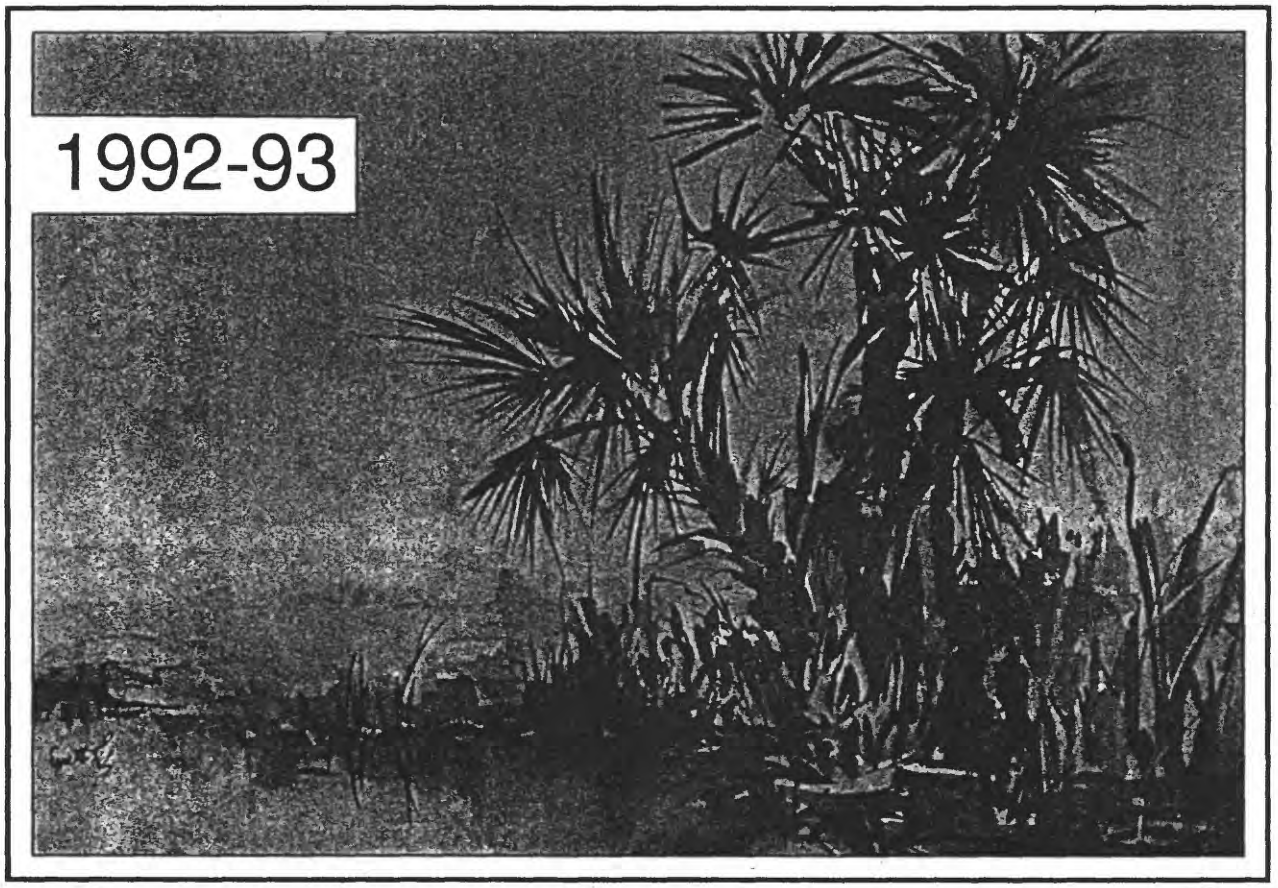
WATER RESOURCES ACTIVITIES IN FLORIDA



U.S. GEOLOGICAL SURVEY

OPEN-FILE REPORT 93-67

Prepared in cooperation with FEDERAL, STATE, and LOCAL AGENCIES

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WATER RESOURCES ACTIVITIES IN FLORIDA, 1992-93

Compiled by Mildred E. Glenn

U.S. GEOLOGICAL SURVEY
Open-File Report 93-67

IN COOPERATION WITH

Florida Dept. of Environmental Regulation
Florida Dept. of Natural Resources
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Florida Game & Fresh Water Fish Commission
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Tallahassee, Florida

1993

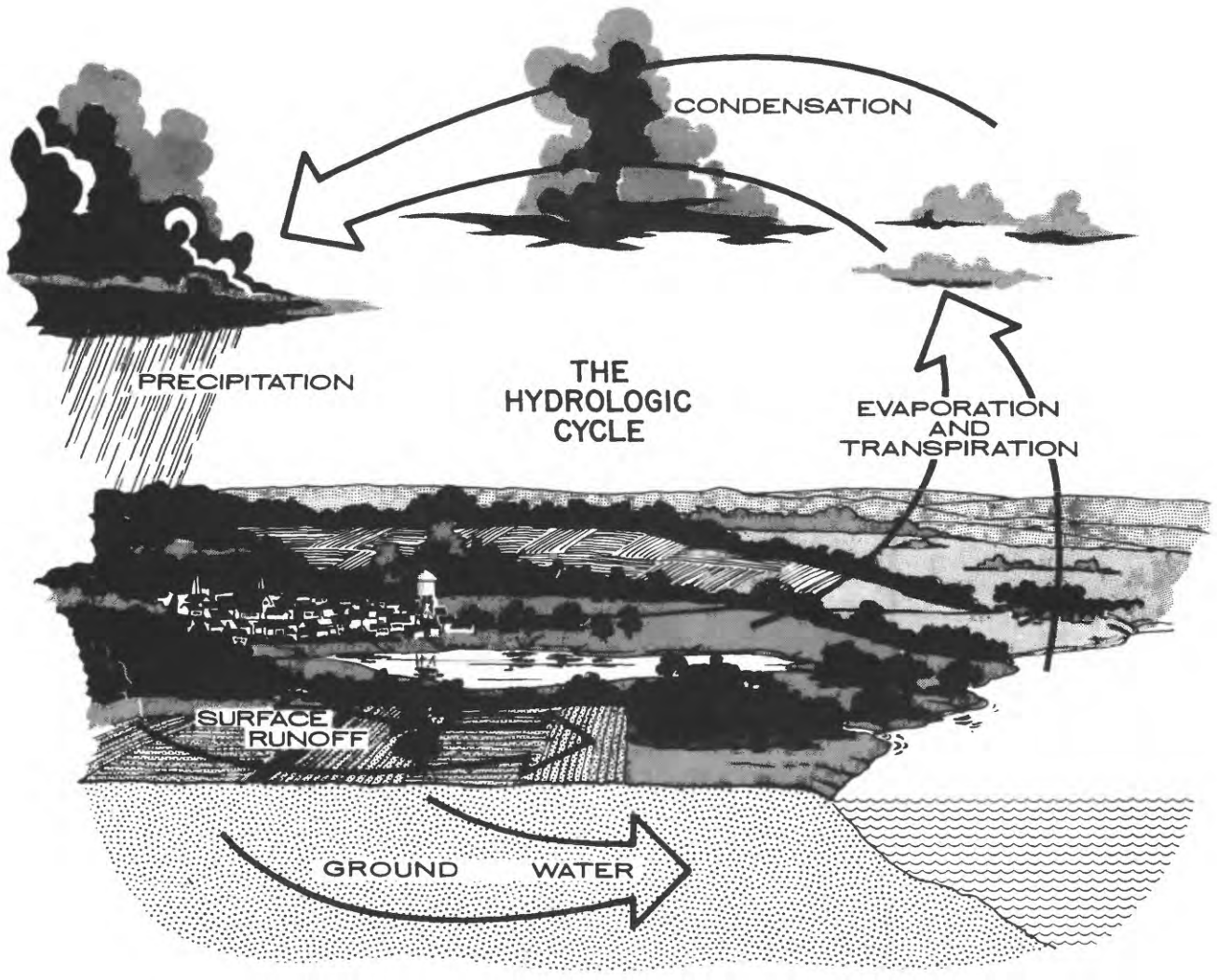
FOREWORD

The U.S. Geological Survey was created by an Act of Congress in 1879, as a bureau of the Department of the Interior, to classify public lands and to examine the geologic structure, mineral resources, and products of the national domain. Since then, the Survey's responsibilities have expanded to include topographic mapping, geochemical and geophysical studies, and the assessment of the quantity, quality, and distribution of water resources. Thus, during the past 100 years, the Survey has become the Nation's principal factfinding and research agency concerned with our physical resources. The mission of the Water Resources Division of the Survey is to provide hydrologic information needed for the development, management, and use of the Nation's water resources.

Although stream gaging began in 1884 as part of a study to identify irrigatable land, the water-resources program of the Survey began in 1894 when a small appropriation was obtained for the specific purpose of "gauging streams and determining the water supply of the United States." In the years following 1884, the need for water-resources information grew rapidly but the Survey was unable to meet the demand because of restricted budgets. Many States initiated water resource programs to fill the deficiency and the Survey worked closely with the various State agencies. However, these efforts did not satisfy the need of the States and the Nation for a comprehensive water resources information program. Accordingly, in 1928 Congress established the cooperative matching program by which the Survey's water resources programs with State agencies may be funded on a 50/50 basis. This cooperative water-resources program has grown over the years into the primary source of water information for the Nation. This is accomplished through cooperation with State and local governments and other Federal agencies by:

- Collecting data on a systematic basis to determine the quantity, quality, and use of surface and ground water.
- Conducting interpretive water-resource appraisals to describe the consequences of alternative plans for developing land and water resources.
- Conducting basic and problem-oriented research in hydraulics, hydrology, and related fields.
- Developing information on water-related natural hazards such as flood, landslides, volcanoes, mudflows, and land subsidence.
- Coordinating the activities of all Federal agencies in the acquisition of water data.
- Disseminating data and findings through reports, maps, and other forms of public release.
- Providing scientific and technical assistance in the hydrologic fields to other Federal agencies, to State and local agencies, and, on behalf of the U.S. Department of State, to international agencies.

The Water Resources, National Mapping, and Geologic Divisions are the three operating Divisions of the Survey. General information pertaining to these Divisions may be obtained from the Information Office, U.S. Geological Survey, 119 National Center, Reston, VA 22092. Circular 900, "A Guide to Obtaining Information from the U.S. Geological Survey," can be obtained free from the U.S. Geological Survey, Branch of Distribution, Federal Center, P.O. Box 25286, Denver, Colorado 80225.


CONDENSATION
PRECIPITATION
THE
HYDROLOGIC
CYCLE
EVAPORATION
AND
TRANSPIRATION
SURFACE
RUNOFF
GROUND WATER

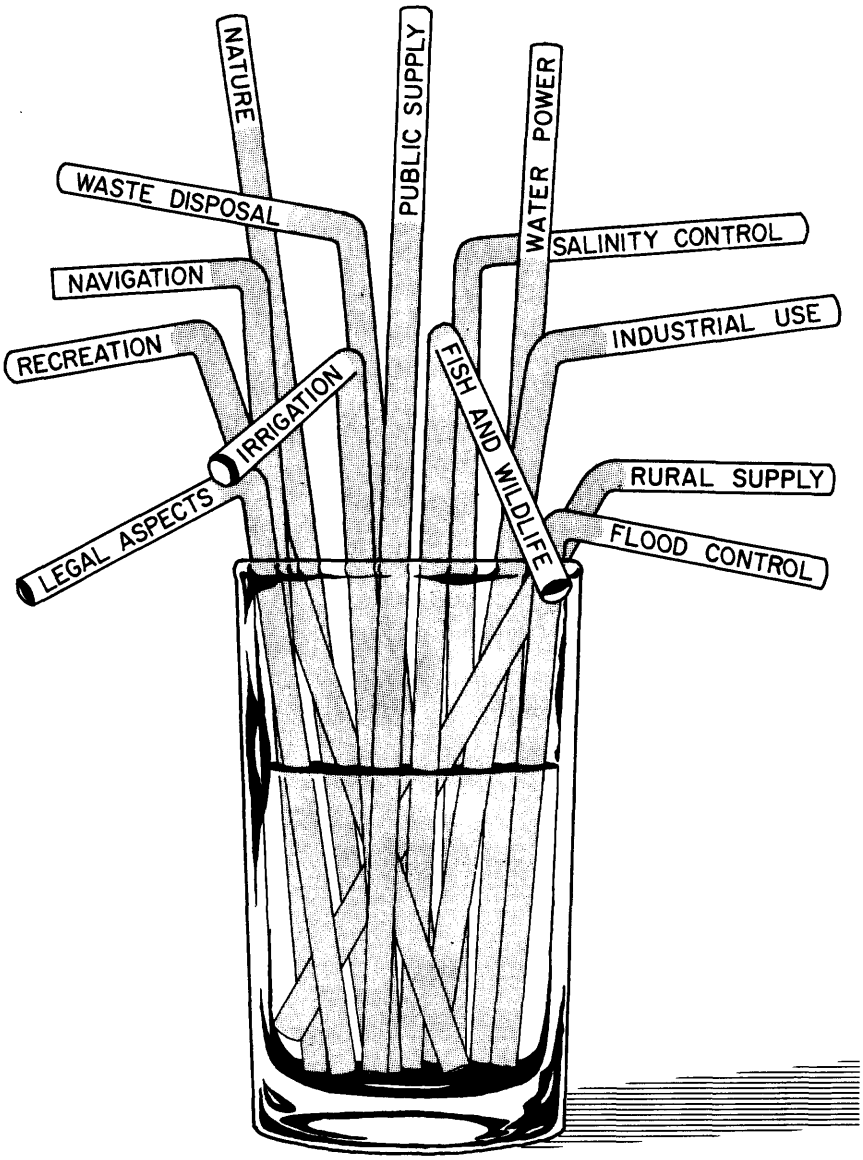
CONTENTS

CONTENTS-Continued

CONTENTS-Continued

ILLUSTRATIONS

COMPETITION FOR WATER



Competition for water is growing. Adequate information and analysis are keys to effective development, protection, and management of a common water resource.

