regarding: a. model development b. development of C-43 basin assessment contract c. development of contract providing a study design for the assessment of nutrient impacts on estuaries.

6. PRODUCTS:

A. FY90-91:

1st Qtr: Executed and working contract to install conductivity recorders.

B. FY 91-92:

3rd Qtr: Draft Technical Publication on CEMP.

CALOOSAHATCHEE RIVER WATER QUALITY MONITORING

• District Contact: Larry Grosser

1. OBJECTIVE: The objective of this task is to collect surface water quality, hydrologic and meteorologic data along the Caloosahatchee River, and to provide a water chemistry database for routine and special water quality evaluations.

2. DISTRICT NEED AND USE: The data will be used in the SWIM project for the evaluation of downstream impacts from diversion of S-4. The data will also be useful for calibrating and verifying the models that are developed for predicting the effects of nutrient discharges on the receiving estuary. The Departments of Regulation, Research & Evaluation and Operations and Maintenance will use the data for criteria development, water quality loadings calculations and special projects (e.g., Nicodemous Slough Plan) and documentation of project structure operations, respectively. Water chemistry data will also 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.

3. SCOPE: Sampling locations have been selected at major water control points to detect significant changes in short-term and long-term water quality. Hydrologic parameter measurements and meteorological data supplied by Data Management Division include water levels, flow, structure operations and rainfall. Water quality stations are presently sampled every eight weeks and analyses are performed by Chemistry Laboratory Division. External funding has not been sought for this project (not applicable).

4. SCHEDULE: Four Caloosahatchee River water quality stations are sampled every eight weeks at the upstream sides of S-78, S-79, S-235, and S-47D.

5. PROGRESS TO DATE: This is an ongoing task which was initiated in 1978.

6. PRODUCTS:

   FY90-91:

   A. 3rd Qtr: Caloosahatchee River Quality Assurance Plan and Standard Operating Procedures.

   B. 4th Qtr: Caloosahatchee River Quality Assurance Systems Audit.

WESTERN COLLIER COUNTY 3-D MODEL/GROUND WATER RESOURCE ASSESSMENT

• District Contact: Michael W. Bennett

1. OBJECTIVE: This project will provide the District with a three-dimensional ground water flow model that will be used in 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 water use management plans, permit evaluations, and drought impact assessments. It will have significantly greater capabilities than the present models used by the District in assessing the interaction between the various aquifers and the connection between ground and surface waters. It is foreseen that the model will be utilized by the following departments/agencies:

   A. Planning Department - in the development of water supply plans

   B. Regulation Department - as a water use cumulative impact model for permit evaluations, and

   C. Collier Co./City of Naples - as a model for analyzing future development and water supply scenarios.

3. SCOPE: This study is being conducted solely by the Hydrogeology Division and encompasses all of Collier County west of SR29 and adjacent land in Lee and Hendry Counties. The study will utilize the existing hydrogeologic data base along with updated land and water use data. A three-dimensional ground-water flow model will be developed using this information and subsequently calibrated. This model will be used to determine the long term development potential of the water resource(s) within the County. When coupled with existing three-dimensional models of surrounding counties, the model could be used to evaluate interactions of the regional multi-aquifer system. External funding is not applicable.

4. SCHEDULE:

   A. FY90-91:

      1. 1st Qtr: Complete calibration and verification of transient three-dimensional model; complete sensitivity analysis. Conduct review meeting regarding draft publication.

      2. 2nd Qtr: Begin writing and preparing diagrams for technical publication; complete first draft.

      3. 3rd Qtr: Internal and external technical publication review.

      4. 4th Qtr: Draft technical publication

   B. FY91-92

      2nd Qtr: Complete technical publication.

5. PROGRESS TO DATE:

   A. FY88-89:

      1. 3rd Qtr: Reviewed existing literature and previous ground water studies in Lee, Hendry and Collier Counties.

2. 4th Qtr: Updated hydrogeologic parameters within study area; compiled rainfall data; constructed rainfall contour maps.

B. FY89-90:

1. 1st Qtr: Constructed ground-water network to be used in model calibration; collected ground water levels; constructed water level spreadsheet; and constructed ground water level maps. Compiled hydraulic parameter spreadsheet and constructed K,T,S. and leakance contour maps of the various aquifers.

2. 2nd Qtr: Reviewed water use permits;compiled public and agricultural water use spreadsheet for Collier and portions of Lee and Hendry Counties.

3. 3rd Qtr: Defined canal/river network; collected surface water parameters; compiled surface water spreadsheet; compiled land use and soils maps for study area. Began model discretization.

4. 4th Qtr: Begin creating input files for the individual MODFLOW packages; start steady-state model calibration. Once steady-state calibration is complete, start transient model calibration.

6. PRODUCTS:

FY90-91:

A. 1st Qtr:

1. An updated agricultural and public water supply/water use data base.

2. An updated surface water spreadsheet.

3. Updated soils and aquifer characteristics maps.

4. A calibrated multi-layer ground water flow model which incorporates cumulative impacts of demands from several fresh water aquifers.

B. 2nd Qtr: First draft of report documenting model development and hydrogeologic regime.

C. 3rd Qtr: Updated drafts of the report documenting model development and hydrogeologic regime.

D. 4th Qtr: Draft technical publication.

FLORIDAN AQUIFER RESOURCE ASSESSMENT STUDY: LOWER WEST COAST

- **District Contact: Michael W. Bennett**

1. OBJECTIVE: This project will provide the District with a three-dimensional ground water flow model that will be used in assessing the availability of ground water from the Floridan Aquifer System (FAS) for reverse osmosis/ASR development.

2. DISTRICT NEED AND USE: The model will be used in the development of the water use management plan and permit evaluations for future reverse osmosis/ASR development of the FAS. Once the model is developed, it will be utilized by:

   A. Planning Department - in the development of future water supply plans for the FAS,

   B. Regulation Department - as a water use cumulative impact model for future permit evaluations, and

   C. Lower West Coast Area - as a model for analyzing future development and water supply scenarios.

3. SCOPE: This project will be conducted solely by the Hydrogeology Division. This project will last for three years and consist of existing data compilation, field data collection, model development and documentation. The study will encompass the Lower West Coast Planning area and will utilize all existing hydrogeologic and water quality data along with updated information. Using this information, a three-dimensional ground water flow model will be developed, calibrated, and verified. This model will be used to determine the long term ASR/reverse osmosis development potential of the FAS. External funding is not applicable.

4. SCHEDULE:

   FY90-91:

   A. 1st Qtr: Desktop compilation of all existing hydrogeologic and water quality data within the study area. Identify data gaps, construct ground water monitor network, review existing literature and previous ground water studies.

   B. 2nd Qtr: Review all available geophysical and geologic logs of previously drilled Floridan wells. Construct contour map of the re-evaluated hydrogeologic and water quality parameters; begin collecting water levels from ground water monitor network.

   C. 3rd Qtr: Gather all pertinent water use data from Regulation Department; compile water use spreadsheet for FAS. If necessary, expand ground water monitor network to provide definition and resolution of the Floridan potentiometric surfaces.

   D. 4th Qtr: Define model boundaries, establish grid system and identify model layers (i.e. production zones).

5. PROGRESS TO DATE: This is a new project.

6. PRODUCTS:

FY90-91:

4th Qtr:

A. An updated water use database suitable for District's GIS.

B. A white paper summarizing the existing hydrogeologic data for the area along with the description and justification of the data collection phase.

LOWER WEST COAST SURFACE WATER MODELING

• District Contact: Nestor Garrido

1. OBJECTIVE: The objectives of this project are:
   A. To develop hydraulic/hydrologic routing models for the Six Mile Cypress Slough and Cocohatchee basins to be used in the Water Management Plan.
   B. To simulate hydroperiods and water levels that are compatible with the environmental well-being of the Six Mile Cypress Slough.
2. DISTRICT NEED AND USE: This project is needed to:
   A. Provide for the Lee County basin specific models to be used in the evaluation of hydroperiods of the Six Mile Cypress Slough.
   B. Provide for the Big Cypress basin H-H models to be used in the evaluation of alternative water management plans for the Cocohatchee basin.
3. SCOPE:
   A. Collect data (stage recorders and discharge) for the Six Mile Cypress Slough.
   B. Develop long-term simulation model--WETLAND for the Six Mile Cypress Slough.
   C. Calibrate numerical model for the Six Mile Cypress Slough.
   D. Estimate hydroperiods and water levels in the Six Mile Cypress Slough
   E. Develop SHEET2D data set for the Cocohatchee basin using a grid resolution of 0.063 square miles.
   F. Develop and refine lateral and main stem inflow hydrograph data sets for DWOPER using SHEET2D and MBR output for the Cocohatchee basin and CREAMS-WT for the Six Mile Cypress Slough.
   G. Document the Cocohatchee basin model development
   H. No other department is involved in this project.
4. SCHEDULE:
   A. FY90-91:
      1. 1st Qtr: Pre-calibration of the wetland model for the Six Mile Cypress Slough.
      2. 2nd Qtr: Six Mile Cypress Slough data collection (decision to be made whether or not to continue process). Complete calibration and verification of H-H model of the Cocohatchee basin.
      3. 3rd Qtr: Include in the modeling process of the Cocohatchee basin a salinity control structure study and the three upstream water level control structures study.
   B. FY91-92:

      3rd Qtr: Publication: documentation of the Cocohatchee study.

5. PROGRESS TO DATE:

A. FY88-89: Data collection for Six Mile Cypress Slough was started during the 2nd Qtr.

B. FY89-90:

1. 1st Qtr: The DWOPER routing model has been applied to the Cocohatchee canal. A data set has been assembled and test runs have been completed.

2. 2nd Qtr: The MBR model has been applied to the permitted projects in the Cocohatchee basin.

3. 3rd Qtr: SHEET2D has been assembled for the Cocohatchee basin and for the Six Mile Cypress Slough basin.

4. 4th Qtr: WETLAND model initial setup was completed for the Six Mile Cypress Slough.

6. PRODUCTS

FY90-91:

A. 1st Qtr: Calibrated and verified H&H model for the Cocohatchee basin.

B. 2nd Qtr:

1. Precalibrated and verified Six Mile Cypress Slough WETLAND model and documentation (via letter to Lee County).

2. Estimated hydroperiods for the Six Mile Cypress Slough.

APPENDICES

Guide 1: PROJECTS BY COUNTY OF MAJOR IMPACT

Guide 1: PROJECTS BY COUNTY

List of Projects	Page #	Broward	Charlotte	Collier	Dade	Glades	Hendry	Highlands	Lee	Martin	Monroe	Okeechobee	Orange	Osceola	Palm Beach	Polk	St. Lucie
DISTRICT WIDE																	
Technology Support - Remote Sensing	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DRE Support for GIS Administration System	2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Laboratory Planning	7	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Shortage Management	8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Land Management Department Support	9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Technical Support to Regulation Department	10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Operations and Maintenance Department Support	16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Construction Management Department Support	18	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Technical Support - Research & Evaluation Department	19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Technical Support - Planning Department	23	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	Glades	Hendry	Highlands	Lee	Martin	Monroe	Okeechobee	Orange	Osceola	Palm Beach	Polk	St. Lucie
Applied Water Resources Research	29																
Inorganic Lab Charges	32	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chemistry Laboratory Overhead	34	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Chemistry Lab Data Base	36	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Surface Water Quality Monitoring Network	37																
Pesticide Monitoring	40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Trace Metals Monitoring	43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Development of Atlases of Surface Water Management Basins	45	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Maintenance and Improvement of Existing Models	46	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Data Processing Software Support	49	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hydrologic Data Base	56	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hydrologic Data Reporting	61																

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List of Projects	Page #	Broward	Charlotte	Collier	Dade	Glades	Hendry	Highlands	Lee	Martin	Monroe	Okeechobee	Orange	Osceola	Palm Beach	Polk	St. Lucie
General Network Hydrologic Instrumentation, Maintenance, Data Collection and Processing	64	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Instrument Evaluation	83																
Hydrogeologic Data Base System Development	87																
USGS Cooperative Studies Coordination	89	X		X	X		X		X	X		X	X	X	X		X
Well Drilling/Geophysics/ Hydrogeologic Field Support	92	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Ground Water Monitoring Network	94	X		X	X		X		X	X					X		X
Ambient Ground Water Monitoring Network	96	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Aquifer Storage and Recovery	99	X									X	X					
Agricultural Demand Management	102																
SOR Land Use Planning	105			X		X		X	X	X		X		X	X	X	X

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UPPER EAST COAST																	
Loxahatchee Estuary Environmental Assessment	106									X					X		
Management of Reese Lands	108														X		
Estuarine Studies NE Florida Bay	109									X							X
Estuarine Nutrient Impacts	110									X							X
C-43 Nutrient and Toxin Loading Assessment	113																
Loxahatchee Estuary Dynamics	115									X					X		
St. Lucie Estuarine Studies	116																X
St. Lucie Ground Water Reconnaissance (Hydrogeologic Reconnaissance and Ground Water Resource Assessment of the Surficial Aquifer System of St. Lucie County, Florida)	120																X

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Osceola Ground Water Reconnaissance Study	122													X			
Martin County Surficial Aquifer System Three-Dimensional Flow Model	125									X							
Upper East Coast Floridan Aquifer Resource Assessment	127									X							X
KISSIMMEE BASIN																	
Environmental Studies of the Kissimmee River	130							X				X	X	X		X	
Demonstration and Evaluation of Biological Treatment Technologies for Nutrient Control on Dairies	133					X	X					X			X		
Boney Marsh Management Technique Evaluation	135													X			
Taylor Creek Nubbin Slough BMP Monitoring	136											X					
Lower Kissimmee River Water Quality Monitoring	138							X				X				X	

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Kissimmee Chain of Lakes Water Quality Monitoring and Modeling	140							X				X		X		X	
Dairy Monitoring - Arbuckle Creek	142															X	
Lake Istokpoga Hydrologic Project	144							X									
Glades/Highlands Counties Ground Water Resource Assessment	147					X		X									
LO/EAA/LEC																	
Everglades Nutrient Removal Project (ENR)	149	X													X		
C-51 West Flood Control	152														X		
C-111 Interim Plan	153				X												
Hydroperiod Restoration on Dupuis Reserve	155									X					X		
Wading Bird Studies	157	X			X	X	X				X				X		

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Phosphorus Dynamics and Circulation Study	159					X	X			X		X			X		
WCA Impacts, Monitoring, and Nutrient Thresholds	161	X													X		
Cattail Expansion in WCA2A	162	X													X		
Surface Water Quality Monitoring in WCA2A	164	X													X		
Vegetation Mapping by Remote Sensing Applications	165	X													X		
Sawgrass-Cattail Transpiration Study: C89-0309	167	X													X		
Factors Influencing Everglades Marsh Sustainability	169	X			X										X		
Water Quality Monitoring	171	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lake Okeechobee Ecosystem Study	172					X	X			X		X			X		
S236 Monitoring	174						X										
Lake Okeechobee Water Class I and II	175						X	X			X	X			X		

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Water Quality Evaluation of Herbicide Spray Programs	176	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Water Quality of Inflows to Everglades National Park	178				X						X						
Holey Land Study	179	X													X		
Holey Land Water and Sediment Quality Evaluation Project	181	X													X		
North Broward County Biscayne Aquifer Three-Dimensional Flow Model	182	X															
Lake Okeechobee Septic Tank Study	184											X					
Everglades Symposium	186				X						X						
Compliance Monitoring, Works of the District	188	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
LOWER WEST COAST																	
Nicodemus Slough	189					X											

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Caloosahatchee Estuary Modeling	190								X								
Caloosahatchee Estuarine Studies	192								X								
Caloosahatchee River Water Quality Monitoring	197								X								
Western Collier County 3-D Model/Ground Water Resource Assessment	198			X													
Floridan Aquifer Resource Assessment Study: Lower West Coast	200			X			X		X								
Lower West Coast Surface Water Modeling	202			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									
Technology Support - Remote Sensing	1			X		X			
DRE Support for GIS Administration System	2								
Laboratory Planning	7								
Water Shortage Management	8	X	X						X
Land Management Department Support	9			X			X		
Technical Support to Regulation Department	10	X	X	X					X
Operations and Maintenance Department Support	16							X	
Construction Management Department Support	18							X	
Technical Support - Research & Evaluation Department	19	X							
Technical Support - Planning Department	23	X	X						X
Applied Water Resources Research	29				X			X	

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List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Inorganic Lab Charges	32								
Chemistry Laboratory Overhead	34								
Chemistry Lab Data Base	36								
Surface Water Quality Monitoring Network	37					X		X	
Pesticide Monitoring	40	X						X	
Trace Metals Monitoring	43		X					X	
Development of Atlases of Surface Water management Basins	45	X					X	X	
Maintenance and Improvement of Existing Models	46	X	X	X	X	X		X	X
Data Processing Software Support	49								
Hydrologic Data Base	56				X			X	X
Hydrologic Data Reporting	61	X	X		X			X	X
General Network Hydrologic Instrumentation, Maintenance, Data Collection and Processing	64				X			X	

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List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Instrument Evaluation	83								
Hydrogeologic Data Base System Development	87								
USGS Cooperative Studies Coordination	89	X	X					X	X
Well Drilling/Geophysics/ Hydrogeologic Field Support	92	X	X						X
Ground Water Monitoring Network	94	X	X						X
Ambient Ground Water Monitoring Network	96	X	X						X
Aquifer Storage and Recovery	99	X	X						X
Agricultural Demand Management	102	X							
SOR Land Use Planning	105	X		X			X	X	
UPPER EAST COAST									
Loxahatchee Estuary Environmental Assessment	106					X			

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List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Management of Reese Lands	108			X			X		
Estuarine Studies NE Florida Bay	109			X		X			
Estuarine Nutrient Impacts	110					X		X	
C-43 Nutrient and Toxin Loading Assessment	113					X		X	
Loxahatchee Estuary Dynamics	115					X			
St. Lucie Estuarine Studies	116					X		X	
St. Lucie Ground Water Reconnaissance (Hydrogeologic Reconnaissance and Ground Water Resource Assessment of the Surficial Aquifer System of St. Lucie County, Florida)	120	X	X	X			X	X	X
Osceola Ground Water Reconnaissance Study	122	X	X						X

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List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Martin County Surficial Aquifer System Three-Dimensional Flow Model	125	X	X	X			X	X	X
Upper East Coast Floridan Aquifer Resource Assessment	127	X	X						X
KISSIMMEE BASIN									
Environmental Studies of the Kissimmee River	130			X			X	X	
Demonstration and Evaluation of Biological Treatment Technologies for Nutrient Control on Dairies	133	X							
Boney Marsh Management Technique Evaluation	135			X					
Taylor Creek Nubbin Slough BMP Monitoring	136	X			X			X	
Lower Kissimmee River Water Quality Monitoring	138	X			X			X	
Kissimmee Chain of Lakes Water Quality Monitoring and Modeling	140				X			X	