WATER RESOURCES ACTIVITIES IN FLORIDA, 1992-93

Compiled by Mildred E. Glenn

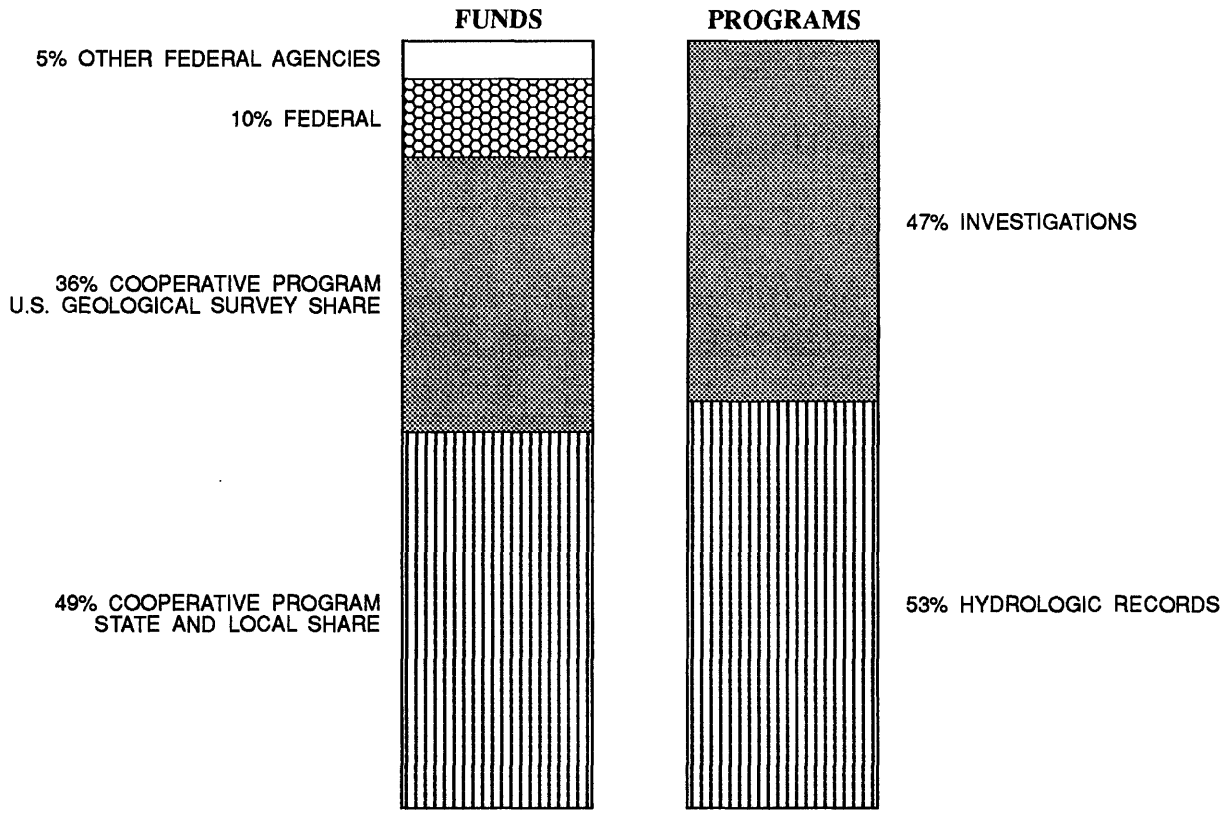
INTRODUCTION

This report contains summary statements of water-resources activities in Florida conducted by the Water Resources Division of the U.S. Geological Survey in cooperation with Federal, State, and local agencies during 1992. These activities are part of the Federal program of appraising the Nation's water resources. Included are brief descriptions of the nature and scope of all active studies, summaries of significant results for 1992, and anticipated accomplishments during 1993. This report is intended to inform those agencies interested in the water resources of Florida as to the current status and objectives of the U.S. Geological Survey Cooperative Program. Almost all of this work is done in cooperation with other public agencies.

Florida is a water-oriented State that, for many years, has experienced a significant increase in population, attendant urban growth, and all the problems associated with such growth, particularly problems of protecting and preserving environmental quality. As the Florida environment is largely water sensitive, most environmental problems are water related. The Florida District of the U.S. Geological Survey has the principal responsibility at the Federal level for appraising water resources and for providing basic hydrologic data on both surface and ground water in the State.

Water-resources appraisals conducted by the Florida District are highly diversified, ranging from hydrologic records networks to interpretive appraisals of water resources and applied research to develop investigative techniques. Thus, water-resources investigations range from basic, descriptive, water-availability studies for areas of low-intensity water development and management to sophisticated cause-and-effect studies in areas of high-intensity water development and management. The interpretive reports that are products of the investigations are a principal hydrologic foundation upon which the plans for development, management, and protection of Florida's water resources can be based.

The need for water-resources information is especially great in urbanized areas where concern is being expressed that the "carrying" capacity of the land and water resources is being exceeded. Increasingly intensive and sophisticated water-management programs will have to be implemented in these urban areas to meet the increasing needs for water and to maintain good water quality. Water data and information required to implement sound water-management programs in highly urbanized areas relate to the quantity and quality of stormwater runoff, sources of aquifer contamination, injection of wastes into deep strata, underground storage of freshwater, artificial recharge of aquifers, environmental effects of reuse of water, and effects of land development on changes in ground-water and surface-water quality. In some parts of the State, broad areas are largely rural. Future growth is anticipated in many of these areas. However, recognition is given to the need for planned development tailored to the environment. The need for water information in these rural areas is related, to a large extent, to the need to provide for primary water development and to provide information on effects of development.



Source of funds and makeup of program, Florida District, 1992-93

WATER RESOURCES DIVISION PROGRAM

Program development in the Water Resources Division is an evolving activity. Programs are reviewed regularly and future needs for water-data and hydrologic investigations are projected. Water problems and data needs suggested by State and local agencies and the public constitute a major part of the planning process; thus, program development is an effort that is responsive to changes in data needs and water problems.

Water Resources Division programs are of three major types: (a) data collection and dissemination, (b) problem-oriented water-resources appraisals, and (c) research. The programs are strongly interrelated; for example, theories arising from research are the foundation of data collection and problem-oriented water-resources appraisals, and data collection is a major component of all water-resources appraisals and most of the research studies.

The Division's activities can be described under three headings: long-term programs, topical programs, and technical-assistance programs.

Long-term programs include the Federal-State Cooperative Program; coordination of Federal water-data acquisition; assistance to other Federal agencies; the National Research Program; the National Water-Use Information Program; the hydrologic data-collection program, including the national stream quality accounting network and the national benchmark program; and the international hydrology program. These programs are fundamental to the Division's mission and they provide the data and research needed for the topical programs.

Topical programs are designed to provide critically needed information on issues of major and immediate concern to the Nation. These programs include hazardous waste hydrology, including high- and low-level nuclear and toxic-chemical wastes; coal and oil-shale hydrology; regional aquifer systems analysis; acid-rain, volcano, subsidence, and flood hazards; and a national water-quality assessment.

Technical-assistance programs include the instrumentation programs, a central water-quality laboratory, and the national training center. These programs are internal to the Division but contribute significantly to the continuing development of hydrologic capabilities and thus to the success of the Division's mission.

NEW REPORTS FROM THE U.S. GEOLOGICAL SURVEY FLORIDA DISTRICT, 1992

The results of many of the water-resources activities of the U.S. Geological Survey are released in reports for use by water agencies and the public. Most Survey reports on the water resources of Florida are available for inspection at the offices listed on the inside of the front cover, at the offices of the five water management districts, and at libraries of the State University system. Write to the Survey District Office in Tallahassee for information regarding the availability of these publications.

Andrews, W.J., 1992, Reconnaissance of water quality at nine dairy farms in north Florida, 1990-91: U.S. Geological Survey Water-Resources Investigations Report 92-4058, 39 p.

Bradner, L.A., Murray, L.C., Phelps, G.C., and Spechler, R.M., 1992 Potentiometric surface of the Upper Floridan aquifer in the St. Johns River, Water Management District and vicinity, May 1992: U.S. Geological Survey Open-File Report 92-466, 1 sheet.

Glenn, M.E., ed., 1992, Water resources activities in Florida, 1992-93: U.S. Geological Survey Open-File Report 92-88, 89 p.

Hammett, K.M., 1992, Physical Processes, salinity characteristics, and potential salinity changes due to freshwater withdrawals in the tidal Myakka River, Florida: U.S. Geological Survey Water-Resources Investigations Report 90-4054, 20 p.

Howie, Barbara, 1992, Effects of dried wastewater-treatment sludge application on ground-water quality in south Dade County, Florida: U.S. Geological Survey Water-Resources Investigations Report 91-4135, 48 p.

Hutchinson, C.B., 1992, Assessment of hydrogeologic conditions with emphasis on water quality and wastewater injection, southwest Sarasota and west Charlotte Counties, Florida: U.S. Geological Survey Water-Supply Paper 2371, p. 74.

Kane, R.L., 1992, Altitude of the water table in the surficial aquifer system, shallow zone, in eastern Palm Beach County, Florida, May 1-5, 1989: U.S. Geological Survey Open-File Report 92-86, 1 sheet.

_____1992, Altitude of the water table in the surficial aquifer system in St. Lucie and Martin Counties, Florida, May 1-5, 1989: U.S. Geological Survey Open-File Report 92-96, 1 sheet.

_____1992, Altitude of the water table in the surficial aquifer system, shallow zone, in eastern Palm Beach County, Florida, May 16-19, 1988: U.S. Geological Survey Open-File Report 92-97, 1 sheet.

Kane, R.L., 1992, Altitude of the water table in the surficial aquifer system in St. Lucie and Martin Counties, Florida, May 13-23, 1988: U.S. Geological Survey Open-File Report 92-98, 1 sheet.

_____1992, Altitude of the water table in the surficial aquifer system in St. Lucie and Martin Counties, Florida, October 27-31, 1988: U.S. Geological Survey Open-File Report 92-99, 1 sheet.

_____1992, Altitude of the water table in the surficial aquifer system, shallow zone, in eastern Palm Beach County, Florida, October 24-26, 1988: U.S. Geological Survey Open-File Report 92-100, 1 sheet.

_____1992, Potentiometric surface of the surficial aquifer system, deep zone in eastern Palm Beach County, Florida, May 16-19, 1988: U.S. Geological Survey Open-File Report 92-101, 1 sheet.

_____1992, Potentiometric surface of the surficial aquifer system, deep zone, in eastern Palm Beach County, Florida, May 1-5, 1989: U.S. Geological Survey Open-File Report 92-102, 1 sheet.

_____1992, Potentiometric surface of the surficial aquifer system, deep zone, in eastern Palm Beach County, Florida, October 24-26, 1988: U.S. Geological Survey Open-File Report 92-103, 1 sheet.

Katz, B.G., 1992, Hydrochemistry of the Upper Floridan aquifer, Florida: U.S. Geological Survey Water-Resources Investigations Report 91-2196, 37 p., 10 plates.

Lopez, M.A., and Fretwell, J.D., 1992, Relation of change in water levels in surficial and Upper Floridan aquifers and lake stage to climatic conditions and well-field pumpage in northwest Hillsborough, Northeast Pinellas, and South Pasco Counties, Florida: U.S. Geological Survey Water-Resources Investigations Report 91-4158, 94 p.

Marella, R.L., 1992, Factors that affect public-supply water use in Florida, with a section on projected water use to the year 2020: U.S. Geological Survey Water-Resources Investigations Report 91-4123, 35 p.

_____1992, Water withdrawals in Florida during 1990, with trends from 1950 to 1990: U.S. Geological Survey Open-File Report 92-80 (FACT SHEET).

Miller, W.L., 1992, Hydrogeology and migration of septic-tank effluent in the surficial aquifer system in the northern Midlands area, Palm Beach County, Florida: U.S. Geological Survey Water-Resources Investigations Report 91-4175, 69 p.

Mularoni, R.A., 1992, Potentiometric surface of the intermediate aquifer system, west-central Florida, May 1991: U.S. Geological Survey Open-File Report 91-523, 1 plate.

_____1992, Potentiometric surface of the intermediate aquifer system, west-central Florida, September 1991: U.S. Geological Survey Open-File Report 92-169, 1 plate.

_____1992, Potentiometric surface of the Upper Floridan aquifer, west-central Florida, May 1991: U.S. Geological Survey Open-File Report 1-524, 1 plate.

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Phelps, G.G., Murray, L.C., Bradner, L.A., and Spechler, R.M., 1992, Potentiometric surface of the upper Floridan aquifer in the St. Johns River Water Management District and vicinity, Florida, May 1991: U.S. Geological Survey Open-File Report 91-515, 1 sheet.

Schoellhamer, D.H., 1992, Noncohesive sediment-transport processes at the bed/water column interface, in Jennings, Marshall, and Bhowmik, N.G., eds., Hydraulic Engineering: Saving a threatened resource--Proceedings of the Hydraulic Engineering sessions at Water Forum '92, Baltimore, Maryland, August 2-6 1992: New York, American Society of Civil Engineers, p. 375-380.

Sumner, D.M., Phelps, G.G., Spechler, R.M., Bradner, L.A., and Murray, L.C., 1992, Potentiometric surface of the Upper Floridan aquifer in the St. Johns River, Water Management District and vicinity, Florida, September 1991: U.S. Geological Survey Open-File Report 92-68, 1 pl.

Swain, E.D., 1992, Effects of horizontal velocity variations on ultrasonic velocity measurements in open channels: U.S. Geological Survey, Water-Resources Investigations Report 91-4200, 15 p.

Swancar, Amy, and Hutchinson, C.B., 1992, Chemical and isotopic composition and potential for contamination of water in the Upper Floridan aquifer, west-central Florida, 1986-89: U.S. Geological Survey Open-File Report 92-47, 47 p.

In addition to published material, The National **WAT**er Data **STO**rage and **RE**trieval System (WATSTORE) was established for handling water data collected through the activities of the U.S. Geological Survey and to provide for more effective and efficient means of releasing the data to the public. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Virginia.

WATSTORE can provide a variety of useful products ranging from simple data tables to complex statistical analyses. A minimal fee, plus the actual computer cost incurred in producing a desired product, is charged to the requester. Information about the availability of specific types of data, the acquisition of data or products, and user charges can be obtained locally from the offices whose addresses are given on the back of the front cover.