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List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Dairy Monitoring - Arbuckle Creek	142	X						X	
Lake Istokpoga Hydrologic Project	144				X			X	
Glades/Highlands Counties Ground Water Resource Assessment	147	X	X	X			X		X
LO/EAA/LEC									
Everglades Nutrient Removal Project (ENR)	149			X					
C-51 West Flood Control	152		X					X	
C-111 Interim Plan	153			X				X	
Hydroperiod Restoration on Dupuis Reserve	155			X			X		
Wading Bird Studies	157			X	X				
Phosphorus Dynamics and Circulation Study	159	X			X				
WCA Impacts, Monitoring, and Nutrient Thresholds	161	X		X					
Cattail Expansion in WCA2A	162	X		X					

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Surface Water Quality Monitoring in WCA2A	164	X		X					
Vegetation Mapping by Remote Sensing Applications	165			X			X		
Sawgrass-Cattail Transpiration Study: C89-0309	167			X					
Factors Influencing Everglades Marsh Sustainability	169			X					
Water Quality Monitoring	171			X	X	X		X	
Lake Okeechobee Ecosystem Study	172			X	X				
S236 Monitoring	174							X	
Lake Okeechobee Water Class I and II	175				X				
Water Quality Evaluation of Herbicide Spray Programs	176				X			X	
Water Quality of Inflows to Everglades National Park	178			X				X	

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Holey Land Study	179			X					
Holey Land Water and Sediment Quality Evaluation Project	181			X					
North Broward County Biscayne Aquifer Three-Dimensional Flow Model	182	X	X	X			X	X	X
Lake Okeechobee Septic Tank Study	184		X						
Everglades Symposium	186			X					
Compliance Monitoring, Works of the District	188	X							
LOWER WEST COAST									
Nicodemus Slough	189			X					
Caloosahatchee Estuary Modeling	190					X			
Caloosahatchee Estuarine Studies	192					X			
Caloosahatchee River Water Quality Monitoring	197							X	

Guide 2: PROJECTS BY LAND USE

List of Projects	Page #	Agricultural Development	Urban Development	Wetlands	Lakes	Estuaries	Uplands	Canals/Rivers	Wellfields
Western Collier County 3-D Model/Ground Water Resource Assessment	198	X	X	X			X	X	X
Floridan Aquifer Resource Assessment Study: Lower West Coast	200	X	X						X
Lower West Coast Surface Water Modeling	202		X	X			X	X	

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											
Technology Support - Remote Sensing	1	X									
DRE Support for GIS Administration System	2										
Laboratory Planning	7								X		
Water Shortage Management	8	X	X	X	X		X	X		X	
Land Management Department Support	9	X								X	
Technical Support to Regulation Department	10				X					X	
Operations and Maintenance Department Support	16			X							
Construction Management Department Support	18			X							
Technical Support - Research & Evaluation Department	19				X					X	
Technical Support - Planning Department	23			X	X			X	X	X	
Applied Water Resources Research	29			X							
Inorganic Lab Charges	32								X		
Chemistry Laboratory Overhead	34								X		
Chemistry Lab Data Base	36								X		
Surface Water Quality Monitoring Network	37								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
Pesticide Monitoring	40								X		
Trace Metals Monitoring	43								X		
Development of Atlases of Surface Water Management Basins	45			X							
Maintenance and Improvement of Existing Models	46			X							
Data Processing Software Support	49			X							
Hydrologic Data Base	56			X							
Hydrologic Data Reporting	61			X			X				
General Network Hydrologic Instrumentation, Maintenance, Data Collection and Processing	64			X			X				
Instrument Evaluation	83										
Hydrogeologic Data Base System Development	87				X						
USGS Cooperative Studies Coordination	89			X	X						
Well Drilling/Geophysics/ Hydrogeologic Field Support	92				X						
Ground Water Monitoring Network	94				X					X	
Ambient Ground Water Monitoring Network	96				X				X		
Aquifer Storage and Recovery	99				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
Agricultural Demand Management	102									X	
SOR Land Use Planning	105	X		X				X			X
UPPER EAST COAST											
Loxahatchee Estuary Environmental Assessment	106	X		X							
Management of Reese Lands	108	X		X							
Estuarine Studies NE Florida Bay	109	X									
Estuarine Nutrient Impacts	110	X									
C-43 Nutrient and Toxin Loading Assessment	113	X							X		
Loxahatchee Estuary Dynamics	115	X									
St.Lucie Estuarine Studies	116	X									
St. Lucie Ground Water Reconnaissance (Hydrogeologic Reconnaissance and Ground Water Resource Assessment of the Surficial Aquifer System of St. Lucie County, Florida)	120				X					X	
Osceola Ground Water Reconnaissance Study	122				X					X	
Martin County Surficial Aquifer System Three-Dimensional Flow Model	125				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
Upper East Coast Floridan Aquifer Resource Assessment	127				X					X	
KISSIMMEE BASIN											
Environmental Studies of the Kissimmee River	130	X		X		X			X		
Demonstration and Evaluation of Biological Treatment Technologies for Nutrient Control on Dairies	133										X
Boney Marsh Management Technique Evaluation	135	X		X					X		
Taylor Creek Nubbin Slough BMP Monitoring	136								X		X
Lower Kissimmee River Water Quality Monitoring	138								X		
Kissimmee Chain of Lakes Water Quality Monitoring and Modeling	140								X		
Dairy Monitoring - Arbuckle Creek	142								X		X
Lake Istokpoga Hydrologic Project	144			X		X					
Glades/Highlands Counties Ground Water Resource Assessment	147				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
LO/EAA/LEC											
Everglades Nutrient Removal Project (ENR)	149	X		X		X			X		
C-51 West Flood Control	152			X							
C-111 Interim Plan	153	X		X							
Hydroperiod Restoration on Dupuis Reserve	155	X		X							
Wading Bird Studies	157	X		X		X					
Phosphorus Dynamics and Circulation Study	159	X				X			X		
WCA Impacts, Monitoring, and Nutrient Thresholds	161	X							X		
Cattail Expansion in WCA2A	162	X									
Surface Water Quality Monitoring in WCA2A	164	X							X		
Vegetation Mapping by Remote Sensing Applications	165	X									
Sawgrass-Cattail Transpiration Study: C89-0309	167	X									
Factors Influencing Everglades Marsh Sustainability	169	X		X					X		
Water Quality Monitoring	171								X		
Lake Okeechobee Ecosystem Study	172	X				X			X		
S236 Monitoring	174										

Guide 3: PROJECTS BY AREA OF STUDY

List of Projects	Page	Ecology	Economics	Hydrology	Hydrogeology	Limnology	Meteorology	Planning	Water Chemistry	Water Use	Ag. Sciences
Lake Okeechobee Water Class I and II	175	X				X			X		
Water Quality Evaluation of Herbicide Spray Programs	176								X		
Water Quality of Inflows to Everglades National Park	178								X		
Holey Land Study	179	X							X		
Holey Land Water and Sediment Quality Evaluation Project	181	X							X		
North Broward County Biscayne Aquifer Three-Dimensional Flow Model	182				X					X	
Lake Okeechobee Septic Tank Study	184								X		
Everglades Symposium	186	X									
Compliance Monitoring, Works of the District	188								X		
LOWER WEST COAST											
Nicodemus Slough	189	X		X							
Caloosahatchee Estuary Modeling	190	X									
Caloosahatchee Estuary Studies	192	X		X					X		
Caloosahatchee River Water Quality Monitoring	197	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
Western Collier County 3-D Model/Ground Water Resource Assessment	198				X					X	
Floridan Aquifer Resource Assessment Study: Lower West Coast	200				X					X	
Lower West Coast Surface Water Modeling	202			X						X	

DEPARTMENT

OF

RESEARCH AND EVALUATION

PUBLICATION LISTING

SFWMD LISTING OF TECHNICAL PUBLICATIONS available from DEPARTMENT OF RESEARCH AND EVALUATION
TECH PUBS, MEMOS REPORTS, AND STUDIES Revision Date: 7/22/91
NOTE: For SWIM PLANS call Environmental Planning Division, Planning Department
For PERMIT MANUALS call the Regulation Department. NEITHER ARE AVAILABLE FROM DRE. Thank you.

DRE#	FY	Date # & Type	Title	Author
DRE-297	1990/91	90/91 Report January 1991	Storm Event of January 15-17, 1991	DRE/O&M/ Regulation
DRE-296	1990/91	90/91 Tech Memo March 1991	Environmental Assessment of McArthur Ranch	P.G. David
DRE-295	1990/91	90/91 Report February 1991	1990 Annual Report for the Nicodemus Slough Mitigation/Monitoring Project	P.G. David, V.B. Osmondson
DRE-294	1990/91	91-02 Tech Pub March 1991	Environmental Responses to the Kissimmee River Demonstration Project	L.A. Toth
DRE-293	1990/91	91-01 Tech Pub Vol 2 (See 85-02) January 1991	Pesticide Residue Monitoring in Sediment and Surface Water Within the SFWMD-Vol. 2 (See 85-02)	R.J. Pfeuffer
DRE-292	1990/91	90/91 Tech Memo November 1990	Herbicide Monitoring Program For N-Methylformamide and Fluridone (Sonar)	R.J. Pfeuffer/WQ
DRE-291	1990/91	90/91 Tech Memo October 1990	Frequency Analysis of One and Three-Day Rainfall Maxima for Central and Southern Florida	Trimble/WR

DRE-290	1989/90	90-04 Tech Pub	A 3-D Finite Difference GW Flow Model of Hendry County	Keith Smith/Hydro-geolist
DRE-289	1989/90	90-03 Tech Pub	Sawgrass and Cattail Nutrient Flux: Leaf Turnover, Decomposition, and Nutrient Flux of Sawgrass and Cattail in the Everglades	S.Davis/E.S.
DRE-288	1989/90	90-02 Tech Pub	Application of Drastic Ground Water Pollution Potential Mapping Methodology to the SFWMD	J. Herr/WQ
DRE-287	1989/90	90-01 Tech Pub	A Three-Dimensional Finite Difference Ground Water Flow Model of Lee County, Florida	Bower, Adams, Restrepo/Hydro.
DRE-286	1989/90	9/90 Spec. Report	Analysis of the 1989-1990 Drought	Trimble, Marban, Molina, Sculley/WR
DRE-285	1989/90	6/90 Tech Memo	Lake Okeechobee Water Quality Monitoring-Annual Report, Year Five	Jones, Soballe/WQ
DRE-284	1989/90	5/90 Final Draft	Final Draft: Monitoring and Operating Plan for C-111 Interim Construction Project (Permit #131654749) Submitted to DER	D. Worth, Proj. Mgr./ E.S.
DRE-283	1989/90	2/90 QA Plan	Generic Quality Assurance Plan - Prepared by SFWMD for DER and DHRS	DRE, EO
DRE-282	1989/90	12/89 Tech Memo	Lake Watch Report-1988; The Status of Algal Blooms on Lake Okeechobee in 1988	Maceina/E.S.
DRE-281	1989/90	10/89 Special Report	Analysis of the 1988/89 Drought	Marban, Sculley, Trimble/W.R.

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DRE-297	1990/91	90/91E Tech Memo January 1991	Storm Event of January 15-17, 1991	DRE/O&M/ Regulation
DRE-296	1990/91	90/91C Tech Memo March 1991	Environmental Assessment of McArthur Ranch	P.G. David
DRE-295	1990/91	90/91D Report February 1991	1990 Annual Report for the Nicodemus Slough Mitigation/Monitoring Project	P.G. David, V.B. Osmondson
DRE-294	1990/91	91-02 Tech Pub March 1991	Environmental Responses to the Kissimmee River Demonstration Project	L.A. Toth
DRE-293	1990/91	91-01 Tech Pub Vol 2 (See 85-02) January 1991	Pesticide Residue Monitoring in Sediment and Surface Water Within the SFWMD-Vol. 2 (See 85-02)	R.J. Pfeuffer
DRE-292	1990/91	90/91B Tech Memo November 1990	Herbicide Monitoring Program For N-Methylformamide and Fluridone (Sonar)	R.J. Pfeuffer/WQ
DRE-291	1990/91	90/91A Tech Memo October 1990	Frequency Analysis of One and Three-Day Rainfall Maxima for Central and Southern Florida	Trimble/WR

DRE-290	1989/90	90-04 Tech Pub	A 3-D Finite Difference GW Flow Model of Hendry County	Keith Smith/Hydro-geolist
DRE-289	1989/90	90-03 Tech Pub	Sawgrass and Cattail Nutrient Flux: Leaf Turnover, Decomposition, and Nutrient Flux of Sawgrass and Cattail in the Everglades	S.Davis/E.S.
DRE-288	1989/90	90-02 Tech Pub	Application of Drastic Ground Water Pollution Potential Mapping Methodology to the SFWMD	J. Herr/WQ
DRE-287	1989/90	90-01 Tech Pub	A Three-Dimensional Finite Difference Ground Water Flow Model of Lee County, Florida	Bower, Adams, Restrepo/Hydro.
DRE-286	1989/90	9/90 Spec. Report	Analysis of the 1989-1990 Drought	Trimble, Marban, Molina, Sculley/WR
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DRE-284	1989/90	5/90 Final Draft	Final Draft: Monitoring and Operating Plan for C-111 Interim Construction Project (Permit #131654749) Submitted to DER	D. Worth, Proj. Mgr./ E.S.
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DRE-282	1989/90	12/89 Tech Memo	Lake Watch Report-1988; The Status of Algal Blooms on Lake Okeechobee in 1988	Maceina/E.S.
DRE-281	1989/90	10/89 Special Report	Analysis of the 1988/89 Drought	Marban, Sculley, Trimble/W.R.

DRE#	FY	Date # & Type	Title	Author
DRE-280	1989/90	10/89 Special Report	Executive Summary & Summary & Conclusions from Special Report: Analysis of the 1988/89 Drought	Marban, Sculley, Trimble/WR

DRE-279	1988/89	89-4 Tech Pub Part II	Ground Water Resource Assessment of Eastern Palm Beach County, Florida Part II	Shine, Padgett, Barfknecht/Hydro
DRE-278	1988/89	89-4 Tech Pub Part I	Ground Water Resource Assessment of Eastern Palm Beach County, Florida Part I	Shine, Padgett, Barfknecht/Hydro
DRE-277	1988/89	89-3 Tech Pub	A Two-Year Field Test of the Rainfall Plan: A Management Plan for Water Deliveries to Everglades National Park	Neidrauer, Cooper/WR
DRE-276	1988/89	89-2 Tech Pub	AVHRR Satellite Monitoring of Algal Blooms and Turbidity on Lake Okeechobee, Florida	Dewey Worth/E.S.
DRE-275	1988/89	89-1 Tech Pub	SFWMD Ambient Ground Water Quality	Herr, Shaw/WQ
DRE-274	1988/89	9/89 Tech Memo	An Atlas of the Everglades Agricultural Area Surface Water Management Basins	Cooper/WR
DRE-273	1988/89	9/89 Tech Memo	Lake Watch Report - 1987: The Status of Algal Blooms on Lake Okeechobee in 1987	Maceina/E.S.
DRE-272	1988/89	7/89 Special Report	Effects of Mudseal Slot Deterioration on Discharge Through Spillway Structures S-70 and S-75	Turcott, Mtundu/Data Mgt
DRE-271	1988/89	6/89 Special Report	Hydrodynamic and Salinity Analysis of a Proposed Navigation Channel in the St. Lucie Estuary	Gove/WR
DRE-270	1988/89	4/89 Tech Memo Vol. 1	Review of Predevelopment Runoff Analysis Methods - Vol. I	Lin, Perkin/WR
DRE-269	1988/89	3/89 Tech Memo	Lake Okeechobee Pesticide Monitoring Report, 1987	Pfeuffer/WQ
DRE-268	1988/89	3/89 Tech Memo	Peak Runoff Estimation From Undeveloped Lands	Cooper, Neidrauer/WR
DRE-267	1988/89	12/88	User's Guide for Multi-Basin Routing Model	Tomasello, Branscome, Perkins/WR
DRE-266	1988/89	11/88 Tech Memo	An Atlas of Martin County Surface Water Management Basins	Richard M. Cooper, Ray Santee/WR
DRE-265	1988/89	11/88 Tech Memo	An Atlas of St. Lucie County Surface Water Management Basins	Cooper, Ortel/WR
DRE-264	1988/89	11/88 Report of Proceedings	Disposal of Concentrates from Brackish Water Desalting Plants: Proceedings of a Seminar (SFWMD/NWSIA)	SFWMD/NWSIA

DRE#	FY	Date # & Type	Title	Author
DRE-263	1987/88	88-13 Tech Pub	Groundwater Availability Assessment for the Surficial Aquifer on Pine Island, Lee County, Florida	Wm. Scott Burns, Richard F. Bower/Hydro
DRE-262	1987/88	88-12 Tech Pub Part 2	Ground Water Resource Assessment of Hendry County, Florida Part 2: Appendices	Keith Smith, Karin Adams/Hydro
DRE-261	1987/88	88-12 Tech Pub Part 1	Ground Water Resource Assessment of Hendry County, Florida Part 1: Text	Keith Smith, Karin Adams/Hydro
DRE-260	1987/88	88-11 Tech Pub	Flood Management Study of C-18 Basin	Steve Lin/WR
DRE-259	1987/88	88-10 Tech Pub	Sediment Characteristics and Toxic Substances in St. Lucie Estuary, Florida	Daniel Haunert/ES
DRE-258	1987/88	88-09 Tech Pub	Assessment of Urban Land Use/Stormwater Runoff	Paul Whelan, Michael Cullum/WQ
DRE-257	1987/88	88-08 Tech Pub	Herbicide Monitoring Program for the Active Ingredient Fluridone	Richard Pfeuffer/WQ
DRE-256	1987/88	88-07 Tech Pub	Caloosahatchee R. Estuary Dynamics	Peter Scarlatos/WR
DRE-255	1987/88	88-06 Tech Pub	Cattail Nutrient dynamics	Lou Toth/ES
DRE-254	1987/88	88-05 Tech Pub	Preliminary Evaluation of the Lake Okeechobee Regulation Schedule	Paul Trimble, Jorge Marban/WQ
DRE-253	1987/88	88-04 Tech Pub Part 2	Production Zones of Major Public Water Supply Wellfields for the Counties in the SFWMD, Part 2, Appendix II	Jose A. Alvarez, Dennis D. Bacon/Hydro
DRE-252	1987/88	88-04 Tech Pub Part 1	Production Zones of Major Public Water Supply Wellfields for the Counties in the SFWMD, Part 1, Text and Appendix 1	Jose A. Alvarez, Dennis D. Bacon/Hydro
DRE-251	1987/88	88-03 Tech Pub	Surface Water Quality Monitoring Network SFWMD	Guy Germain, Jon Shaw/WQ
DRE-250	1987/88	88-02 Tech Pub	Environmental Response of WCA-2A to Reduction in Regulation Schedule and Marsh Drawdown	Dewey F. Worth/ES
DRE-249	1987/88	88-01 Tech Pub	Herbicide Monitoring Program for the Active Ingredient Glyphosate	Richard J. Pfeuffer/WQ
DRE-248	1987/88	9/88 Tech Memo	Hydrologic Characteristics of the Kissimmee River Floodplain Boney Marsh Experimental Area	R. Mierau, P. Trimble/DM-WR
DRE-247	1987/88	8/88 Tech Memo	Lake Okeechobee Water Quality Monitoring Program Annual Report-Year Four	WQ
DRE-246	1987/88	6/88 Tech Memo	Permittable Water Use Estimates of the Floridan Aquifer System in the Upper East Coast Planning Area	Hydro/RPD
DRE-245	1987/88	6/88 Tech Memo	Water Budget Analysis Water Conservation Area 1	S. Lin, R. Gregg/WR