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U.S. Geological Survey
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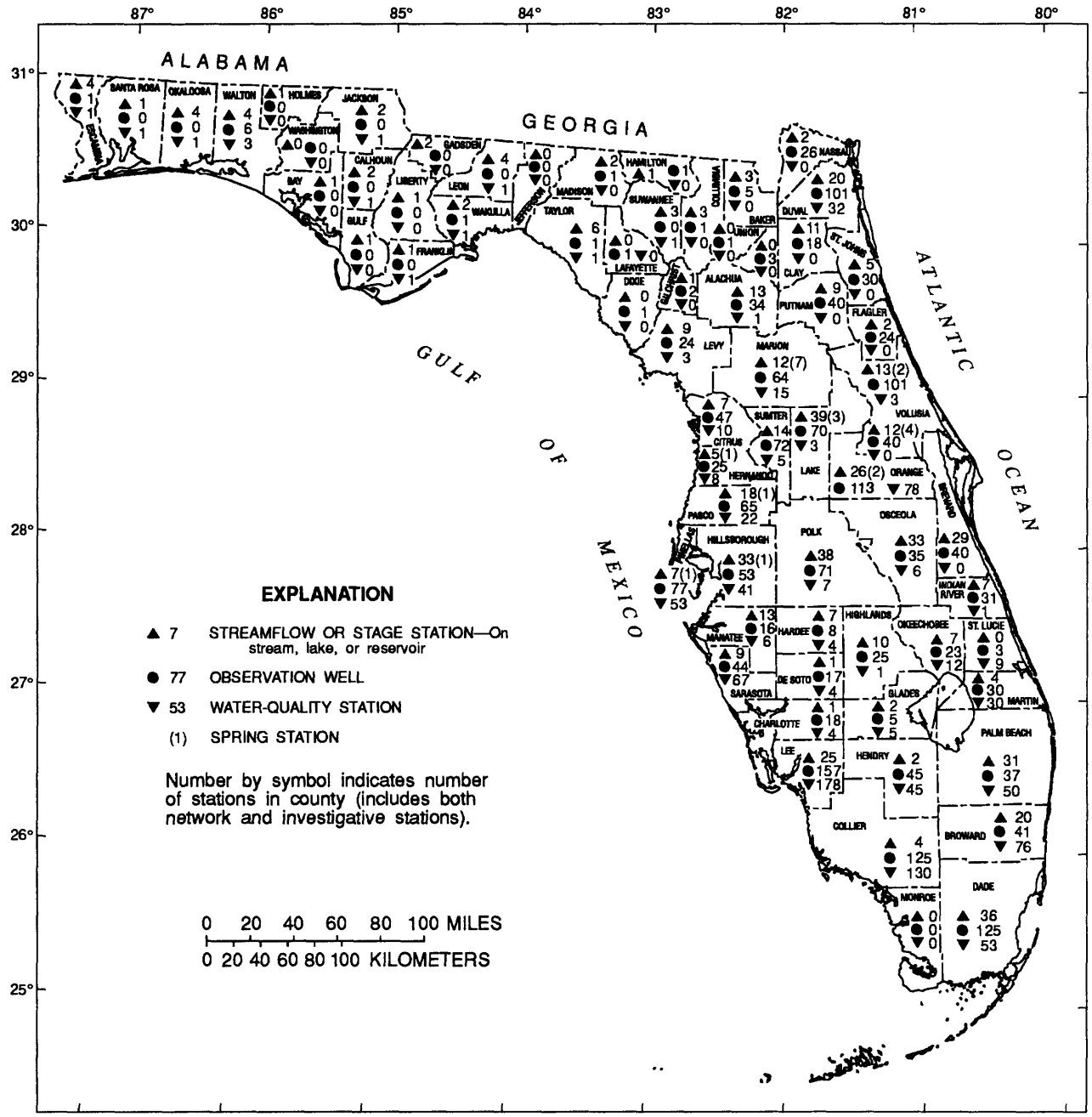
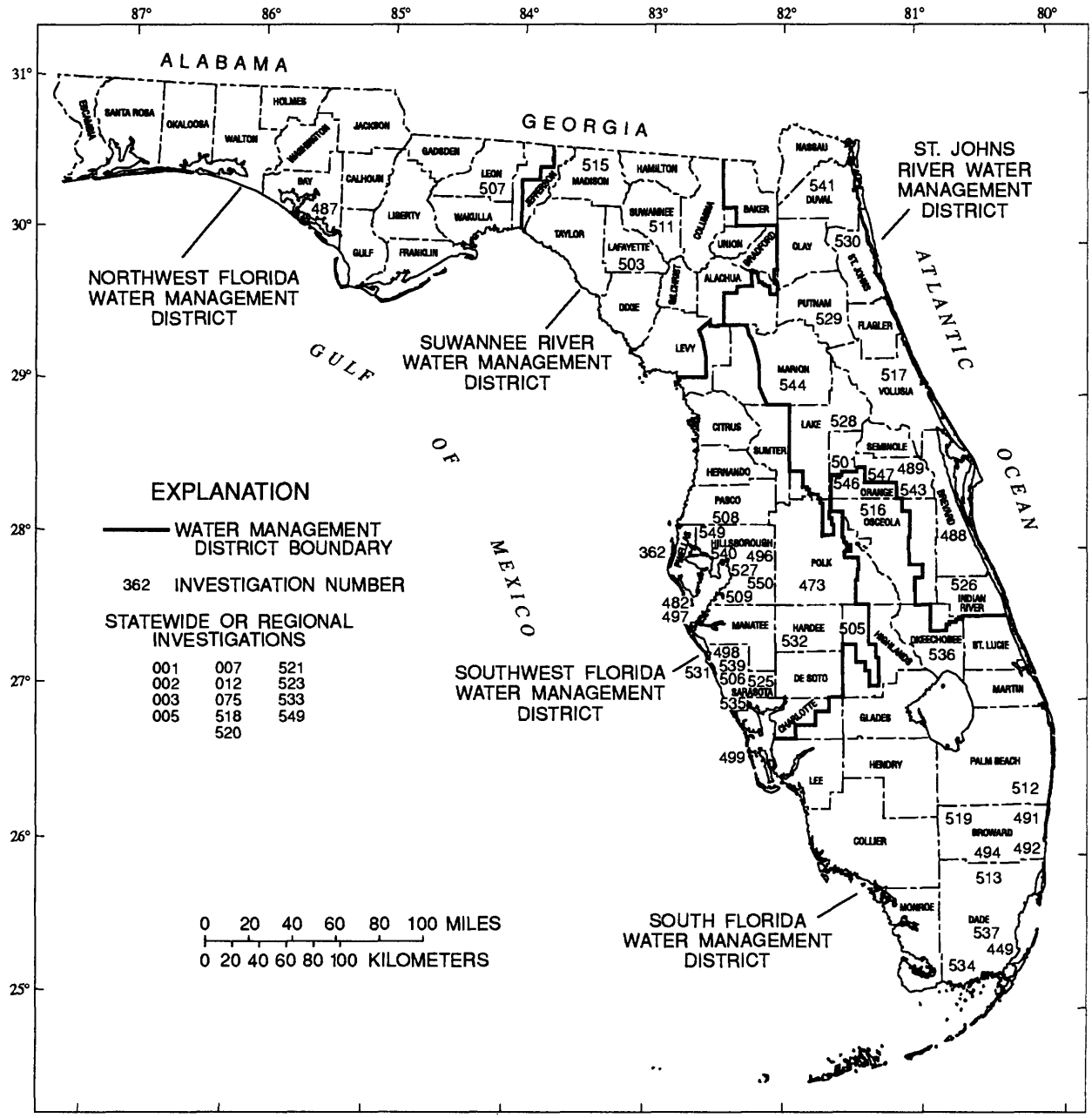
HYDROLOGIC DATA STATIONS IN FLORIDA



Hydrologic data stations in Florida as of September 1992.

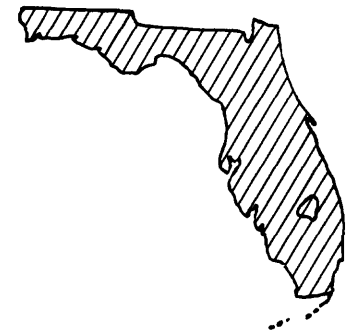
LOCATION OF FLORIDA DISTRICT PROJECT ACTIVITIES



FLORIDA DISTRICT PROJECT ACTIVITIES

A brief description of current District projects follows and includes the following information:

- Number
- Title
- Period of project
- Principal investigator
- Cooperating agency(ies)
- Problem
- Objective(s)
- Approach
- Progress
- Plans for this year
- Reports in process
- Reports released



FL-001 SURFACE-WATER NETWORK STATIONS

DATE PROJECT BEGAN: 1926

DATE PROJECT ENDS: Continuing

PROJECT COORDINATOR: Marvin Franklin, Tallahassee

PRINCIPAL INVESTIGATORS: R.A. Craig, Orlando; W.J. Haire, Miami; J.E. Coffin, Tampa; M.A. Franklin, Tallahassee

COOPERATING AGENCIES: Most of the agencies shown in the list of cooperators

PROBLEM: Surface-water information is needed for purposes of surveillance, planning, design, hazard warning, operation, and management in water-related fields such as water supply, flood control, irrigation, bridge and culvert design, wildlife management, pollution abatement, flood-plain management, and water-resources development. To provide this information, an appropriate data base is necessary.

OBJECTIVE: To obtain and document an unbiased inventory of streamflow, stream, and lake stage data for use in the planning and development of the water resources of the State of Florida.

APPROACH: Collect stream discharge, stream, and lake-stage data from a network of gaging stations that include daily discharge, periodic discharge, daily stage, and periodic stage stations to define streamflow and stage conditions within the State of Florida.

PROGRESS: Streamflow and stage data were collected from 676 network sites and prepared for publication. Streamflow and stage data currently are being obtained at the number of hydrologic data network stations given below.

Station Classification	Number of Stations
Stream stations	**547**
Continuous record:	
Discharge and stage	327
Stage only	130
Partial record:	
Peak (maximum) flow	21
Periodic streamflow	69
Lake and reservoir stations	**129**
Stage and contents	2
Stage only:	
Continuous	63
Periodic	64

(FL-001)

PLANS FOR THIS YEAR: Continue operations as needs are defined.

REPORTS IN PROCESS: Water-resources data for Florida, water year 1992.

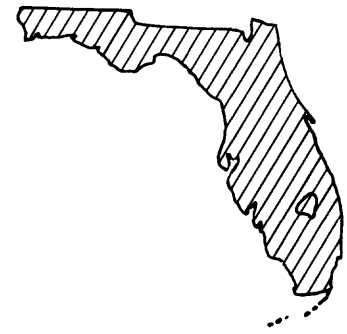
REPORTS RELEASED:

U.S. Geological Survey, 1991, Water resources data, Florida, water year 1991, volume 1A, northeast Florida surface water: U.S. Geological Survey Water-Data Report FL-91-1A, 444 p.

_____1991, Water resources data, Florida, water year 1991, volume 2A, south Florida surface water: U.S. Geological Survey Water-Data Report FL-91-2A, 203 p.

_____1991, Water resources data, Florida, water year 1991, volume 3A, southwest Florida surface water: U.S. Geological Survey Water-Data Report FL-91-3A, 278 p.

_____1991, Water resources data, Florida, water year 1991, volume 4, northwest Florida surface water: U.S. Geological Survey Water-Data Report FL-91-4, 210 p.



FL-002 GROUND-WATER NETWORK STATIONS

DATE PROJECT BEGAN: 1930

DATE PROJECT ENDS: Continuing

PROJECT COORDINATOR: Marvin Franklin, Tallahassee

PRINCIPAL INVESTIGATOR: R.A. Craig, Orlando; W.J. Haire, Miami; J.E. Coffin, Tampa; M.A. Franklin, Tallahassee

COOPERATING AGENCIES: Most of the agencies shown in the list of cooperators

PROBLEM: Long-term water level records are needed to evaluate the effects of climatic variations on the recharge to and discharge from the ground-water systems, to provide a data base from which to measure the effects of development, to assist in the prediction of future supplies, and to provide data for management of the resource.

OBJECTIVE: To obtain and document an unbiased inventory of water-level data for use in the planning and development of the water resources of the State of Florida.

APPROACH: Collect water-level data for the various aquifers by a network of observation wells that includes 2,575 periodic observation sites and 430 sites where data are recorded continuously.

PROGRESS: Water-level data were collected and published as planned.

PLANS FOR THIS YEAR: Collection and publication of data will continue.

REPORTS IN PROCESS: Water-resources data for Florida, water year 1992.

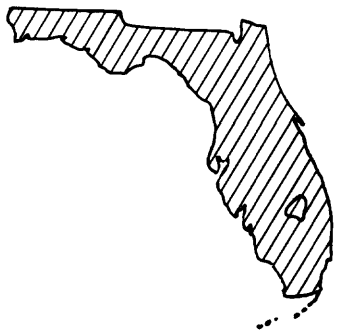
REPORTS RELEASED:

U.S. Geological Survey 1991, Water resources data, Florida, water year 1991, volume 1B, northeast Florida ground water: U.S. Geological Survey Water-Data Report FL-91-1B, 354 p.

_____1991, Water resources data, Florida, water year 1991, volume 2B, south Florida ground water: U.S. Geological Survey Water-Data Report FL-91-2B, 427 p.

_____1991, Water resources data, Florida, water year 1991, volume 3B, southwest Florida ground water: U.S. Geological Survey Water-Data Report FL-91-3B, 241 p.

_____1991, Water resources data, Florida, water year 1991, volume 4, northwest Florida: U.S. Geological Survey Water-Data Report FL-91-4, 210 p.



FL-003 QUALITY OF WATER NETWORK STATIONS

DATE PROJECT BEGAN: 1939

DATE PROJECT ENDS: Continuing

PROJECT COORDINATOR: Marvin Franklin, Tallahassee

PRINCIPAL INVESTIGATOR: R.A. Craig, Orlando; W.J. Haire, Miami; J.E. Coffin, Tampa; M.A. Franklin, Tallahassee

COOPERATING AGENCY: Most of the agencies shown in the list of cooperators

PROBLEM: Water-resource planning and water-quality assessment require a nationwide basic level of relatively standardized information. For planning and realistic assessment of the water resource, the chemical and physical quality of surface and ground waters must be defined and monitored.

OBJECTIVE: To obtain and document an unbiased inventory of water-level data for use in the planning and development of the water resources of the State of Florida.

APPROACH: Collect water-quality data from a network of daily, weekly, and periodic stations, which include streams, lakes, springs, and wells, to define water-quality conditions within the State of Florida.

PROGRESS: Water-quality data are obtained at 141 surface-water network stations. These stations are used to monitor the quality of surface water in Florida. Some of these stations also are part of a U.S. Geological Survey nationwide network known as the National Stream Quality Accounting Network which is used to detect nationwide trends in water quality. The types of data determined at these sites are given below. Inasmuch as several types of data may be determined at a particular site, but not all types of data are determined at each site, the number given below will not equal the total number of surface-water sites.

Data Classification	Number of Surface-Water Sites
Physical data:	
Temperature, specific conductance, or pH	140
Sediment	23
Chemical data:	
Inorganic constituents	140
Organic constituents	69
Pesticides	13
Radiochemical data	3
Biological data	15

(FL-003)

Water-quality data are obtained at network observation wells and springs. The types of data determined at these sites are listed below. Inasmuch as several types of data may be determined at a particular site, but not all types of data are determined at each site, the number given below will not equal the total number of ground-water sites.

Data Classification	Number of Wells	Number of Springs
Physical data:		
Temperature, specific conductance, or pH	742	13
Chemical data:		
Inorganic constituents	112	1
Organic constituents	9	0
Biological data	7	0

PLANS FOR THIS YEAR: Collection and publication of data will continue.

REPORTS IN PROCESS: Water-resources data for Florida, water year 1992.

REPORTS RELEASED:

U.S. Geological Survey, 1991, Water resources data, Florida, water year 1991, volume 1A, northeast Florida surface water: U.S. Geological Survey Water-Data Report FL-91-1A, 444 p.

_____1991, Water resources data, Florida, water year 1991, volume 1B, northeast Florida ground water: U.S. Geological Survey Water-Data Report FL-91-1B, 354 p.

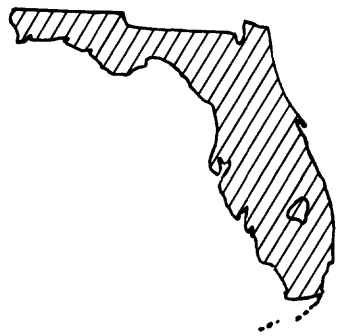
_____1991, Water resources data, Florida, water year 1991, volume 2A, south Florida surface water: U.S. Geological Survey Water-Data Report FL-91-2A, 203 p.

_____1991, Water resources data, Florida, water year 1991, volume 2B, south Florida ground water: U.S. Geological Survey Water-Data Report FL-91-2B, 427 p.

_____1991, Water resources data, Florida, water year 1991, volume 3A, southwest Florida surface water: U.S. Geological Survey Water-Data Report FL-91-3A, 278 p.

_____1991, Water resources data, Florida, water year 1991, volume 3B, southwest Florida ground water: U.S. Geological Survey Water-Data Report FL-91-3B, 241 p.

_____1991, Water resources data, Florida, water year 1991, volume 4, northwest Florida ground water: U.S. Geological Survey Water-Data Report FL-91-4, 210 p.



FL-005 QUALITY OF PRECIPITATION

DATE PROJECT BEGAN: July 1983

DATE PROJECT ENDS: Continuing

PRINCIPAL INVESTIGATORS: Terrie M. Lee, Tampa;
Jerilyn J. Collins, Tallahassee

COOPERATING AGENCY: Federal Program

PROBLEM: The amount of substances dispersed in the atmosphere and deposited by precipitation, aerosols, and bases is expected to continue to increase throughout North America. Thus, there is a need for careful measurements of the amounts, nature, and effects of these substances. Such measurements are essential for responsible management of the agricultural, forest, and aquatic ecosystems of the United States.

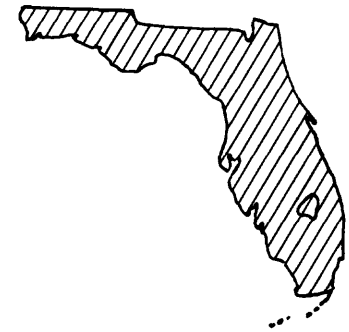
OBJECTIVE: The National Atmospheric Deposition Program (NADP) was created to conduct research on atmospheric deposition and its affect on surface waters and agricultural and forest lands in cooperation with Federal, State and private research agencies. The U.S. Geological Survey (USGS) is participating in this program under the title of the National Trends Network (NTN) by establishing up to 40 stations nationwide with coordination and analytical services provided by NADP. These stations are established for the purpose of long term coordinated data collection for use in local, regional, and national studies.