DRE#	FY	Date # & Type	Title	Author
DRE-244	1987/88	6/88 Tech Memo	An Atlas of Eastern Palm Beach County Surface Water Management Basins; w/map	Cooper, Lane/WR
DRE-243	1987/88	3/88 Tech Memo	Orlando Retrofit Water Conservation Program--Evaluation by the SFWMD	Sandra Wood/WU
DRE-242	1987/88	3/88 Tech Memo	Investigation of Water Use, Land Use, and the Groundwater Monitoring Network in Hendry County	Smith, Sharp, G. Shih/Hydro
DRE-241	1987/88	2/88 Tech Memo	Lake Okeechobee Water Quality Monitoring Program Annual Report-Year 3	WQ
DRE-240	1987/88	1/88 Tech Memo	Rural Clean Waters Program	WQ
DRE-239	1987/88	10/87 Tech Memo	An Atlas of E. Dade County Surface Water Management Basins	R.M. Cooper, Jim Lane/WR
DRE-238	1987/88	10/87 Tech Memo	One Foot Drawdown Zone of Influence Wellfields in Palm Beach County Surrounding Municipal Water Supply	Don Padgett/Hydro
	-----			
DRE-237	1986/87	87-06 Tech Pub	Effects of Hydrologic Regimes on Lifetime Production and Nutrient Dynamics of Sawgrass	Louis A. Toth/ES
DRE-236	1986/87	87-05 Tech Pub	Field Testing of Exfiltration Systems	Joycelyn Branscome, Richard S. Tomasello/WR
DRE-235	1986/87	87-04 Tech Pub	Desalination A Viable Alternative for Local Government Water Supply Planning in So. Florida	Khanal/RPD Staff
DRE-234	1986/87	87-03 Tech Pub	Vegetation Changes in the Lake Okeechobee Littoral Zone 1972-1982	James F. Milleson/ES
DRE-233	1986/87	87-02 Tech Pub	Periphyton and Water Quality Relationships in the Everglades Water Conservation Areas 1978-82	David W. Swift, Robert Nicholas/ES
DRE-232	1986/87	87-01 Tech Pub	Modeling of Hydrodynamics and Salinity in the St. Lucie Estuary	Fred Morris/WR
DRE-231	1986/87	11/87 Tech Memo	An Atlas of Broward County Surface Water Management Basins	R.M. Cooper, Jim Lane/WR
DRE-230	1986/87	8/87 Rpt. of Proceedings	Desalination in So. Florida: Proceedings of a Seminar (NWSIA and SFWMD)	SFWMD/NWSIA
DRE-229	1986/87	5/87 Special Report	Martin County Water Resource Assessment (Covers period from 1984 to 1986)	RPD
DRE-228	1986/87	3/87 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
DRE-227	1986/87	12/86 Tech Memo	Okeechobee County Airport Landfill Investigation Pilot Study	Jeffry W. Herr/WQ

DRE#	FY	Date # & Type	Title	Author

DRE-226	1985/86	86-6 Tech Pub	Frequency Analysis of SFWMD Rainfall	Shawn Sculley/WR
DRE-225	1985/86	86-5 Tech Pub	A Routing Model for the Upper Kissimmee Chain of Lakes	Andrew Fan/WR
DRE-224	1985/86	86-4 Tech Pub	Bathymetry of the St. Lucie Estuary (w/maps)	Frederick W. Morris/WR
DRE-223	1985/86	86-3 Tech Pub	South Florida Regional Routing Model	Paul Trimble/WR
DRE-222	1985/86	86-2 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
DRE-221	1985/86	86-1 Tech Pub	Appendices Preliminary Assessment of the Ground Water Resources of Western Collier County, FL-Part 2	Michael S. Knapp, Wm. Scott Burns, Timothy S. Sharp/Hydro
DRE-220	1985/86	86-1 Tech Pub	Preliminary Assessment of the Ground Water Resources of Western Collier County, FL-Part 1	Michael S. Knapp, Wm. Scott Burns, Timothy S. Sharp/Hydro
DRE-219	1985/86	8/86 Tech Memo	South Dade Agricultural Pilot Study	S. Anderson/WQ
DRE-218	1985/86	7/86 Tech Memo	Nicodemus Slough/C-19 Project Conceptual Design Report	Steve Reel/RPD Staff
DRE-217	1985/86	1/86 Report	A Proposed Work Plan on Nonconventional Water Supply Alternatives	RPD
DRE-216	1985/86	10/85 Tech Memo	Program Documentation - A General Program to Compute Flow Through Gated Culverts	Andrew Fan/WR

DRE-215	1984/85	85-03 Tech Pub (Sept. 1985)	A Wet Season Field Test of Experimental Water Deliveries to Northeast Shark River Slough	Thomas K. MacVicar/DM
DRE-214	1984/85	85-02 Tech Pub Vol 1-see 91-01)	Pesticide Residue Monitoring in Sediment and Surface Water Bodies within the SFWMD (Vol. 1-See 91-01)	Richard J. Pfeuffer/WQ
DRE-213	1984/85	85-01 Tech Pub	Short Term Effects of a Freshwater Discharge on the Biota of St. Lucie Estuary, Florida	D. Haunert, R. Startzman/ES
DRE-212	1984/85	11/85 Tech Memo	Rainfall Drought Frequency and Availability of Surface Water in Martin County	Andrew Fan/WR
DRE-211	1984/85	9/85 Tech Memo	Urban Water Demand Estimates for Martin County: 1983 Existing and Committed, and Buildout	Stephen Opalat/WR

DRE#	FY	Date # & Type	Title	Author
DRE-210	1984/85	9/85 Tech Report (July 1985)	A Wet Season Field Test of Experimental Water Deliveries to Northeast Shark River Slough August-November 1984	MacVicar/HDM
DRE-209	1984/85	8/85 Report	Report of Tropical Storm Bob July 22-24, 1985	WR/RS Op/Res Control
DRE-208	1984/85	7/85 Report	Lake Okeechobee Water Supply Management Plan	SFWMD
DRE-207	1984/85	6/85 Tech Memo	Preliminary Evaluation of Hydrologic Data Collected from the C103 Basin, Dade City	John Shaw/Hydro
DRE-206	1984/85	5/85 Report	May 9, 1985-Update Interim Drought Management Report	SFWMD:RPS, RCD, ROD, R Coord, Commun.
DRE-205	1984/85	4/85 Report	April, 1985-Update Interim Drought Management Report	SFWMD:RPS, RCD, ROD, R Coord, Commun.
DRE-204	1984/85	3/85	The Role of the SFWMD in Growth Management	Report by Warren Viessman, Dept. Env. Eng. Science/U/F
DRE-203	1984/85	12/84 Report	Preliminary Report of Rainfall Event of November 21-26, 1984 - So. Florida Coast Area	
DRE-202	1984/85	10/84 Tech Memo	Summary of 1983-84 Dry Season Hydrologic Conditions	Steve Linn/WR

DRE-201	1983/84	84-11 Tech Pub Vol. 2	Vol. 2 Evaluation of the Water Management System at a Single Family Residential Site: Hydrology and Hydraulics of Timbercreek Subdivision in Boca Raton, Florida	James R. Gregg/WR; Michael G. Cullum/WQ
DRE-200	1983/84	84-11 Tech Pub Vol. 1	Vol. 1 Evaluation of the Water Management System at a Single Family Residential Site: Hydrology and Hydraulics of Timbercreek Subdivision in Boca Raton, Florida	James R. Gregg/WR; Michael G. Cullum/WQ
DRE-199	1983/84	84-10 Tech Pub Part 1	Preliminary Water Resource Assessment of the Mid and Lower Hawthorn Aquifers in Western Lee County, Florida - Part 2, Appendices	Knapp, Burns, Sharp, Shih/Hydro
DRE-198	1983/84	84-10 Tech Pub Part 2	Preliminary Water Resource Assessment of the Mid and Lower Hawthorn Aquifers in Western Lee County, Florida - Part 1, Text	Knapp, Burns, Sharp, Shih/Hydro
DRE-197	1983/84	84-9 Tech Pub	Wading Bird Utilization of Lake Okeechobee Marshes 1977-1981	Michael Zaffke/ES
DRE-196	1983/84	84-8 Tech Pub	Cattail Leaf Production, Mortality, and Nutrient Flux in Water Conservation Area 2A	Steven M. Davis/ES

DRE#	FY	Date # & Type	Title	Author
DRE-195	1983/84	84-7 Tech Pub	Meteorological and Hydrological Analysis of the 1980/82 Drought	Steve Lin, Jim Lane, Jorge Marban/WR
DRE-194	1983/84	84-6 Tech Pub	An Evaluation of Wastewater Reuse Policy Options for the SFWMD	Bruce P. Adams, Davis J. Samples, L. Carl Woehcke/WU
DRE-193	1983/84	84-5 Tech Pub	Resistivity Investigation of the Coastal Ridge Aquifer Hydrostratigraphy Martin County, FL	A.M. Stodghill, Mark T. Stewart/Hydro
DRE-192	1983/84	84-4 Tech Pub	Phytoplankton, Chlorophyla, and Primary Production in Lake Okeechobee	B. Jones, A. Federico, WQ
DRE-191	1983/84	84-3 Tech Pub	SFWMD Model Documentation Report	T. MacVicar, T. VanLent, A. Castro
DRE-190	1983/84	84-2 Tech Pub	Hydrogeologic Data Collected from the Kissimmee Planning Area, SFWM	D. Reece, R. Belles, M. Brown/Hydro
DRE-189	1983/84	84-1 Tech Pub Part 2	Hydrogeology of the Kissimmee Planning Area, SFWM - Part 2, Appendices	J.E. Shaw, S. Trost/Hydro
DRE-188	1983/84	84-1 Tech Pub Part 1	Hydrogeology of the Kissimmee Planning Area, SFWM - Part 1, Text	J.E. Shaw, S. Trost/Hydro
DRE-187	1983/84	9/84 Tech Memo	Interim Modifications to the Faka-Union Canal Outlet System	Steve Linn/WR
DRE-186	1983/84	7/84 Tech Memo	Water Budget for Upper Kissimmee Chain of Lakes	Fan, Lin/WR
DRE-185	1983/84	7/84 Report	Evaluation Report - A Thirty Day Field Experiment of Water Deliveries to Northeast Shark River Slough (April-May 1984)	T. MacVicar, T. VanLent/DM
DRE-184	1983/84	6/84 Report	Preliminary Report of Rainfall Event May 22-31, 1984 Lower East Coast	RPD, WR, RES, OPS, FLD ENG, RES OP
DRE-183	1983/84	5/84 Report	Summary of 1983 Hydrologic Conditions Div.	WR/RPD
DRE-182	1983/84	5/84 Tech Memo	A Time Series Analysis of So. Florida Rainfall Records (Cited Draft)	Geo. Shih/RPD
DRE-181	1983/84	4/84 Tech Memo	Preliminary Evaluation of the Ground Water Monitor Network in Collier County, Florida	W.S. Burns, Geo. Shih/Hydro
DRE-180	1983/84	4/84 Tech Memo	Groundwater Quality Study of the Water Conservation Areas	D. Nealon/Hydro
DRE-179	1983/84	3/84 Tech Memo	North New River Backpumping Water Quality Impact Study Report No. 1 Preconstruction and Initial Operation	Water Chem. Div./WQ
DRE-178	1983/84	3/84 March Plan	Water Management Planning for the Western C-51 Basin	RPD Staff

DRE#	FY	Date # & Type	Title	Author
DRE-177	1983/84	10/83 Report	Report of Rainfall Event, September 22-25, 1983. North & West P.B. County	RPD/ROD/RCD

DRE-176	1982/83	.83-08 Tech Pub	Well Plugging Applications to the Inter-Aquifer Migration of Saline Groundwater in Lee County, Florida	Wm Scott Burns
DRE-175	1982/83	83-07 Tech Pub	Field Investigation into the Feasibility of Storing Fresh Water i Saline Portions of the Floridan Aquifer System, St. Lucie County, Florida	L. Wedderburn, Mike Knapp
DRE-174	1982/83	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
DRE-173	1982/83	83-05 Tech Pub	The Post Eocene Stratigraphy of Southern Collier County, Florida, July 1983	Roland Peacock
DRE-172	1982/83	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
DRE-171	1982/83	83-03 Tech Pub	Hydrogeology of the Shallow Aquifer South of Naples, Collier County.	Paul G. Jakob
DRE-170	1982/83	83-02 Tech Pub	Rainfall Averages and Selected Extremes for Central and South Florida	T.K. MacVicar
DRE-169	1982/83	83-01 Tech Pub	Upper East Coast - Water Quality Studies	A. Federico
DRE-168	1982/83	12/83 Report	Engineering, Hydro and WQ Analysis of Detention/Retention Sites: Fourth Annual Report from SFWMD to Coord. Council on the Restoration of the KR & TC/NS Basin Detention/Retention Demo Project	Goldstein
DRE-167	1982/83	6/83 Tech Memo	Preliminary Water Quality and Trophic State Assessment of the Upper Kissimmee Chain of Lakes, Florida, 1981-82	Jones, Millar, Miller, Swift, Federico
DRE-166	1982/83	5/83 Tech Memo	A Potable Water Use Data Base for South Florida - 1980	C. Woehlcke, Bucca, Loving
DRE-165	1982/83	5/83 Tech Memo	Data Analysis to Detect Rainfall Changes in South Florida	George Shih
DRE-164	1982/83	5/83 Tech Memo	Plant Communities of Water Conservation Area 3A; Base-Line Documentation prior to the Operation of S-339 and S-340	M. Zaffke
DRE-163	1982/83	3/83 Tech Memo	Surface Water Availability of the Caloosahatchee Basin	Andrew Fan, Ray Burgess

DRE#	FY	Date # & Type	Title	Author
DRE-162	1982/83	3/83 Mgmt Plan	Water Quality Management Plan for the S-2 and S-3 Drainage Basins in the Everglades Agricultural Area	RPD/Spec. Proj. Div.
DRE-161	1982/83	2/83 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
DRE-160	1982/83	1/83 Tech Memo	Lake Okeechobee Water Quality - April 1981-March 1982	B. Jones
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DRE-159	1981/82	82-08 Tech Pub	Taylor Creek Headwaters Project Phase I and Report; Water Quality. October 1982	Ritter, Allen
DRE-158	1981/82	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
DRE-157	1981/82	82-06 Tech Pub	Application of DC Resistivity Surveys to Regional Hydrogeologic Investigations, Collier County, Florida	Stewart, Lizanec, Layton
DRE-156	1981/82	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	Layton, Stewart
DRE-155	1981/82	82-04 Tech Pub	A Survey of Water Quality Characteristics and Chlorophyll a Concentrations in the Caloosahatchee River System, Florida. July 1982	Miller, Federico, Milleson
DRE-154	1981/82	82-03 Tech Pub	Water Quality Characteristics of the Lower Kissimmee River Basin, Florida	A. Federico
DRE-153	1981/82	82-02 Tech Pub	Patterns of Radiophosphorus Accumulation in the Everglades after its Introduction into Surface Water	Steve Davis
DRE-152	1981/82	82-01 Tech Pub Part 3	Hydrogeologic Reconnaissance of Lee County, Florida - Part 3, Appendices	Wedderburn, Knapp, Waltz, Burns
DRE-151	1981/82	82-01 Tech Pub Part 2	Hydrogeologic Reconnaissance of Lee County, Florida - Part 2, Atlas	Wedderburn, Knapp, Waltz, Burns
DRE-150	1981/82	82-01 Tech Pub Part 1	Hydrogeologic Reconnaissance of Lee County, Florida - Part 1, Text	Wedderburn, Knapp, Waltz, Burns
DRE-149	1981/82	12/82 Tech Memo	Upland Detention/Retention Demonstration Project (Fourth Annual Report to the Coordinating Council-KR)	Alan Goldstein

DRE#	FY	Date # & Type	Title	Author
DRE-148	1981/82	12/82 Report	Seasonal Variations of Mannings Roughness Coefficient in a Subtropical Marsh (ASAE presentation 79-82)	Shih, Rahi
DRE-147	1981/82	12/82 Report	Evapotranspiration Studies on Rice in Relation to Water Use Efficiency (ASAE presentation 79-82)	Shih, Rahi, Harrison
DRE-146	1981/82	11/82 Ex. Summ. Addend.	Water Quality Management Strategy for Lake Okeechobee	SFWMD
DRE-145	1981/82	10/82 Tech Memo	Southwest Broward County Study	Burns, Cassagnol, Millar, Nealon, Santee, Trimble, Walker
DRE-144	1981/82	6/82 Report	Report on Tropical Storm Dennis - August 16-18, 1981	SFWMD-WRD
DRE-143	1981/82	5/82 Report	Preliminary Report on Rainstorm of April 23-26, 1982	S. Lin
DRE-142	1981/82	4/82 Tech Memo	Long Term Tropical Storm Incidence-Kissimmee River Basin Rainfall Analysis	Khanal, Hamrick
DRE-141	1981/82	4/82 Report	Preliminary Report on Rainstorm March 28-29	S. Lin/J. Lane
DRE-140	1981/82	4/82 Report	Consumptive Use and Supplemental Water Requirements of Crops Grown in the Everglades Agricultural Area	N. Khanal
DRE-139	1981/82	3/82 Tech Memo	Lake Okeechobee Water Quality, April 1980 - March 1981	B.L. Jones
DRE-138	1981/82	3/82 Sum. Report	Project 2WM Summary Report - Drought Cloud Seeding Program	
DRE-137	1981/82	2/82 Report	An Analysis of Water Supply Backpumping for the Lower East Coast Planning Area	SFWMD
DRE-136	1981/82	12/81 Exec. Summ.	Water Quality Management Strategy for Lake Okeechobee - Executive Summary	RPD
DRE-135	1981/82	12/81 WQ Plan	Water Quality Management Plan	RPD
DRE-134	1981/82	11/81 Report	DRAFT - Agricultural Water Use - UECPA (Cited Draft)	Popalzai
DRE-133	1981/82	10/81 Report	Preliminary Assessment of Drainage Impacts in the East Everglades Area of Dade County	Mierau, Lane
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DRE-131	1980/81	81-5 Tech Pub	Preliminary Investigation of Periphyton and Water Quality Relationships in the Everglades Water Conservation Areas	Donald R. Swift
DRE-130	1980/81	81-4 Tech Pub	Management of Water Levels in the "Frog Pond" Area, South Dade County, Florida	Wedderburn, Trost, Lane