APPROACH: Basic data atmospheric deposition will be collected at NADP/NTN approved sites (FL14 and FL41). Methods of data collection and instrumentation conform to NADP procedures and guidelines. Data collection will be continuous with weekly sample collections in addition to collection of samples for nonstandard events. All samples will be shipped to NADP Central Analytical Laboratory (CAL), which is operated by the Illinois State Water Survey.

PROGRESS: Weekly precipitation samples were collected from an NTN site at the Verna well-field site near Sarasota, FL (FL41), and at the Florida Agricultural Research Center near Quincy, FL (FL14), according to NTN/NADP protocol.

PLANS FOR THIS YEAR: The NTN sites will be maintained and operated according to NADP/NTN standards and schedules. Data will be stored in WATSTORE data files.

FL-007 FLORIDA WATER-USE PROGRAM



DATE PROJECT BEGAN: July 1975

DATE PROJECT ENDS: Continuing

PRINCIPAL INVESTIGATOR: Richard L. Marella, Tallahassee

COOPERATING AGENCIES: Florida Department of Environmental Regulation
Northwest Florida Water Management District
St. Johns River Water Management District
South Florida Water Management District
Southwest Florida Water Management District
Suwannee River Water Management District

PROBLEM: Consistent and accurate statewide water-use data are essential for the sound management of Florida's water resources. To date, periodic compilations of water-use data have been hampered by a lack of adequate long-term funding for water use in the cooperative program. The five water management districts are the primary collectors of water-use information. Consequently, within the State, there are five different levels of data collection, storage, compilation, and publications of water-use information.

OBJECTIVE: The water-use program will ensure long-term continuity and technical coordination of water-use data in Florida. Specifically, the water-use program will include: (1) a liaison between the five water management districts, Florida Department of Environmental Regulation, and other State agencies regarding water-use data; (2) consultation and assistance with each water management district to locate, collect, tabulate, and interpret water-use data; and (3) collation, interpretation, and publication of statewide data at 5-year intervals starting in 1990.

APPROACH: The water-use program will compile data for six major categories of water use for all 67 counties and five water management districts on a monthly basis. Data will be collected for all sources of withdrawal including fresh and saline, ground and surface water. Other data collected will include acreage irrigated for specific crop types, wastewater discharge from public and industrial facilities, aquifer withdrawals, water reused for irrigation, water used for desalinization, and site-specific pumpage for commercial, industrial, and power-generation facilities. Special projects to improve collection and accuracy of water-use data will be undertaken during time not devoted to the major assessment every 5 years. Additionally, periodic contact with key personnel at the five water management districts will be maintained on a periodic basis.

PROGRESS: Collected and compiled statewide water-use data in Florida for 1990. Data was tabulated for all 5 categories (public-supply, domestic self-supplied, commercial-industrial self-supplied, agricultural irrigation, and thermoelectric power generation), water management districts, counties, hydrological units, and principal aquifers. The data were submitted to the USGS Southeast Regional office as part of the United States compilation effort, and published in the National Water-use Report for 1990 (U.S. Geological Survey Information Circular 1081). Additional data collected for 1990 included domestic and industrial wastewater discharges. This data were compiled by facility and is currently being reviewed and verified by FDER.

(FL-007)

PLANS FOR THIS YEAR: Continue working on the reports "Estimated use of water in the Apalachicola-Chattahoochee-Flint River basin during 1990, with State summaries from 1970 to 1990," and "Public-supply water use in Florida, 1990." Also, work on two additional reports will begin. The first report will detail water use in the Georgia-Florida Coastal Plain study area. This report will provide the National Water-Quality Assessment Program the necessary water-use data for this study unit. A second report will detail wastewater discharge data by county and facility for Florida during 1990. Data collection of 1991 public-supply water withdrawals in Florida will also begin during this fiscal year.

REPORTS IN PROCESS: The statewide public-supply water-use data that were collected for 1990, will be published in a separate report. The report will detail public-supply water-use data by county, aquifer, and water management district, and is currently in review. Additionally, water-use data for the Apalachicola-Chattahoochee-Flint River Basin for 1990 were compiled. These data have been summarized in a report entitled "Estimated use of water in the Apalachicola-Chattahoochee-Flint River basin during 1990, with State summaries from 1970 to 1990" and is currently in review.

REPORTS RELEASED:

Pride, R.W., 1975, Estimated water use in Florida, 1965 (2d ed.): Florida Bureau of Geology Map Series 36.

Healy, H.G., 1977, Public water supplies of selected municipalities in Florida, 1975: U.S. Geological Survey Water-Resources Investigations 77-53 (PB-271 691/AS), 309 p.

Leach, S.D., 1977, Water use inventory in Florida, 1975: U.S. Geological Survey Open-File Report 77-577, 57 p.

_____1978, Freshwater use in Florida, 1975: Florida Bureau of Geology Map Series 87.

_____1978, Source, use, and disposition of water in Florida, 1975: U.S. Geological Survey Water-Resources Investigations 78-17 (PB-284 126/AS), 90 p.

Leach, S.D., and Healy, H.G., 1980, Estimated water use in Florida, 1977: U.S. Geological Survey Water-Resources Investigations 79-112, 76 p.

Duerr, A.D., and Trommer, J.T., 1981, Estimated water use in the Southwest Florida Water Management District and adjacent areas, 1979: U.S. Geological Survey Open-File Report 81-56, 58 p.

_____1981, Estimated water use in the Southwest Florida Water Management District and adjacent areas, 1980: U.S. Geological Survey Open-File Report 81-1060, 60 p.

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REPORTS RELEASED: (continued)

Duerr, A.D., and Trommer, J.T., 1982, The benchmark farm program--A method for estimating irrigation water use in southwest Florida: U.S. Geological Survey Water-Resources Investigations 82-17, 49 p.

Leach, S.D., 1982, Estimated water use in Florida, 1980: Florida Bureau of Geology Map Series 103.

Duerr A.D., and Sohm, J.E., 1983, Estimated water use in southwest Florida, 1981, and summary of water use, 1970, 1975, and 1977-81: U.S. Geological Survey Open-File Report 83-45, 75 p.

Leach, S.D., 1983, Consumptive use of freshwater in Florida, 1980: Florida Bureau of Geology Map Series 105.

_____1983, Source, use, and disposition of water in Florida, 1980: U.S. Geological Survey Water-Resources Investigations 82-4090, 337 p.

Spechler, R.M., 1983, Estimated irrigation water use in Florida, 1980: Florida Bureau of Geology Map Series 106.

Geiger, L.H., 1984, Water-use computer programs for Florida: U.S. Geological Survey Open-File Report 84-442, 91 p.

Leach, S.D., 1984, Projected public supply and rural (self-supplied) water use in Florida through year 2020: Florida Bureau of Geology Map Series 108.

Marella, R.L., 1988, Water withdrawals, use, and trends in Florida, 1985: U.S. Geological Survey Water-Resources Investigations Report 88-4103, 43 p.

Solley, W.B., Merk, C.F., and Pierce, R.R., 1988, Estimated use of water in the United States in 1985: U.S. Geological Survey Circular 1004, 82 p.

Conover, C.S., Vecchioli, John, and Foose, D.W., 1989, Ground-water sources and 1985 withdrawals in Florida: Florida Geological Survey Map Series 124, 1 sheet.

Marella, R.L., 1989, Freshwater withdrawals and water-use trends in Florida, 1985: Florida Geological Survey Map Series 123, 1 sheet.

_____1990, Florida water-supply and use, in National Water Summary, 1987--Water supply and use: U.S. Geological Survey Water-Supply Paper 2350, p. 207-214.

_____1990, Public-supply water use in Florida, 1987: U.S. Geological Survey Open-File Report 90-596, 39 p.

_____1991, Water use in the Apalachicola-Chattahoochee-Flint River basin, 1985: In proceedings of the 1991 Georgia Water Resource Conference, March 19 and 20, 1991, at the University of Georgia, Institute of Natural Resources, Athens, p.9.

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REPORTS RELEASED: (continued)

Marella, R.L., 1992, Factors that affect public-supply water use in Florida, with a section on projected water use to the year 2020: U.S. Geological Survey Water-Resource Investigation Report 91-4123, 35 p.

_____1992, Water withdrawals in Florida during 1990, with trends from 1950 to 1990: U.S. Geological Survey Open-File Report 90-80, 2 p.

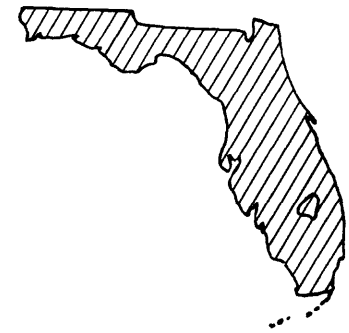
_____1992, in press, use, and trends in Florida, 1990: U.S. Geological Survey Water-Resources Investigations Report 92-4140.

Bucca, James, and Marella, R.L., 1992, An improved method for determining the nonresidential water-use component of total public water-supply estimates: In proceedings of the American Institute of Hydrology 1992 annual meeting, Portland, Oregon.

Holland, T.W., 1992, Water-use data collection techniques in the southeastern United States, Puerto Rico, and the U.S. Virgin Islands: Little Rock, Ark. U.S. Geological Survey Water-Resources Investigations Report 92-4028, 76 p.

Solley, W.B., Pierce, R.R., and Perlman, H.A., 1992, Estimated use of water in the United States in 1990: U.S. Geological Survey Circular 1081, 70 p.

FL-012 FLOOD ASSESSMENTS



DATE PROJECT BEGAN: July 1964

DATE PROJECT ENDS: Continuing

PRINCIPAL INVESTIGATOR: Marvin Franklin, Tallahassee

COOPERATING AGENCY: Florida Department of Transportation

PROBLEM: Local and State governments, highway designers, planners, and zoning commissions have a responsibility to avoid uneconomic, hazardous, or incompatible use and development of the State's flood plains. Prime requisites to meet these criteria are a knowledge of the floodflow characteristics of streams and the ability to make reliable estimates of the flood magnitude and frequency.

OBJECTIVE: To assess the hydraulic and hydrologic characteristics of Florida streams. To collect floodflow data and analyze hydraulic problems for selected stream reaches as well as for hydrologic regions. To document and prepare reports for extreme flood events.

APPROACH: Update and maintain the computer files for basin characteristics and peak flow for use in regional flood-frequency analysis. Respond by letter to specific requests for hydraulic and hydrologic information for selected stream reaches. Assess extreme flood events, including indirect flood measurements, analysis, and preparation of reports to disseminate the flood information.

PROGRESS: Performed regional analysis and prepared draft report. Flood-frequency report in review.

PLANS FOR THIS YEAR: Shift emphasis to bridge scour by installing monitoring system.

REPORTS RELEASED:

Bridges, W.C., 1972, Effect of Port Orange Bridge-Causeway on flow of Halifax River, Volusia County, Florida: U.S. Geological Survey Open-File Report FL-72005, 19 p.

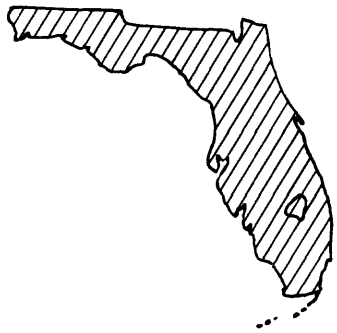
_____1974, An analysis of 1972-73 floods on Monroe Street and St. Augustine Branch, Tallahassee, Florida: U.S. Geological Survey Open-File Report FL-74023, 14 p.

_____1982, Technique for estimating magnitude and frequency of floods on natural-flow streams in Florida: U.S. Geological Survey Water-Resources Investigations 82-4012, 44 p., 1 pl.

_____1985, Analysis of water-level fluctuations of the U.S. Highway 90 retention pond, Madison, Florida: U.S. Geological Survey Water-Resources Investigations Report 85-4057, 19 p.

Bridges, W.C., and Davis, D.R., 1972, Flood of September 20-23, 1969, in the Gadsden County area, Florida: Florida Bureau of Geology Information Circular no. 79, 37 p.

FL-075 FLORIDA WATER ATLAS



DATE PROJECT BEGAN: September 1961

DATE PROJECT ENDS: Continuing

PRINCIPAL INVESTIGATOR: Michael P. Planert, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: Water use planners have repeatedly expressed the need for maps that show the characteristics and availability of water in Florida or that show related information such as climate. Prior to the start of this project only a few maps had been published that give hydrologic data or other data closely related to hydrologic problems in Florida.

OBJECTIVE: This project seeks to make available the needed information in the form of a water atlas--a series of map reports designed to furnish to the user generalized hydrologic, geologic, and related information, portrayed graphically on a standard size map. These maps are most useful for broad planning to aid legislators, planners, industrialists, laymen, and others as well as hydrologists to provide readily available hydrogeologic information for decisionmaking.

APPROACH: Emphasis will be largely on graphical presentation of hydrologic data. Although each map will contain some text, it will be generalized and will be used to supplement the graphical presentation. No special or involved methods of synthesis or analysis are contemplated. All the maps will be of identical size and will depict conditions through the State. No field mapping or testing will be done; all maps will be prepared from existing data.

PROGRESS: Statewide potentiometric surface map of the Upper Floridan aquifer was compiled and published.

PLANS FOR THIS YEAR: Work on map report for low-flow conditions will begin.

REPORTS RELEASED:

Healy, H.G., 1961, Piezometric surface of the Floridan aquifer in Florida, July 6-17, 1961: Florida Geological Survey Map Series 1, 1 pl.

_____1962, Piezometric surface and areas of artesian flow of the Floridan aquifer in Florida, July 6-17, 1961 (2d ed.): Florida Bureau of Geology Map Series 4, 1 pl.

Hoy, N.D., and Teel, J.R., 1963, Hydrologic features of the Floridan aquifer in Seminole County, Florida: Florida Division of Geology Map Series 5, 1 pl.

Hoy, N.D., 1964, Generalized water-table contours in southern Florida: Florida Division of Geology Map Series 7, 1 pl.

Shattles, D.E., 1965, Quality of water from the Floridan aquifer in Hillsborough County, Florida, 1963: Florida Division of Geology Map Series 9, 1 pl.

Toler, L.G., and Shampine, W.J., 1965, Quality of water from the Floridan aquifer in the Econfina Creek basin area, Florida, 1962: Florida Division of Geology Map Series 10, 1 pl.

Toler, L.G., 1965, Fluoride content of water from the Floridan aquifer of northwest Florida, 1963: Florida Division of Geology Map Series 11, 1 pl.

Shampine, W.J., 1975, Chloride concentration in water from the upper part of the Floridan aquifer in Florida (2d ed.): Florida Bureau of Geology Map Series 12, 1 pl.

_____1975, Hardness of water from the upper part of the Floridan aquifer in Florida (2d ed.): Florida Bureau of Geology Map Series 13, 1 pl.

_____1975, Dissolved solids in water from the upper part of the Floridan aquifer in Florida (2d ed.): Florida Bureau of Geology Map Series 14, 1 pl.

_____1975, Sulfate concentration in water from the upper part of the Floridan aquifer in Florida (2d ed.): Florida Bureau of Geology Map Series 15, 1 pl.

Hyde, L.W., 1975, Principal aquifers in Florida (2d ed.): Florida Bureau of Geology Map Series 16, 1 pl.

Shampine, W.J., 1965, Quality of water from the Floridan aquifer in Brevard County, Florida, 1963: Florida Division of Geology Map Series 17, 1 pl.