DRE#	FY	Date # & Type	Title	Author
DRE-129	1980/81	81-3 Tech Pub	Frequency Analysis of Rainfall Maximum for Central and South Florida	T. MacVicar
DRE-128	1980/81	81-2 Tech Pub	Lake Okeechobee Water Quality Studies and Eutrophication Assessment	Federico, Dickson, Kratzer, Davis
DRE-127	1980/81	81-1 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
DRE-126	1980/81	9/81 Report	Water Shortage Planning and review Team for County meeting, Special interest meeting, and General Public Meeting	Bruce Adams
DRE-125	1980/81	8/81 Report	A Methodology for Estimating Economic Impacts in So. Florida from Agricultural Drought Research Project - Program No. 8007	Cowne, (J. Toomey)
DRE-124	1980/81	7/81 Report	Upland Detention-Retention/Demo Project...3rd Annual Report	Goldstein/RPD
DRE-123	1980/81	6/81 Report	Agricultural Water use Modeling (Presentation at Moscow State University, Moscow)	N. Khanal
DRE-122	1980/81	6/81 Report	Indirect Flow Measuring Devices for Moscow Agricultural Water Use Data Collection (Presentation at Moscow State University)	N. Khanal
DRE-121	1980/81	5/81 Report	Water Quality Analysis in WCA 1978-79	Millar
DRE-120	1980/81	5/81 Report	Guidebook to the SFWMD's Geophysical Logging and Digitized Data Processing Techniques	Brown, Hynes, Wedderburn
DRE-119	1980/81	4/81 Report	Open Channel Flow Monitoring under Small Water and Surface Gradients	Mierau
DRE-118	1980/81	10/80 Report	1980 Annual Report - SFWMD Water Quality Monitoring Network	Kevin Dickson
DRE-117	1980/81	10/80 Report	Economics of Surface Water Runoff Storage in Brackish Aquifers in So. Florida	Stanley Winn, N. Khanal
DRE-116	1980/81	10/80 Report	Two Dimensional Interpolation and Uncertainty Estimation by an Information-weighted-Point-Spline Method (Environmetrics 81 Program Committee)	G. Shih
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DRE-115	1979/80	80-09 Tech Pub	The Stratigraphy of the Floridan Aquifer System East and Northeast of Lake Okeechobee, Florida	Rodney T. Mooney III
DRE-114	1979/80	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

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DRE-113	1979/80	80-07 Tech Pub	Plan Communities of the Kissimmee River Valley	Milleson, Goodrick, VanArman
DRE-112	1979/80	80-06 Tech Pub	Advanced Water Supply Alternatives for the Upper East Coast Planning Area, Parts 1 and 2 - August 1980	N. Khanal
DRE-111	1979/80	80-05 Tech Pub	Hydrogeologic Data Collected from the Upper East Coast Planning Area SFWMD - May 1, 1980	Weinberg, Reece, Allman
DRE-110	1979/80	80-04 Tech Pub	Effect of Urban Stormwater Runoff to a Man-Made Lake on Groundwater Quality - May 1, 1980	Weinberg, Reece, Allman
DRE-109	1979/80	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	Haunert, Startzman
DRE-108	1979/80	80-02 Tech Pub	Demonstration Project on Water Use Data Collection Storage and Retrieval System; January 1980	N. Khanal
DRE-107	1979/80	80-01 Tech Pub	Aquifer Recovery Test Data and Analyses of the Floridan Aquifer System in the Upper East Coast Planning Area, SFWMD - Jan. 1980	Michael P. Brown
DRE-106	1979/80	9/80 Report	Water Quality Aspects of the Caloosahatchee System, Phase II, 1978-79	Tom Miller
DRE-105	1979/80	8/80 Report	Hydrogeologic Investigation along Eastern Portion of Lake Okeechobee	John Shaw
DRE-104	1979/80	7/80 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
DRE-103	1979/80	7/80 Report	Boney Dike Marsh Water Budget	Paul Trimble, Ron Mierau
DRE-102	1979/80	4/80 Report	Interim Final Draft Report on Embankment Failure Florida Power and Light Company Martin Plan Cooling Reservoir	SFWMD
DRE-101	1979/80	3/80 Report	Chlorinated Hydrocarbon Pesticide Residues in Freshwater Fishes within the SFWMD	J. Milleson
DRE-100	1979/80	1/80 Report	Upland Detention/Retention Demonstration Project. Semi-Annual Report to KRCC	A. Goldstein, T. MacVicar, R. Mierau, M. Smith, R. Ulevich
DRE-99	1979/80	11/79 Report	Natural Gamma Ray/Neutron Porosity Logging	M. Brown, S. Anderson
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DRE#	FY	Date # & Type	Title	Author
DRE-97	1978/79	79-03 Tech Pub	An Analysis of Water Requirements and Water Demands for the SFWMD. December 1979	John W. Toomey, Carl Woehlcke
DRE-96	1978/79	79-02 Tech Pub	Improvement of the Canal-Aquifer Flow Regime in the C-1N Basin	D. Allman, P. Jakob, T. McCann
DRE-95	1978/79	79-01 Tech Pub	Floodplain Management Studies of the Shingle Creek Basin	S. Lin, J. Lane, T. McCann
DRE-94	1978/79	79-01 Tech Maps	Tech Map Series 79-1 -- Hydrogeologic Reconnaissance of the Floridan Aquifer System Upper East Coast Planning Area	M.P. Brown, D.E. Reece
DRE-93	1978/79	9/79 Report	DRAFT - Clad Model and its Applications	Jay Foy
DRE-92	1978/79	9/79 Report	Non-Agricultural Water use in the Upper East Coast Planning Area (Rev. Dec. 1980)	C. Woehlcke, D. Loving
DRE-91	1978/79	7/79 Report	The Application of the Receiving Water Quality Model to the Conservation Areas of So. Florida	Steve S. T. Lin
DRE-90	1978/79	7/79 Report	Mathematical Models in Water Resources	A. Shahane
DRE-89	1978/79	7/79 Report	Membrane Plants in So. Florida	N. Khanal, Stanley Winn
DRE-88	1978/79	5/79 Report	Preliminary Report on the Severe Storm of April 24-25, 1979	SFWMD
DRE-87	1978/79	5/79 Report	Interim Progress Report - Water Quality Aspects of the Caloosahatchee River System, Phase I	Thomas H. Miller
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DRE-85	1977/78	78-03 Tech Pub	Water Quality in the Everglades Agricultural Water Quality in the Everglades Agricultural Area and its Impact on Lake Okeechobee	K. Dickson, A. Federico, J. Lutz
DRE-84	1977/78	78-02 Tech Pub	Environmental Studies in the Chandler Slough Watershed	A. Federico, J. Milleson, P. Millar, M. Rosen
DRE-83	1977/78	78-01 Tech Pub	Limnological Investigations of Seven Lakes in the Istokpoga Drainage Basin	James F. Milleson
DRE-82	1977/78	6/78 Report	Overview of Cooperative WQ Studies in the SFWMD and Florida Sugar Cane League	Wtr Chem Div
DRE-81	1977/78	6/78 Report	Application of Computer Techniques for Long Range Regional Groundwater Resources Management (Presentation at 10th International Higher Hydrological Course, Moscow St. Univ., USSR, 6/10/78	Khanal
DRE-80	1977/78	6/78 Report	The Water Quality Planning Model	A. Shahane, J.R. Maloy

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DRE-79	1977/78	3/78 Report	FINAL DRAFT - Hydro. and WQ Studies in Upper Taylor Creek and Chandler Slough	D. Ammon, W. Huber, J.P. Heaney
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DRE-78	1976/77	77-06 Tech Pub	Water Quality and Nutrient Loadings of the Major Inflows from the Everglades Agricultural Area to the Conservation Areas, Southeast Florida	J. Lutz
DRE-77	1976/77	77-05 Tech Pub	Development of an Operational Water Quantity Model (with Technical Supplement)	A. Shahane
DRE-76	1976/77	77-04 Tech Pub	Water Quality Characteristics of Several Southeast Florida Canals (supplement combined with text)	J. Lutz
DRE-75	1976/77	77-03 Tech Pub	Investigations of the Relationship between Land Use, Rainfall, and Runoff Quality in the Taylor Creek Watershed	A. Federico
DRE-74	1976/77	77-02 Tech Pub	Phytoplankton and Primary Productivity Studies in Lake Okeechobee During 1974	M. Marshall
DRE-73	1976/77	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
DRE-72	1976/77	6/77 Report	A Framework of the Water Quality Planning Model for the Conservation Areas of the Florida Everglades	A. Shahane, D. Paich, R.L. Hamrick
DRE-71	1976/77	2/77 Report	Landsat Investigation of Water Quality in Lake Okeechobee	M. Marshal, J. Gervin
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DRE-70	1975/76	76-03 Tech Pub	Environmental Responses to Marshland Re-flooding in the Kissimmee River Basin	J. Milleson
DRE-69	1975/76	76-02 Tech Pub	Predictive Water Demand Model for Central and Southern Florida	N. Khanal
DRE-68	1975/76	76-01 Tech Pub	Synthetic Data Generator - A Joint Distribution Technique	T. Shih
DRE-67	1975/76	9/76 Report	C-51 Leakage	D. Allman, G. Winter
DRE-66	1975/76	8/76 Report	Water Management Plan for the Western C-9 Basin	RPD
DRE-65	1975/76	6/76 Report	Addendum to Annual Report 1974-75	RPD
DRE-63	1975/76	5/76 Report	Final Report - Environmental Resources (Note: incorporated with Management Studies of the Kissimmee River Basin by Bedient & Bowden)	Huber, Heaney