Cherry, R.N., 1966, Chloride content of ground water in Pinellas County, Florida, in 1950 and 1963: Florida Division of Geology Map Series 20, 1 pl.

Lichtler, W.F., and Joyner, B.F., 1966, Availability of ground water in Orange County, Florida: Florida Geological Survey Map Series 21, 1 pl.

Kenner, W.E., 1966, Runoff in Florida: Florida Division of Geology Map Series 22, 1 pl.

Toler, L.G., 1966, Fluoride content of water from the Floridan aquifer in northwestern Florida: Florida Division of Geology Map Series 23, 1 pl.

Anderson, Warren, and Joyner, B.F., 1966, Availability and quality of surface water in Orange County, Florida: Florida Division of Geology Map Series 24, 1 pl.

MacKichan, K.A., 1967, Temperature and chemical characteristics of the St. Johns River near Cocoa, Florida: Florida Division of Geology Map Series 25, 1 pl.

Barraclough, J.T., 1967, Ground-water features in Escambia and Santa Rosa Counties, Florida: Florida Division of Geology Map Series 26, 1 pl.

Kaufman, M.I., and Dion, N.P., 1967, Chemical character of water in the Floridan aquifer in southern Peace River basin, Florida: Florida Division of Geology Map Series 27, 1 pl.

Kenner, W.E., Pride, R.W., and Conover, C.S., 1967, Drainage basins in Florida: Florida Division of Geology Map Series 28, 1 pl.

McCoy, H.J., and Sherwood, C.B., 1968, Water in Broward County, Florida: Florida Division of Geology Map Series 29, 1 pl.

Knochenmus, D.D., 1968, Surface drainage characteristics in Volusia County, Florida: Florida Division of Geology Map Series 30, 1 pl.

Kenner, W.E., 1975, Seasonal variation of streamflow in Florida (2ded.): Florida Bureau of Geology Map Series 31, 1 pl.

Visher, F.N., and Hughes, G.H., 1975, The difference between rainfall and potential evaporation in Florida (2d ed.): Florida Bureau of Geology Map Series 32, 1 pl.

Kaufman, M.I., 1975, Generalized distribution and concentration of orthophosphate in Florida streams (2d ed.): Florida Bureau of Geology Map Series 33, 1 pl.

Kenner, W.E., Hampton, E.R., and Conover, C.S., 1975, Average flow of major streams in Florida (2d ed.): Florida Bureau of Geology Map Series 34, 1 pl.

Kaufman, M.I., 1975, Color of water in Florida streams and canals (2d ed.): Florida Bureau of Geology Map Series 35, 1 pl.

_____1975, The pH of water in Florida streams and canals (2d ed.): Florida Bureau of Geology Map Series 37, 1 pl.

Pride, R.W., 1975, Estimated water use in Florida, 1965 (revised 1975): Florida Bureau of Geology Map Series 36, 1 pl.

Hughes, G.H., 1970, Hydrologic setting of Deer Point Lake near Panama City, Florida: Florida Bureau of Geology Map Series 38, 1 pl.

Stewart, J.W., and Hanan, R.V., 1970, Hydrologic factors affecting the utilization of land for sanitary landfills in northern Hillsborough County, Florida: Florida Bureau of Geology Map Series 39, 1 pl.

Hughes, G.H., Hampton, E.R., and Tucker, D.F., 1971, Annual and seasonal rainfall in Florida: Florida Bureau of Geology Map Series 40, 1 pl.

Klein, Howard, 1975, Depth to base of potable water in the Floridan aquifer (2d ed.): Florida Bureau of Geology Map Series 42, 1 pl.

Anderson, Warren, 1975, Temperature of Florida streams (2d ed.): Florida Bureau of Geology Map Series 43, 1 pl.

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Freiberger, H.J., 1972, Streamflow variation and distribution in the Big Cypress watershed during wet and dry periods: Florida Bureau of Geology Map Series 45, 1 pl.

Foster, J.B., 1972, Guide to users of ground water in Bay County, Florida: Florida Bureau of Geology Map Series 46, 1 pl.

Coble, R.W., 1973, The Anclote and Pithlachascotee Rivers as water-supply sources: Florida Bureau of Geology Map Series Reichenbaugh, R.C., 1972, Sea-water intrusion in the upper part of the Floridan aquifer in coastal Pasco County, Florida, 1969: Florida Bureau of Geology Map Series 47, 1 pl.

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Kaufman, M.I., 1975, The chemical type of water in Florida streams (2d ed.): Florida Bureau of Geology Map Series 51, 1 pl.

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Anderson, Warren, and Faulkner, G.L., 1973, Quantity and quality of surface water in Marion County, Florida: Florida Bureau of Geology Map Series 55, 1 pl.

Reichenbaugh, R.C., 1976, Effects on ground-water quality from irrigating pasture with sewage effluent near Lakeland, Florida: U.S. Geological Survey Water-Resources Investigations 76-108, 56 p.

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Rodis, H.G., 1973, Encroaching salt water in northeast Palm Beach County, Florida: Florida Bureau of Geology Map Series 59, 1 pl.

Hunn, J.D., 1974, Hydrology of Lake Tarpon near Tarpon Springs, Florida: Florida Bureau of Geology Map Series 60, 1 pl.

Coble, R.W., 1973, The Anclote and Pithlachascotee Rivers as water-supply sources: Florida Bureau of Geology Map Series 61, 1 pl.

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Hughes, G.H., 1974, Water-level fluctuations of lakes in Florida: Florida Bureau of Geology Map Series 62, 1 pl.

Rosenau, J.C., and Faulkner, G.L., 1975, An index to Springs of Florida, (2d ed.): Florida Bureau of Geology Map Series 63, 1 pl.

Stone, R.B., 1974, Low streamflow in Florida--magnitude and frequency: Florida Bureau of Geology Map Series 64, 1 pl.

Healy, H.G., 1974, The observation-well network of the U.S. Geological Survey in Florida: Florida Bureau of Geology Map Series 65, 1 pl.

Snell, L.J., and Kenner, W.E., Surface water features of Florida: Florida Bureau of Geology Map Series 66, 1 pl.

Robertson, A.F., and Mills, L. R., 1974, Ground-water withdrawals in the upper Peace and upper Alafia River basins, Florida: Florida Bureau of Geology Map Series 67, 1 pl.

Tibbals, C.H., 1975, Recharge areas of the Floridan aquifer in Seminole County and vicinity, Florida: Florida Bureau of Geology Map Series 68. 1 pl.

Bush, P.W., 1974, Hydrology of the Oklawaha Lakes area of Florida: Florida Bureau of Geology Map Series 69, 1 pl.

Pascale, C.A., 1975, Estimated yield of freshwater wells in Florida: Florida Bureau of Geology Map Series 70, 1 pl.

Healy, H.G., 1975, Terraces and shorelines of Florida: Florida Bureau of Geology Map Series 71, 1 pl.

Conover, C.S., and Leach, S.D., 1975, River basin and hydrologic Unit map of Florida: Florida Bureau of Geology Map Series 72, 1 pl.

Healy, H.G., 1975, Potentiometric surface and areas of artesian flow of the Floridan aquifer in Florida, May 1974: Florida Bureau of Geology Map Series 73, 1 pl.

Causey, L.V., and Leve, G.W., 1976, Thickness of the potable-water zone in the Floridan aquifer: Florida Bureau of Geology Map Series 74, 1 pl.

Slack, L.J., and Goolsby, D.A., 1976, Nitrogen loads and concentrations in Florida streams: Florida Bureau of Geology Map Series 75, 1 pl.

Slack, L.J., 1977, Program for monitoring surface-water quality in Florida: Florida Bureau of Geology Map Series 76, 1 pl.

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Phelps, G.G., 1978, Chemical quality of water used for municipal supply in Florida, 1975: Florida Bureau of Geology Map Series 82, 1 pl.

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Leach, S.D., 1978, Freshwater use in Florida, 1975: Florida Bureau of Geology Map Series 87, 1 pl.

Hull, R.W., and Irwin, G.A., 1979, Quality of untreated water for public supplies in Florida with reference to the National Primary Drinking Water Regulations: Florida Bureau of Geology Map Series 91, 1 pl.

Miller, R.A., Potential subsurface zones for liquid-waste storage in Florida: Florida Bureau of Geology Map Series 94, 1 pl.

Slack, L.J., and Rosenau, J.C., 1979, Water quality of Florida Springs: Florida Bureau of Geology Map Series 96, 1 pl.

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Healy, H.G., 1981, Estimated pumpage from ground-water sources for public supply and rural domestic use in Florida, 1977: Florida Bureau of Geology Map Series 102, 1 pl.

Leach, S.D., 1982, Estimated water use in Florida, 1980: Florida Bureau of Geology Map Series 103, 1 pl.

Healy, H.G., 1982, Potentiometric surface of the Floridan aquifer in Florida, May 1980: Florida Bureau of Geology Map Series 104, 1 pl.

Leach, S.D., 1983, Consumptive use of freshwater in Florida, 1980: Florida Bureau of Geology Map Series 105, 1 pl.

Spechler, R.M., 1983, Estimated irrigation water use in Florida, 1980: Florida Bureau of Geology Map Series 106, 1 pl.

Foose, D.W., and Sohm, J.E., 1983, Long-term streamflow stations in Florida, 1980: Florida Bureau of Geology Map Series 107, 1 pl.

Leach, S.D., 1985, Projected public supply and rural (self-supplied) water use in Florida through year 2020: Florida Bureau of Geology Map Series 108, 1 pl.

Hampson, P.S., 1984, Wetlands in Florida: Florida Bureau of Geology Map Series 109, 1 pl.

Sinclair, W.C., and Stewart, J.W., 1985, Sinkhole type, development, and distribution in Florida: Florida Bureau of Geology Map Series 110, 1 pl.

(FL-075)

Foose, D.W., 1987, Long-term stage records of lakes in Florida: Florida Geological Survey Map Series 118, 1 pl.

Barr, G.L., 1987, Potentiometric surface of the Upper Floridan aquifer in Florida, May 1985: Florida Geological Survey Map Series 119, 1 pl.

Aucott, W.R., 1989, Areal variation in recharge to and discharge from the Floridan aquifer system in Florida: U.S. Geological Survey Water-Resources Investigations Report 88-4057, 1 pl.

Rumenik, R. P., 1988, Runoff to streams in Florida: Florida Geological Survey Map Series 122, 1 pl.

Marella, R.L., 1989, Freshwater withdrawals and water-use trends in Florida, 1985: Florida Geological Survey Map Series 123, 1 pl.

Conover, C.S., Vecchioli, John, and Foose, D.W., 1989, Ground-water sources and 1985 withdrawals in Florida: Florida Geological Survey Map Series 124, 1 pl.

Andrews, W.J., 1990, Transmissivity and well yields of the Upper Floridan aquifer in Florida: Florida Geological Survey Map Series No. 132, 1 pl.

FL-362 EVALUATION OF STORMWATER DETENTION BASINS IN WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: October 1980

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Staff, Tampa

COOPERATING AGENCY: Pinellas County

PROBLEM: Pinellas County is one of the most densely populated counties in Florida, and serious water-quality problems in the Gulf of Mexico and Tampa Bay are caused by the increase in urban runoff. There is a need for data to evaluate the cost effectiveness of the pollution control measures being planned to satisfy receiving water-quality standards.

OBJECTIVE: To determine the effectiveness of runoff detention ponds in reducing suspended solids, nutrients, metals, and biochemical oxygen demand loads entering receiving waters from urban areas in Pinellas County.

APPROACH: Runoff quantity and quality of an urban watershed will be monitored for a year before the construction of a stormwater detention pond just upstream from the monitoring station. This will provide background information to compare with data after the completion of the pond in the second year. After completion of the pond, an additional monitoring station will be operated at the inflow. Loads entering and leaving the pond will be compared. An interpretive report will be written in the third year after at least one complete year of inflow and outflow data have been analyzed.

PROGRESS: Constituent loads of chloride, copper, chromium, lead, zinc, mercury, nitrogen, phosphorous, biochemical oxygen demand, and dissolved solids have been computed for selected storms. Final report is in preparation.

PLANS FOR THIS YEAR: Tentative approval date for final report is August 1993 and target date for publication is September 1993.

REPORTS IN PROCESS:

Woodham, W.M., Changes in urban runoff water quality in a multi-purpose stormwater detention area, Pinellas Park, Florida, 80 p.

FL-449 SIMULATION OF A SALTWATER PLUME FROM A FLOWING WELL IN A SURFICIAL AQUIFER, DADE COUNTY, FLORIDA

DATE PROJECT BEGAN: October 1985

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Michael L. Merritt, Miami

COOPERATING AGENCIES: Metro-Dade Environmental Resources Management (DERM)

PROBLEM: Water supply in highly populated southeastern peninsular Florida is obtained almost entirely from the surficial aquifer. The presence of a chloride plume in the aquifer was established in 1979 and traced to a flowing well in Chekika Hammock State Park that was constructed in 1944. It was plugged in March 1985. Dade County plans to develop a new well field to the northeast of the plume, and concerns exist about the possible well field contamination and about the future movement and dilution of the plume.

OBJECTIVE: To obtain information about the hydrologic regime in the surficial aquifer of south-central Dade County and about the local movement and dispersal of pollutants, and to use this information to assess the future migration and attenuation of the chloride plume and the possibility of contamination of water withdrawn from the proposed new well field.

APPROACH: A digital model will be constructed to represent flow and transport in the area containing the chloride plume. Information used to design the model will include descriptions of rock samples and cores and the results of hydraulic testing now taking place as part of a separate study. Information used to calibrate the model will include the results of synoptic quality water (QW) reconnaissance by the U.S. Geological Survey (USGS) in 1979 and a time series of QW data collected by the Department of Environmental Regulation Management (DERM) at various sites since 1981. The hydraulic regime will be simulated first, to be followed by chloride transport calculations and analyses to predict future plume movement and assess possible well field contamination.

PROGRESS: Field data collection is complete and a final report is in review.

PLANS FOR THIS YEAR: Continue review process of final report. The report is anticipated to have Director's approval in 1993.

FL-473 HYDROLOGIC IMPACTS OF PHOSPHATE MINING ON SMALL BASINS, CENTRAL FLORIDA

DATE PROJECT BEGAN: April 1987

DATE PROJECT ENDS: March 1992

PRINCIPAL INVESTIGATOR: Billy R. Lewelling, Tampa

COOPERATING AGENCY: Florida Institute of Phosphate Research

PROBLEM: The hydrologic characteristics of small basins in central Florida are poorly defined. Permits for mined-land reclamation require that runoff from reclaimed land not exceed pre-mining conditions and there be no degradation of water quality of the receiving streams. There are no data on the hydrologic characteristics of reclaimed land forms.

OBJECTIVE: (1) Define the hydrology and water quality of undisturbed small basins in the phosphate mining area of central Florida; (2) define the hydrology and water-quality characteristics of the four most common reclaimed land forms: a clay settling area, a land and lakes (graded overburden) area, a sand-clay mix settling area, and an overburden capped sandtailings fill area; (3) compare results from 1 and 2 above.

APPROACH: Collect hydrologic data from small, undisturbed basins and from four nearby basins representing the common reclaimed land forms to define streamflow and aquifer characteristics. Collect ground-water samples during high and low water-table conditions to define ground-water quality. Collect streamflow samples during base flow and during related storm runoff to define water quality of streamflow. Compare and describe statistical differences between unmined and reclaimed basin pairs and among various reclamation types.

PROGRESS: Final report is in review.

PLANS FOR THIS YEAR: Continue review process for final report and submit for Director's approval. Tentative publication date is March 1993.

REPORTS IN PROCESS:

Lewelling, B.R., An evaluation of the hydrologic effect of phosphate-mined land reclamation in small watersheds, central Florida, 80 p.

FL-482 FINE SEDIMENT RESUSPENSION PROCESSES AND LIGHT ATTENUATION IN SHALLOW ESTUARINE ENVIRONMENTS

DATE PROJECT BEGAN: October 1987

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: David H. Schoellhamer, Tampa

COOPERATING AGENCIES: City of St. Petersburg, Hillsborough County Environmental Protection Commission, Pinellas County, Southwest Florida Water Management District, and Tampa Port Authority

PROBLEM: Fine sediment plays an important role in the overall environmental quality of shallow estuaries, such as Tampa Bay, in at least two ways. Elevated concentrations of fine sediment in the water column reduce the depths to which sunlight can support photosynthesis. This could be partly why Tampa Bay has lost more than 80 percent of its seagrass beds during the last 100 years. Fine sediment also absorbs a wide range of toxic organic and inorganic chemicals whose distribution and availability to various biological communities are then primarily governed by fine sediment transport processes. These processes, particularly the mechanisms of resuspension from the bay bottom, are poorly understood and presently contribute little toward proper management of Tampa Bay.

OBJECTIVE: The objectives of the project are to determine the mechanisms that cause resuspension of fine sediments from the bottom of Tampa Bay and to determine the effects of these resuspended materials on light attenuation.

APPROACH: To accomplish the first of these objectives, two sites were selected: one in Hillsborough Bay and one in Old Tampa Bay, each representative of a large part of the bay bottom in relatively deep water. At the Old Tampa Bay site, a platform was built from which vertical profiles of velocity and suspended solids can be monitored and used to detect resuspension caused by tidal currents, cold fronts, tropical storms, thunderstorms, and ship wakes. A submersible instrument package was used to monitor velocity and suspended solids at a companion shallow-water site in Old Tampa Bay. After the hurricane season in 1990, the platform equipment was reconfigured into two new submersible instrument packages for use in Hillsborough Bay in 1991.

To relate the resuspension information to light attenuation and to detect possible interferences from nonresuspension processes (such as photoplankton blooms, river discharges, and stormwater runoff), light and water-quality data are collected at least every month at the two primary sites and at two nearby companion sites with sandy bottoms. The data are analyzed to determine the significance of resuspended sediment on light attenuation and to determine other causes of light attenuation.

PROGRESS: Continue report preparation.

(FL-482)

PLANS FOR THIS YEAR: Project reports will be completed and published. Target date for Director's approval is September 1993 with a publishing date of April 1994.

REPORTS IN PROCESS:

Schoellhamer, D.H., Resuspension of bottom sediments, sedimentation, and tributary storm discharge at Bayboro Harbor and the Port of St. Petersburg, Florida, 1 pl.

Schoellhamer, D.H., Sediment resuspension data for Old Tampa Bay. Sediment resuspension data for Hillsborough bay, 1 pl.

Schoellhamer, D.H., Light attenuation and water quality in upper Tampa Bay, 20 p.

FL-487 WATER BUDGET OF A SOFTWATER SEEPAGE LAKE IN THE FLORIDA PANHANDLE

DATE PROJECT BEGAN: June 1988

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Trey Grubbs, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: Acidification of lakes over much of eastern Canada and the Northeastern United States has become a serious problem in recent years. Although it has not been demonstrated that Florida lakes have shown a clear trend toward acidity, some of Florida's lakes are acidic. Many lakes can be naturally acidic, but an assessment of the contribution of acidic precipitation to lake acidification has not been made. Softwater seepage lakes having low conductance and low alkalinity might be the most susceptible to further acidification from acid deposition and it is important to establish the relative quantitative importance of hydrologic and chemical parameters on the acid neutralization capacity (ANC) of softwater seepage lakes. An accurate hydrologic budget is essential in assessing the effects of acid precipitation on the ANC of a given lake because ground water may have a significant effect on the degree of ANC.

OBJECTIVE: The primary objectives of this study are to establish a complete hydrologic budget for Lake Five-O and to collect samples of precipitation, ground water, and lake water for chemical analysis.

APPROACH: To make accurate and independent calculations of each component of the hydrologic budget including ground water, evaporation, and precipitation. A network of monitoring wells and piezometer nests distributed vertically within the ground-water flow system will be used to establish detailed water-level maps and determine horizontal and vertical hydraulic head gradients. Piezometers will be placed in the lake bed to identify areas of ground-water recharge and discharge areas within the lake. Using these data, ground-water inflows and outflows will be determined by flow-net analysis and numerical modeling studies. Evaporation losses will be determined by the energy budget evaporation method. This requires detailed measurements of various parameters such as wind speed and direction, relative humidity, air and water temperature, and incoming solar radiation. Lake volume will be monitored throughout the study using lake bathymetry data and lake stage data. Precipitation in the lake basin will be measured directly using two different types of rain gages.

PROGRESS: Evaporation estimates were finalized and an error analysis for the energy budget estimates of evaporation were completed. Three-dimensional, steady-state and transient ground-water flow models were calibrated and used to estimate monthly ground water exchange with Lake Five-O. The evaporation estimates, precipitation data, and results from the ground-water flow models were used to complete a monthly water budget for Lake Five-O. A final report is in preparation.

(FL487)

PLANS FOR NEXT YEAR: Complete planned report.

REPORTS IN PROCESS:

Grubbs, J.W., Evaluation of ground-water flow near a seepage lake in northwest Florida, 60 p.

Sacks, L.A., Lee, T.M., and Radell, M.J, Comparison of energy-budget evaporation losses from two morphometrically different Florida seepage lakes, journal article

REPORTS RELEASED:

Andrews, W.J., Oliveros, J.P., and Collins, J.J., 1990, Preliminary report on the hydrogeology of Lake Five-O and vicinity, Bay County, Florida: U.S. Geological Survey Water-Resources Investigations Report 90-4148, 1 pl.

Pollman, C.D., Lee, T.M., Andrews, W.J., Sacks, L.A., Gherini, S.A. and Munson, R.K., 1991, Preliminary analysis of the hydrologic and geochemical controls on acid-neutralizing capacity in two acidic seepage lakes in Florida: Water Resources Research, v. 27, p.2321-2336

FL-488 FRESHWATER INFLOW TO INDIAN RIVER LAGOON, FLORIDA

DATE PROJECT BEGAN: October 1988

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Leel Knowles, Jr., Orlando

COOPERATING AGENCY: St. Johns River Water Management District

PROBLEM: Estuarine-dependent fish are adversely affected by lower salinities that are caused by excessive freshwater inflows to the Indian River Lagoon. Data are needed to quantify the natural inflows so that controlled flows can be more effectively managed.

OBJECTIVE: Define the runoff of freshwater from the natural basins that empty into the Indian River Lagoon by: (1) operating gaging stations, and (2) simulating discharges using a computer model.

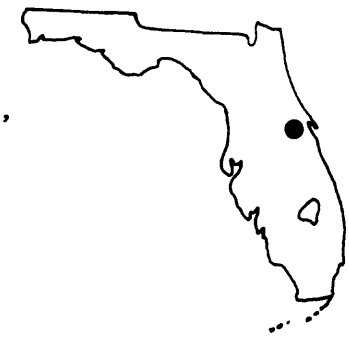
APPROACH: Traditional gaging will be used on some of the sites. Flow in tide-affected areas will be defined using the 1-D BRANCH model. Rainfall data will be collected in the smaller, previously ungaged, basins draining into the lagoon.

PROGRESS: Data collection and processing continued through the entire year. The BRANCH model was used to compute mean daily discharges for three tidal sites. The final report presents rainfall and streamflow trends of the Indian River lagoon basin for the period ending December 31, 1991. Report is in review.

PLANS FOR THIS YEAR: Report will be completed and published. Target date for Director's approval is June 1993.

REPORTS IN PROCESS:

Knowles, L., Freshwater inflow to the Indian River Lagoon, FL.



FL-489 WATER QUALITY IN THE WINTER PARK CHAIN OF LAKES, AND IMPACT OF DEVELOPMENT, CENTRAL FLORIDA

DATE PROJECT BEGAN: October 1988

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: E.R. German, Orlando

COOPERATING AGENCIES: City of Winter Park and the St. Johns Water Management District

PROBLEM: Although data are sparse, there are indications that the lakes are eutrophic and are receiving phosphorus loading in excess amounts. Lake water clarity may be decreasing and inflow of vegetative and other debris with stormwater runoff may be contributing to excessive sediment buildup in the lakes. Because of the lack of knowledge of the relative inputs from the various nutrient sources, a practical water-quality management strategy is not possible.

OBJECTIVE: Establish a systematic program of data collection to determine rainfall quantity, lake level and water quality, and surface inflow quality and quantity. Investigate composition of lake sediments and rate of sediment buildup. Estimate loads of nutrients to the lakes from atmospheric deposition, storm runoff, and ground-water seepage. Determine contribution of coarse, fine, very fine, and dissolved material to the total stormwater loading to the lakes for nutrient and oxygen demand.

APPROACH: Install and operate discharge stations on the three major surface-inflow canals, and the outflow canal. Install and operate lake-level recorder and rain gage. Begin a bimonthly schedule of lake water-quality sampling. Sample bottom sediments and conduct bathymetric surveys with sound reflection and ground-penetrating radar. Determine major source of nutrient inflow by sampling stormwater inflow, surface inflow from upstream lakes, and ground water. Select two stormwater inflow sites for determination of loading of oxygen demand and nutrient inflow due to coarse, fine, very fine, and dissolved materials in the runoff.

PROGRESS: Measurement of tributary and stormwater inflow, canal outflow, and rainfall and bimonthly water quality sampling were completed as of September 30, 1992. During the year, ground penetrating radar and color fathometer surveys of the lakes were made to investigate the thickness and nature of lake bottom sediments. Additional samples of stormwater inflow collected at two sites were analyzed for nutrient concentrations. The head difference between the lakes and the surficial aquifer was measured at 20 sites and samples of ground water were collected at each site and analyzed. An inventory of vegetation surrounding the lakes was compiled. Preliminary sections of the final report were written.

PLANS FOR THIS YEAR: Complete data analysis and write final report.

FL-491 ASSESSMENT OF SALTWATER INTRUSION IN COASTAL BROWARD COUNTY, FLORIDA

DATE PROJECT BEGAN: October 1988

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: Michael Merritt, Miami

COOPERATING AGENCIES: Broward County Office of Environmental Services and the South Florida Water Management District

PROBLEM: Water management agencies need simulation modeling to reduce the cost of data collection in assessing the degree of saltwater intrusion and to permit assessments of scenarios for amelioration.

OBJECTIVE: The objectives of the study are to collect special data that quantitatively describe the mechanisms of saltwater intrusion and to develop, evaluate, and apply digital simulation methodology to represent the saltwater intrusion process and to predict future changes under hypothetical scenarios.

APPROACH: Approximately 10 additional pairs of sampling wells will be added to the current observation network. These wells are intended to locate the position of the saltwater intrusion where it is not presently known. In addition, geologic test wells and hydraulic test wells will be installed that will provide data to be used for hydrologic models. Simulation efforts using a cross-sectional model will be conducted at a well field located near the saltwater interface. When the vertical layering is adequately simplified, the model will be extended into three dimensions, which will include additional well fields, canals, and other local features for more realistic and precise simulations.

PROGRESS: Drilling and sampling of saltwater reconnaissance wells were completed. A review of water management activities over the past several decades has been conducted for the sharp interface model application.

PLANS FOR THIS YEAR: The sharp interface model will be applied to average conditions existing in the study area, and a report describing the data collection and modeling activities will be prepared.

FL-492 DEVELOPMENT OF AN ARTIFICIAL INTELLIGENCE ROUTINE IN BROWARD COUNTY, FLORIDA

DATE PROJECT BEGAN: October 1988

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Roy Sonenshein, Miami

COOPERATING AGENCIES: Broward County and the South Florida Water Management District

PROBLEM: The Florida Department of Environmental Regulation requires each of the five water-management districts within the State to design and implement a monitoring network that will be utilized to determine the effects of land use on ground-water quality. However, a cost-effective method to design a monitoring network that describes land-use effects has not been technically defined.

OBJECTIVE: (1) Develop a routine within the framework of an existing artificial intelligence (AI) software package that will analyze hydrogeologic and anthropogenic information, and (2) develop the computer program for interfacing ground-water flow model results and Geographic Information System (GIS) information with AI.

APPROACH: The first phase of the development of the AI software will be accomplished using the commercial AI program "Insight." This program will house the decision tree elements, and a search aspect will be developed using a FORTRAN routine that will interface initially with GIS programs. The second phase will use an operational AI that interfaces with a number of data bases from ground-water model output.

PROGRESS: Final report is in press.

PLANS FOR THIS YEAR: Complete report and submit for review and approval by April 1993.

REPORTS IN PROCESS:

Sonenshein, R., Use of ground-water flow model to analyze ambient ground-water quality monitoring networks in Broward County, Florida, 50 p.

FL-494 **ASSESSMENT OF CANAL-AQUIFER INTERACTION IN THE SURFICIAL AQUIFER SYSTEM USING A COUPLED SURFACE-WATER FLOW MODEL, BROWARD COUNTY, FLORIDA**

DATE PROJECT BEGAN: October 1988

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Eric Swain, Miami

›rida Water Management District

USGS Research Fur

for surface-water/ground-water flow modeling
: canal-aquifer interaction on a regional
.ow models have been developed by the U.S.
incorporate surface-water routing models.
›ed for two-dimensional ground-water flow and
; flow in the multilayer or multiple aquifer

›und-water/surface-water flow model by modi-
ıensional finite-difference ground-water flow
:he flow routing techniques of the USGS
lel to better simulate canal-aquifer inter-
:ation, the model will be used to simulate
ıal flow in Dade County, Florida.

· flow model will be modified to include the
· the RIVER module. An interactive procedure will be designed within the main program to solve the resulting nonlinear system of equations. The modified model will be extensively tested to verify that no coding or computational errors have been introduced. Documentation of changes made to the two computer codes will be provided to the South Florida Water Management District along with a user's guide describing additional input data requirements for the modified MODFLOW model. Once the modified MODFLOW model has been tested and verified as computationally correct, data collected in this investigation will be used to simulate coupled ground-water and surface-water flow in the area. The results of these simulations will be compared to those obtained using the original MODFLOW model to demonstrate the improvement in simulation capabilities and the model's effectiveness as a management tool.

PROGRESS: Final report has been completed.

REPORTS RELEASED:

Swain, E.D., Wexler, E.J., 1991, "A coupled surface-water and ground-water model, proceedings of the 1991 National Conference of the Irrigation and Drainage Division, American Society of Civil Engineers, p. 330-336.

Swain, E.D., Wexler, E.J., 1992, "A coupled surface-water and ground-water model for simulation of stream-aquifer interactions: U.S. Geological Survey Open-File Report 92-138.

FL-496 TRACER TESTS OF GROUND-WATER FLOW IN A KARST AQUIFER IN WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: October 1989

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: James T. Robinson, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: The rationale for delineating protection zones, which considers the Upper Floridan aquifer a homogeneous medium, probably is not valid for west-central Florida. If the aquifer cannot be treated as a homogeneous porous medium, which appears to be the case, there is the need to reconsider the guidelines for establishing protection zones.

OBJECTIVE: The study will provide information and hydrogeologic data needed to evaluate ground-water flow near pumping wells in a karst aquifer system and apply this knowledge to wellhead protection strategies for west-central Florida. Specific objectives are: (1) estimate the extent of fracture systems/solution cavities within a selected wellhead protection zone; (2) define the hydraulic properties of the aquifer system in the protection zone; (3) measure movement of tracers in the protection zone; (4) simulate the measured tracer movement and quantify transport properties of the karst aquifer within the protection zone, and (5) propose guidelines to assist in evaluating the adequacy of present well-head protection strategies for west-central Florida.