DRE#	FY	Date # & Type	Title	Author
DRE-62	1975/76	12/75 Report Part 1 - Text 12/76 Report Part 2 - Computer Programs	The Development of an Operational Water Quantity Model (FEB. 1976 - Computer Programs Developed for the Operational Water Quanity Model included.)	A. Shahane, P. Berger, R. Hamrick
DRE-61	1975/76	12/75 Report	FCD Comp Programs for Area Calculation	Sun-Fu Shih
DRE-60	1975/76	12/75 Report	Report on Investigation of Back-pumping Reversal and Alternate Water Retention Sites (Miami Canal and North New River Canal Basins Everglades Ag. Area) (Holeyland Report)	W. Storch
DRE-59	1975/76	12/75 Report	Seepage Investigation for the Holeyland	B. Cutright
DRE-58	1975/76	12/75 Report	The Recent Chlorination Controversy	A. Shahane
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DRE-57	1974/75	75-04 Tech Pub	Hydrologic Aspects of On-Site Retention Systems for Urban Storm Runoff	N. Khanal
DRE-56	1974/75	75-03 Tech Pub	Agricultural Reservoir Study	C. Tai
DRE-55	1974/75	75-02 Tech Pub	Progress Report Upper Kissimmee Chain of Lakes Water Quality and Benthic Invertebrate Sampling	J. Milleson
DRE-54	1974/75	75-01 Tech Pub	Chemical and Biological Investigations of Lake Okeechobee, January 1973 - June 1974 Interim Report	F. Davis, M. Marshall
DRE-53	1974/75	9/75 Report	FCD Backwater Profile Computation	Sun-Fu Shih
DRE-52	1974/75	8/75 Report	Guideline for Evaluation of Irrigation Use Permits	RPD
DRE-51	1974/75	7/75 Summ.	Summary of the Condition of South Florida Water Storage Areas in the 1974-75 Dry Season	W.V. Storch
DRE-50	1974/75	7/75 Report	Water Availability in the Dade County Agricultural Area	R. Mierau, R. Taylor, N. Khanal, W. Storch, G.E. Dail
DRE-49	1974/75	7/75 Report	A Framework for he Operational Water Quantity Model	Shahane, P. Berger, R. Hamrick
DRE-48	1974/75	6/75 Report	Shingle Creek Flood Plain Study	S. Lin
DRE-47	1974/75	6/75 Report	Water Use & Water Supply Development (Rough draft of Part 2)	RPD
DRE-46	1974/75	6/75 Report	Interdisciplinary Models and Optimization Techniques used in Water Resource Planning	A. Shahane
DRE-45	1974/75	3/75 Report	Lake Okeechobee Kissimmee Basin Water Quality Information (combined with L.O. Proposals for Management Actions)	W. Storch

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DRE-44	1974/75	2/75 Report	Report to the Gov. Board on Regulatory Levels for the Lakes of the Upper Kissimmee Basin	W. Storch
DRE-43	1974/75	11/74 Report	Impact of Upland Marsh on Water Quality. IIA. Dy Study; IIB. Roughness Coefficients, IIC. Quality Sampling	Sun-Fu Shih, David Hallett
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DRE-42	1973/74	74-04 Tech Pub	Supplemental Water Use in the Everglades Agricultural Area	R. Mierau
DRE-41	1973/74	74-03 Tech Pub	Water Consumption Trends within the Central and Southern Florida Control District Level Fluctuation in the Kissimmee River Valley	A. Kreitman, R. Walker, J. Beck
DRE-40	1973/74	74-02 Tech Pub	Studies of Floodplain Vegetation and Water	R. Goodrick, J. Milleson
DRE-39	1973/74	74-01 Tech Pub	Chemical Quality of Water in Conservation Area 2A and Associated Canals	P. Gleason
DRE-38	1973/74	9/74 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
DRE-37	1973/74	9/74 Report	Water Yield to Kissimmee River Basin by Use of the FCD Model	N. Khanal
DRE-36	1973/74	8/74 Report	Response to U.S. C/E Draft Survey. Review Report on the Hillsboro Canal Basin	RPD Dept
DRE-35	1973/74	7/74 Report	Memo Report on Surface Water Availability in the St. Lucie County Area	R. Mierau, R.L. Taylor, W.V. Storch
DRE-34	1973/74	7/74 Report	Summary of the Condition of South Florida Water Storage Areas in 1973-74 Dry Season	RPD
DRE-33	1973/74	7/74 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
DRE-32	1973/74	4/74 Report	Report on Progress of Hydrologic, Water Quality and Land Use Studies in the Kissimmee River Watershed and Lake Okeechobee	RPD Staff
DRE-31	1973/74	3/74 Report	A Modified Monte Carlo Technique to solve Thiessen Coefficients	T. Shih, R. Hamrick
DRE-30	1973/74	10/73 Report	Preliminary Evaluation Report on Land and Water Management Planning in the C-51 Watershed	RPD Staff
DRE-29	1973/74	10/73 Report	Water Management and Environmental Control in South Florida	W.V. Storch
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DRE-28	1972/73	7/73 Report	Kissimmee River Basin Water-Quality University of Model Study	Miami, Civil Eng. Dept.
DRE-27	1972/73	7/73 Report	Summary of the Condition of South Florida and 1972-72 Dry Season	W.V. Storch, Water Storage Areas in the 1970-71
DRE-26	1972/73	6/73 Report	Program of Lake Okeechobee Investigations	RPD
DRE-25	1972/73	6/73 Report	Evaluation of the West Palm Beach Canal Watershed Tributary to Pumping Station S-5A	RPD Staff
DRE-24	1972/73	12/72 Report	Statement on the Kissimmee Basin Project presented to the Governor and Cabinet	W.V. Storch
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DRE-22	1971/72	7/72 Report	Role of Synthetic Time Series in Hydrometeorological Data Analysis	A.N. Shahane
DRE-21	1971/72	7/72 Summary	Summary of the Condition of South Florida Water Storage Areas in the 1970-71 and 1972-72 Dry Seasons	W.V. Storch
DRE-20	1971/72	6/72 Report	A Simplified Approach to Predict Surface Runoff and Water Loss Hydrographs	Lalit K. Sinha
DRE-19	1971/72	3/72 Report	Hydrologic Data for Phase II of the Economic Model Study	N. Khanal
DRE-18	1971/72	12/71 Tech Memo	Estimation of Rainfall for the Kissimmee River Basin	L.K. Sinha, N. Khanal
DRE-17	1971/72	12/71 Tech Memo	An Operational Watershed Model: General Considerations, Purposes, and Progress	L.K. Sinha, L.E. Lindhal
DRE-16	1971/72	10/71 Tech Memo	An Approach to Operation of a Regional Primary Water Control System	W.V. Storch, R.L. Hamrick
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DRE-13	1970/71	08/71 Tech Memo	A Stochastic Model for Daily Rainfall Data Synthesis	N. Khanal, R.L. Hamrick
DRE-12	1970/71	07/71 Tech Memo	Operational Analysis of a Flood in the Lower Kissimmee River Basin	SFWMD-Engr.
DRE-11	1970/71	06/71 Tech Memo	Hydrologic Reconnaissance of Conservation Areas 1, 2 & 3 of the Central and Southern Florida Project (Report for C&SFFCD)	J.P. Heaney, W.C. Huber
DRE-10	1970/71	6/71 Report	Some Aspects of the Hydrology of Conservation Areas #3	RPD
DRE-09	1970/71	5/71 Report	Pollution Control Aspects of Water Management	W.V. Storch
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SFWMD LISTING OF TECHNICAL PUBLICATIONS available from DEPARTMENT OF RESEARCH AND EVALUATION
TECH PUBS, MEMOS REPORTS, AND STUDIES Revision Date: 7/22/91
NOTE: For SWIM PLANS call Environmental Planning Division, Planning Department
For PERMIT MANUALS call the Regulation Department. NEITHER ARE AVAILABLE FROM DRE. Thank you.

DRE#	FY	Date # & Type	Title	Author
DRE-08	1969/70	8/70 Report	Report of the Special Study Team on the Florida Everglades	G. Cornwell, R.L. Downing, A.R. Marshall, J.N. Layne
DRE-07	1969/70	1/70 Report	The Potential and Practicality of Watershed Models in Operational Water Management	L.E. Lindhal, R.L. Hamrick
DRE-06	1969/70	10/79 Report	An Operational Watershed Model; Step 1-B Regulation of Water Levels in the Kissimmee River Basin	L.K. Sinha
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DRE-05	1967/68	Memo	Some Environmental Effects of Drainage in Florida	W.V. Storch, R.L. Taylor
DRE-04	1967/68	9/68 Report	Report on Development of Hydrologic Model	L. Lindahl
DRE-03	1967/68	5/68 Report	Present and Projected Land Use Analysis of the Earman River Canal (C-17)	FCD

DRE-02	1964/65	09/65	Effect of Hurricane Betsy on Project Salinity Structures of the Central and Southern Florida Flood Control District	

DRE-01	1958/59	04/89 Report	A Report on Area B Dade and Broward Counties	FCD/Dade Co. Gov.