APPROACH: The study will consist of four main phases: (1) geophysical studies will be conducted at a suitable test site with well-developed karst features; (2) aquifer tests will be conducted to define hydraulic properties that control flow to a production well and observation wells for tracer injection and monitoring; (3) tracer tests will be conducted over large and small depth intervals of the aquifer and tracer movement monitored for up to 6 months; and (4) the U.S. Geological Survey (USGS) modular ground-water flow model, with a recently developed particle tracking module or another existing analytical method, will be used to simulate tracer movement and to test the validity of relations among aquifer heterogeneity, hydrodynamic dispersion, and porosity.

PROGRESS: Data collection is complete. Data analysis is complete. A written report has been prepared and is in review.

PLANS FOR THIS YEAR: Continue to process and publish report.

REPORTS IN PROCESS:

Robinson, J.L., Tracer tests of ground-water flow in a karst aquifer, west-central Florida.

FL-497 LIGHT ATTENUATION IN THE ESTUARINE AND COASTAL WATERS OF SOUTHWEST FLORIDA--CAUSE AND IMPLICATIONS

DATE PROJECT BEGAN: October 1989

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Benjamin F. McPherson, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: The amount of photosynthetically active radiation (PAR) in estuarine and coastal waters is of fundamental importance in determining growth and vigor of aquatic plants. The availability of PAR in these waters may be severely limited by dissolved (color) and suspended material, so that plants compete with one another for light. In deep-water environments, phytoplankton have an advantage over benthic plants and may flourish in the upper sunlit waters and thereby shade benthic algae, periphyton, and seagrasses. In shallow water, drift algae and periphyton may cover seagrasses and reduce light available to the seagrasses. Cultural enrichment of estuarine waters favors the growth of phytoplankton, drift algae, and periphyton, and that growth may greatly reduce light penetration and light available to seagrasses. Understanding the causes of light attenuation that result from the complex interaction of these physical, chemical, and biological processes will be necessary to help set long-term goals for properly managing our estuarine and coastal water resources.

OBJECTIVE: The overall objective of this study is to provide information to help guide management strategies in the estuarine and coastal waters of southwestern Florida by determining the causes of light attenuation. The causes of light attenuation include the identification of both the material (dissolved organic material, suspended sediment, phytoplankton, periphyton, drift algae) and the processes that contribute to its presence in the water column or on seagrasses (wind, tide, water depth, type of shoreline, benthic plants and animals, bottom and suspended sediment characteristics, freshwater inflow, nutrient concentrations and loads). The study area will include Tampa Bay, Charlotte Harbor, and nearshore waters of the Gulf of Mexico. The study will include 6 months of method development and testing, and approximately 2 years of data collection and analysis, including two summers of intensive sampling.

APPROACH: Ten study areas in Tampa Bay and Charlotte Harbor that represent different regional environments and different levels of basin development were sampled for this study. Within each of these areas, several stations were established to characterize the light-attenuating properties of different benthic and shoreline environments. If seagrasses occurred in the study area, a station was established within the seagrass meadow and another was established beyond the meadow in deeper water. The study areas were sampled approximately 20 times over 2 years. The most intensive sampling was during May through September. The 2-year span provides the minimum time needed for an annual comparison. Measurements were made of light attenuation (PAR) in the water column and in seagrass and drift algae communities. Physical, chemical, and biological data that may affect light attenuation were collected.

(FL-497)

PROGRESS: Work continued on preparation of reports. Graphs were made and tables of data generated. The reports received colleague review and were modified accordingly. Results of the study were presented to the cooperator and other interested agencies.

PLANS FOR THIS YEAR: Work will continue on processing of reports through the review system. Target date for Director's approval is February 1993.

REPORTS IN PROCESS:

McPherson, B.F., Light Attenuation -- Data Report, 50 p.

McPherson, B.F., Causes of Light Attenuation, 50 p.

FL-498 CIRCULATION AND CONSTITUENT TRANSPORT IN SARASOTA BAY, FLORIDA

DATE PROJECT BEGAN: January 1990

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Kathleen M. Hammett, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: Sarasota Bay was selected by the U.S. Environmental Protection Agency for inclusion in the National Estuary Program (NEP). As part of the NEP, a comprehensive management plan that includes strategies for preservation, restoration, and enhancement will be developed for Sarasota Bay. To preserve, restore, or enhance the estuary, it is necessary to describe and quantify the circulation and constituent transport characteristics of the system. A hydrodynamic model provides a tool for evaluating both circulation and constituent transport. No hydrodynamic model presently exists for the whole Sarasota Bay study area.

OBJECTIVE: The primary purpose of this investigation is to develop a calibrated and verified hydrodynamic model of water circulation and constituent transport in Sarasota Bay. The model will closely simulate the existing system and will be able to evaluate the changes to circulation and constituent transport due to natural and proposed manmade physical changes in the system. A related objective is to develop the hydrodynamic model so that, as understanding is gained about the physical, chemical, and biological processes that affect water clarity, these processes eventually can be incorporated into the model.

APPROACH: This investigation is a joint effort between the U.S. Geological Survey and the University of Florida (UF) Coastal and Oceanographic Engineering Department. Bathymetric and tidal-stage data collection will be started while the workplan is being prepared. Following approval of the workplan, preliminary modeling and intensive data collection will begin. Model calibration will begin when reliable data are available from the field and will be documented in an interim report prepared by UF. Following calibration, an independent data set will be used to verify the model.

PROGRESS: Recording gages in the southern part of the study area were removed and four gages in the northern part were reactivated during the year. Offshore conductance meters were deployed and discharge through the northern inlets was measured in coordination with intensive data collection by the university. Data collection ended September 30. The USGS is not publishing any reports on this activity. A report on the three-dimensional model will be prepared by the university.

PLANS FOR THIS YEAR: Analyze the collected data and store for future reference. Furnish the cooperator the data for inclusion in the report prepared by the university.

FL-499 HYDRAULIC AND SALINITY CHARACTERISTICS OF MATLACHA PASS ESTUARY, LEE COUNTY, FLORIDA

DATE PROJECT BEGAN: July 1989

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Gary Russell, Stuart

COOPERATING AGENCIES: Florida Department of Environmental Regulation, Lee County, and the City of Cape Coral

PROBLEM: The western spreader canal system in Cape Coral has altered the sheetflow patterns of freshwater runoff into Matlacha Pass. The Florida Department of Natural Resources (DNR) has expressed concern that altering the freshwater runoff patterns into the pass will have a detrimental effect on salinity distribution which, in turn, will affect the aquatic system of the pass. Adequate data are not available to evaluate the effects of redistribution of freshwater inflow, its movement, and mixing. This proposed study will help identify the hydrodynamic aspects for managing the estuary.

OBJECTIVE: The objectives of the study are to determine the hydrodynamics of tidal-flow, freshwater inflow, and water circulation in Matlacha Pass estuary and to evaluate the effects that water circulation has on the distribution of selected physical and chemical characteristics of the pass. The study will provide baseline information on bathymetry, salinity, and selected water-quality data. The main focus of the study will include development of a two-dimensional hydrodynamic simulation model of Matlacha Pass. The model will be calibrated by the use of bathymetry, tidal stage, tidal velocity, tidal discharge, freshwater inflow, and selected water-quality data.

APPROACH: (1) A preliminary two-dimensional flow and circulation model will be simulated by the use of an existing two-dimensional model of the Charlotte Harbor estuary, (2) continuous collection of calibration data in the estuary will be compared with data generated from the initial model, and concurrent water-quality information will be used in conjunction with stage and velocity measurements to calibrate and verify the model, and (3) documentation of the model will be prepared.

PROGRESS: Freshwater runoff into Matlacha Pass is primarily from surface water canals that drain Cape Coral. Salinity distribution in the pass is characterized by well-mixed conditions. Freshwater mixing has been observed near breaks in the spreader canal system. Bathymetry measurements indicate a relatively flat bottom with an irregularly narrow main channel with depths varying from 4 to 14 feet. Data collection and analysis are completed. Documentation of the model are in the final stages of preparation.

PLANS FOR THIS YEAR: Complete model setup and documentation. Final report is in review. Target date for Director's approval is September 1993.

REPORTS IN PROCESS:

Russell, G., Bathymetry, freshwater inflow, and salinity of Matlacha Pass, southwestern Florida.

FL-501 AVAILABILITY OF GROUND WATER IN THE ORLANDO METROPOLITAN AREA, EAST-CENTRAL FLORIDA

DATE PROJECT BEGAN: April 1990

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Louis Murray, Orlando

COOPERATING AGENCIES: Florida Department of Environmental Regulation, St. Johns River Water Management District, and South Florida Water Management District

PROBLEM: Growth in the Orlando metropolitan area is expected to cause ever-increasing demands on the ground-water resources. Available well-field locations are constrained by the occurrence of salty water, contaminated ground water, and zones of low aquifer transmissivity, and by the proximity of existing well fields. At present, there is insufficient interpretive information to assess what long-term effect that land-use changes and increasing water use will have on the ground-water resources.

OBJECTIVE: To assess the potential for developing additional large ground-water supplies in the Orlando metropolitan area, to identify favorable locations for well fields, and to develop a strategy for monitoring changes in the geohydrology.

APPROACH: (1) Assimilate all ground-water and geologic information from published and unpublished reports. (2) Use existing current and historical ground-water quality data to prepare interpretive thematic maps of the areal and depth distribution of selected water-quality constituents. (3) Construct and calibrate a high-resolution, 3-D finite-difference ground-water flow model, a particle-tracking model, and an optimizing model for identifying areas where aquifer characteristics are suitable for development. (4) Outline a strategic ground-water monitoring network to observe changes in ground-water quality and quantity.

PROGRESS: The steady-state flow model for 1988 stressed conditions has been calibrated to reflect measured 1988 spring flows and the average 1988 potentiometric surface of the upper Floridan aquifer.

PLANS FOR THIS YEAR: (1) Complete interpretive report on simulation of the groundwater-flow system. (2) Collect water-quality data (chlorides, sulfates, and dissolved solids) for project area. (3) Perform particle-tracking analyses of the flow system. (4) Write final report describing the results of particle-tracking simulations and identifying favorable areas for new well-field development.

FL-503 EFFECTS OF DAIRY FEEDLOTS ON GROUND- AND SURFACE-WATER QUALITY IN NORTH FLORIDA

DATE PROJECT BEGAN: November 1989

DATE PROJECT ENDS: December 1994

PRINCIPAL INVESTIGATOR: William Andrews, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: In the past few years, an increasing number of dairies have been located near the Suwannee River in Lafayette and Suwannee Counties. Dairy cows deposit approximately 75 kilograms of nitrogen per year per animal as manure, much of which can be converted to nitrate, which is highly soluble and mobile in ground-water systems and can cause human health problems. The area where the dairies are located is highly susceptible to ground-water contamination because the principal source aquifer in the area, the Upper Floridan aquifer, consisting of the Suwannee and Ocala Limestones, is unconfined, near the land surface, and in many places is directly connected to the land surface by karstic drainage features. The Suwannee River, designated as an Outstanding Florida Water requiring the highest priority of protection, is directly connected to the Upper Floridan aquifer in the area through numerous springs which flow from the aquifer into the river. Elevated nutrient concentrations in surface waters can cause undesirable eutrophication of those waters.

State regulatory agencies require more detailed information on the effects that these dairy operations are having on water quality in north Florida in order to identify waste-management practices that minimize ground- and surface-water contamination from these operations.

OBJECTIVE: To determine the extent of contamination of ground water beneath and surface water flowing from dairy operations and how the contamination relates to varying waste-management practices and hydrogeological conditions in LaFayette and Suwannee Counties.

APPROACH: Twelve to thirteen monitoring wells have been installed at each of four dairies located near the Suwannee River. In addition, three springs in the vicinity of the river will be sampled. Water samples are being analyzed for dissolved nitrogen species, chloride, inorganic carbon, oxygen, denitrifying bacteria, and physical parameters in order to assess the role of denitrification in reducing nitrate concentrations in ground water in the region.

PROGRESS: Water quality monitoring of 51 monitoring wells and three springs will be completed in March 1993.

PLANS FOR THIS YEAR: A network of 51 monitoring wells on 4 dairies will be sampled on a quarterly basis, with selected wells being sampled monthly. Final report will be written. Continue preparing interpretive report for review.

REPORTS IN PROCESS: "Water quality and denitrification near four north Florida dairy farms" is in draft stage.

FL-505 HYDROLOGY AND EFFECTS OF WATER-RESOURCES DEVELOPMENT IN THE HIGHLANDS RIDGE OF WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: July 1989

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: D.K. Yobbi, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: The Highlands Ridge, occupying 700 square miles in central Polk and Highland Counties, is an uplands recharge area along the axis of the Florida Peninsula. Many large sinkhole lakes occur along the crest of the ridge. Since the early 1960's, significant declines in lake levels have occurred in this important citrus-producing area. The problem of declining lake levels may be related to several factors, including below normal rainfall, increased ground-water pumpage for agricultural and industrial use, reduced recharge and drainage related to the channelization of the Kissimmee River, and agricultural drainage practices. In order to maintain the lake environment, it is important to understand and quantify the flow to, from, and within the ground-water system.

OBJECTIVE: To develop an understanding of the hydrogeologic regime and the effects of water-resources development in a regional lake environment that is strongly affected by pumping. A numerical model of ground-water flow will be used to simulate the response of the water table and lake levels to hydrologic stress.

APPROACH: Literature and file searches will be made and existing data will be compiled and geologic maps and cross sections will be prepared. The hydrogeologic system in the Highlands Ridge will be simulated using the USGS finite-difference modular computer code. Existing coarsely gridded models will be divided into 1-square mile or 1-minute (latitude and longitude) grid blocks. Starting heads, recharge, evapotranspiration, streamflow, pumping, and aquifer hydraulic properties will be estimated using the best available information. The initial steady-state calibration will be based on September 1989 hydrologic conditions. A transient model calibration will be made for the time period September 1989-September 1990. A sensitivity analysis of the model-input parameters will be performed following the steady-state and transient calibrations. Simulation runs will be made to demonstrate how the model can be used to assess the regional effects of water-resources development.

PROGRESS: Transient calibration of the model for the period October 1989 to October 1990 was completed. The transient simulation indicates that the hydrologic parameters derived during steady-state calibration were appropriate and simulated water-level fluctuations compare acceptably with measured water levels on a monthly basis.

PLANS FOR THIS YEAR: Perform verification and predictive model runs. Write final report, including steady-state, transient, and predictive model results. Target date for Director's approval is September 1993 with a publishing date of June 1994.

FL-506 NEAR-SURFACE WATER BALANCE FOR A SITE IN CENTRAL FLORIDA: A CASE STUDY AND MODELING INVESTIGATION

DATE PROJECT BEGAN: July 1990

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: W.R. Bidlake, Tampa

COOPERATING AGENCIES: Southwest Florida Water Management District and Sarasota County

PROBLEM: Water and energy exchanges between the atmosphere and terrestrial ecosystems are crucial components of the hydrologic cycle. Recharge and contaminant transport to saturated ground-water systems are regulated by hydrologic processes that occur near the soil surface. A greater understanding of these processes is needed to help elucidate potential effects of management decisions and climate change.

OBJECTIVES: Study objectives are to provide a site-specific example of the near-surface water balance and to develop predictive capabilities for key near-surface hydrologic processes through the use of a physically based hydrologic process model.

APPROACH: Investigators will conduct a detailed examination of the near-surface water balance for a site in a prevalent type of native vegetation in west-central Florida. Principal water-balance components to be monitored include: precipitation, evapotranspiration, and changes in soil-water storage. A physically based model will be used to simulate the water balance of the unsaturated zone. The model will be used to examine and predict evapotranspiration and other water-balance components under different vegetative conditions.

PROGRESS: Sixteen months of continuous monitoring of water balance components at the field site ended on October 1, 1992. Evapotranspiration, precipitation, and changes in soil water storage were monitored. Work on the hydrologic process model continued, and hydrologic parameters were determined from field and laboratory measurements. Soil physical properties, including bulk density, saturated hydraulic conductivity, and specific moisture capacity were measured. Interception of solar radiation by the plant canopy was measured, and that information will be used in modeling of transpiration and soil evaporation.

PLANS FOR THIS YEAR: Water balance data will be analyzed and summarized. The hydrologic process model will be completed, and it will be used to simulate the unsaturated-zone water balance at the field site. Measurements of soil physical properties will be completed and analyzed. A draft of the principal study report will be prepared.

FL-507 DEFINITION OF THE UPPER FLORIDAN FLOW SYSTEM IN THE CITY OF TALLAHASSEE AND LEON COUNTY

DATE PROJECT BEGAN: July 1990

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: James H. Davis, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulation and City of Tallahassee Water Quality Laboratory

PROBLEM: The city of Tallahassee discontinued the use of several city supply wells due to contamination. The city and the Florida Department of Environmental Regulation (FDER) realize the importance of protecting ground-water resources. One approach is to delineate wellhead protection areas. This cannot be done effectively until the aquifer's flow system is well understood. The Tallahassee and Leon County area is an ideal location in which to evaluate the efficacy of different wellhead protection methods in an environment of complex, possibly anisotropic, fracture and conduit flow.

OBJECTIVE: To improve understanding of the flow system in the complex fracture and conduit dominated environment of the city of Tallahassee and Leon County in order to allow local officials to develop ground-water protection strategies including wellhead protection.

APPROACH: (1) Assemble existing hydrogeologic and well information. This includes a detailed well inventory and study of well logs and other published materials. (2) Collect additional hydrogeologic and well information. A potentiometric-surface map will be constructed for the Upper Floridan aquifer in the study area and aquifer tests will be conducted to determine anisotropy. This may include installation of 2-4 monitor wells. (3) Construct a detailed ground-water flow model and delineate areas contributing water to pumping centers based on capture areas and time criteria. The USGS modular model will be used. (4) Conduct a preliminary evaluation of wellhead protection methods.

PROGRESS: A potentiometric surface map of the Floridan aquifer has been constructed using water level measurements collected as part of this study. A 600-foot deep ground-water monitoring well has been completed in downtown Tallahassee. Caliper, natural gamma, acoustic velocity, gamma-gamma, salt tracer, fluid resistivity, teleview, long and short normal resistivity, focused resistivity, and spontaneous potential geophysical logs were run. A pressure transducer was installed in a Floridan aquifer well in downtown Tallahassee; the purpose of the transducer is to record water level fluctuations caused by natural recharge or discharge and by the pumping of municipal supply wells.

PLANS FOR THIS YEAR: Aquifer tests will be conducted to determine the transmissivity and storage capacity of the Floridan aquifer within the Tallahassee area. The U.S. Geological Survey MODFLOW model will be used to simulate flow within the Floridan aquifer.

FL-508 TECHNIQUES FOR ESTIMATING AREAS THAT CONTRIBUTE GROUND WATER TO PUBLIC-SUPPLY WELLS IN WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: July 1990

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: L.A. Knochenmus, Tampa

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: The Upper Floridan aquifer is the primary source of public water supply in west-central Florida. Over most of the area of northern Hillsborough and Pinellas Counties, and most of Pasco County, the aquifer is at or near land surface and is vulnerable to contamination. To protect public water supplies from possible sources of contamination, areas that contribute water to these wells must be known as well as factors that affect the size and shape of the contributing area.

OBJECTIVE: Define ground-water flow in a carbonate aquifer system and apply this knowledge to wellhead protection strategies for west-central Florida. Test the validity of Darcian ground-water flow in a carbonate aquifer. Simulate the flow system to indicate which factors affect the size and shape of the contributing areas. Compare methods for area delineation. Suggest areas in the State where methodologies can be applied.

APPROACH: Experimentally use analytical and numerical-mathematical models to estimate ground-water flow pathlines, velocity fields, time-of-travel, and contributing areas to wells. The hydrologic parameters will be compiled from previous numerical modeling results, aquifer-test data, and laboratory values of effective porosity from core samples. Vary the controlling factors including model grid size, pumping rate, transmissivity, porosity, anisotropy and well penetration depth to evaluate the effects on size and shape of the contributing area. Compare the results of the study with previous wellhead protection strategies.

PROGRESS: The effects on travel time and size and shape of areas of contribution to public supply wellfields in west-central Florida were simulated by incorporating secondary porosity features into ground-water flow and particle-tracking models. Hypothetical secondary porosity distributions were determined from analytical models of aquifer anisotropy and borehole geophysical and television log interpretations. The simulated areas of contribution to wellfields were compared with one another.

PLANS FOR THIS YEAR: Continue writing report for Open-File Report pending Water-Supply Paper release. Target dates for Director's approval is September 1993 and publication is June 1994.

REPORTS IN PROCESS:

Knochenmus, L.A., "Estimation of the contributing areas to public supply wells in a carbonate aquifer in west-central Florida".

FL-509 MEASUREMENT OF NONPOINT-SOURCE NUTRIENT LOADING TO ESTUARIES WITH EMPHASIS ON TIDALLY DOMINATED RIVERS: A CASE STUDY OF HILLSBOROUGH BAY, FLORIDA

DATE PROJECT BEGAN: August 1990

DATE PROJECT ENDS: April 1993

PRINCIPAL INVESTIGATOR: Yvonne E. Stoker, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: The effects of land-use changes and other human activities on the water quality and ecology of estuaries and other coastal waters is a national concern that is being addressed in many coastal areas of the country. Increased nutrient availability in estuaries and coastal waters creates conditions conducive to eutrophication. There is a lack of recent measurements of major point-source loads and little information on nonpoint source loads of nutrients from three major tributaries: the Hillsborough, Palm, and Alafia Rivers. It is essential that these nutrient loads be measured in order to help develop a realistic estimate of the nutrient budget of both Hillsborough and Tampa Bays. Standard constituent loading measurement techniques for streams are of limited usefulness because tidal conditions extend for large distances upstream. Standard stage/discharge relations cannot be established in tidal reaches and large parts of the drainage basin cannot be measured for nutrient load contributions in a cost-effective manner.

OBJECTIVE: Provide realistic estimates of the nonpoint-source loading of nutrients to Hillsborough Bay in order to satisfy the need to develop a nutrient budget and provide reliable data for input to a eutrophication model to be developed at some future time. Develop and operate a cost-effective technique for measuring nutrient loads in a tidally dominated river at its most downstream point in order to eliminate unmeasured loads from parts of the drainage basin.

APPROACH: The overall approach for developing reliable and nonpoint-source nutrient loading estimates for Hillsborough Bay is based on an extensive program of field measurements and sampling. An innovative application of state-of-the-art velocity measuring equipment and automated water sampling will be tested and evaluated for continual measurement of tidal discharge and appropriate nutrient concentrations at the mouth of the Alafia River for determining nutrient loading rates from the entire basin. If successful, such techniques could later be applied to other major tributaries to Tampa Bay. Results will be used to design a data collection program which will provide yearly constituent loading and seasonal variability from the Alafia River basin.

PROGRESS: Water quality collection was completed in March 1992. Discharge ratings were defined and continuous discharge was computed. Water quality sampling was completed in March. Load computation procedures were defined, and instantaneous, daily, monthly, and annual loads were computed. Continue to prepare final report.

(FL-509)

PLANS FOR THIS YEAR: Complete preparation of report and submit for approval and publication. Target dates are August 1993 for Director's approval and February 1994 for publication.

REPORTS IN PROCESS:

Stoker, Y.E., Investigative methods for computation of annual nutrient loading to Hillsborough Bay, Florida, 50 p.

FL-511 AN EVALUATION OF THE EFFECTS OF NONPOINT-SOURCE POLLUTION FROM SWINE AND POULTRY OPERATIONS ON GROUND- AND SURFACE-WATER QUALITY IN NORTH FLORIDA

DATE PROJECT BEGAN: October 1990

DATE PROJECT ENDS: March 1993

PRINCIPAL INVESTIGATOR: Hilda Hatzell, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: The presence of swine and poultry operations in north Florida poses a potential threat to the water quality of the Suwannee River and the Floridan aquifer. Data obtained from a statewide monitoring network show elevated nitrate concentrations in wells in the vicinity of the river. Ammonium in livestock waste is oxidized to nitrate, a form of nitrogen that is not readily retained by sandy soils. In areas where swine and poultry wastes are concentrated, nitrates may be lost by runoff to surface water or by leaching to ground water.

OBJECTIVE: To determine the degree to which ground water and surface water in the vicinity of swine and poultry operations are contaminated and to relate the contamination to varying waste-management practices and hydrogeology in Lafayette and Suwannee Counties in northern Florida.

APPROACH: Swine and poultry sites representative of differing production and waste-disposal practices will be selected. Monitoring wells will be located within or adjacent to areas of animal activity and waste disposal. Water from the wells will be examined for concentrations of nitrogen species and other waste tracers such as phosphorus, chloride, and fecal bacteria. The relative abundance of ^{15}N and ^{14}N isotopes in nitrates will be used to evaluate the pattern of organic and inorganic nitrate sources in the study area.

PROGRESS: A total of 21 monitoring wells were installed on 5 poultry farms located in Suwannee and Lafayette Counties. Two quarterly samples have been completed. Water samples from six of the wells have nitrate concentrations greater than 10 milligrams per liter as nitrogen. Twelve swine farms in Jackson County were visited. Five of these farms have been selected as monitoring sites. The nitrogen isotope analysis for 100 wells in the vicinity of the Suwannee River has been completed. Evaluation of the analysis has been initiated.

PLANS FOR THIS YEAR: Quarterly sampling of the poultry farms and evaluation of the data will be completed. Twenty monitoring wells will be installed on swine farms in Jackson County. Quarterly sampling of the wells on swine farms will begin. The regional pattern of organic and inorganic sources of nitrate will be compared to land uses in the study area.

FL-512 EFFECTS OF THE HILLSBORO CANAL PUMPAGE ON WATER QUALITY OF THE SECONDARY CANALS IN BOCA RATON, FLORIDA

DATE PROJECT BEGAN: October 1989

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Donald McKenzie, Miami

COOPERATING AGENCY: City of Boca Raton

PROBLEM: The major source of water, other than local rainfall and runoff, to maintain stages of the Lake Worth Drainage District (LWDD) canals in the Boca Raton area is the Hillsboro Canal. Rapidly increasing water demands in the Boca Raton area have required that increasing amounts of water be pumped from the Hillsboro Canal. The city of Boca Raton is concerned that the quality of the water of the LWDD canals flowing through the city and near its well field may be degraded by pumpage from the Hillsboro Canal. This concern has arisen partly because water in the Hillsboro Canal flows from Lake Okeechobee, through an area of organic soils and intensive agriculture, receiving highly mineralized ground water. There have been sporadic water-quality analyses of the Boca Raton canals in recent years, but because of varying sampling sites and infrequent sampling, appraisal of water-quality conditions and trends has not been feasible.

OBJECTIVE: The objectives of the investigations are to (1) collect and compile all available historical data, and select target constituents for long-term trend analysis and (2) characterize the present water quality of the Boca Raton canal system and determine the effect of pumpage from the Hillsboro Canal.

APPROACH: All available canal-water analyses for the area of investigation will be evaluated. Canal sampling sites will be selected according to the movement of water from the Hillsboro Canal, land-use patterns, and sediment deposition. The sampling frequency for most of the constituents will be determined by seasonal rainfall distribution and the discharge from the Hillsboro Canal pump station. High-flow sampling will be emphasized. Samples collected will be analyzed for major inorganic constituents, nutrients, and metals. GC-FID reconnaissance sampling also will be conducted to qualitatively detect organic contaminants. All data collected will be evaluated and analyzed using summary statistics for individual sampling sites. An analysis will be made for constituent trends with attention to seasonal effects (rainfall) and pumpage at the Hillsboro Canal. Relations of constituents to land use and point sources of contamination will be developed. A long-term water-quality monitoring program is anticipated, following the 3-year investigation.

PROGRESS: Surface waters were sampled at 10 sites during wet and dry seasons, and analyses completed for major ions and related constituents, trace elements, and micronutrients. Available historical water quality data from 1933 to 1991 were examined. Water samples and bottom sediments were collected at four sites that were used previously by the Geological Survey (1982-84) for

pesticide analyses. Key water quality parameters were referenced to flow from the Hillsboro Canal to evaluate the influence of more highly mineralized water on the Boca Raton canal system.

PLANS FOR THIS YEAR: Continuing processing report. Target date for Director's approval is January 1993.

REPORTS IN PROCESS:

McKenzie, D., Effects of the Hillsboro Canal pumpage on water quality of the secondary canals Boca Raton, Florida, 30 p.

FL-513 GEOCHEMISTRY AND WATER QUALITY OF THE FLORIDAN AQUIFER SYSTEM, DADE COUNTY, FLORIDA

DATE PROJECT BEGAN: August 1990

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Ron Reese, Miami

COOPERATING AGENCIES: Miami-Dade Water and Sewer Authority Department and South Florida Water Management District

PROBLEM: There is a need for additional public-water supply as the population of southeastern Florida increases. Use of the Floridan aquifer system can provide additional supply. Three methods are being considered for using the Floridan. One is to blend brackish ground water from the Floridan aquifer system with the freshwater of the overlying Biscayne aquifer at the well field. A second method is to temporarily store excess freshwater in the Upper Floridan aquifer, withdrawing it when needed by aquifer storage and recovery (ASR). The third method is to treat Upper Floridan water directly by reverse osmosis (RO). Study of the water quality of the Floridan aquifer system in southern Florida has not been done on a comprehensive basis, and an evaluation of background data is needed.

OBJECTIVE: Objectives for the characterization of the geochemistry of the Floridan aquifer system are as follows: (1) delineate zones of high permeability in the Floridan, (2) delineate geochemical zones in the Floridan (zones of similar water quality), (3) determine possible geochemical areal trends in constituents that may affect the use of Floridan aquifer system water for RO processing or blending with freshwater, and (4) use geochemical modeling techniques to determine the state of equilibrium of ground water with respect to present mineralization with the aquifer and determine the equilibrium effects of mixing Upper Floridan water with freshwater.

APPROACH: Zones of high permeability will be defined, along with geologic units, on cross sections using geophysical logs of key wells and data from aquifer tests and core samples at existing wells. Zones of similar water chemistry will be delineated based upon dissolved solids and major-ion concentrations using samples produced from specified intervals in the Floridan. Placement of geochemical zone boundaries will be made taking into account the hydrogeology and flow system boundaries. Areal geochemical trends within a zone will be mapped using constituents such as dissolved solids and chloride. Consideration will be given to the hydrogeology, ground-water movement, and possible recharge areas when defining a trend. Geochemical modeling of the Upper Floridan will involve using U.S. Geological Survey models, such as PHREEQE and NETPATH. These models output thermodynamic speciation calculations, the equilibrium state with respect to minerals (saturation index), and reaction path simulations.

PROGRESS: Final report has been written and is in review.

PLANS FOR THIS YEAR: Continue to process report for Director's approval.

REPORTS IN PROCESS:

Reese, R., Distribution and origin of salinity in the Floridan aquifer system, southeastern Florida, 100 p.

FL-515 REGIONALIZATION OF LOW-FLOW CHARACTERISTICS IN STREAMS IN NORTHERN FLORIDA

DATE PROJECT BEGAN: October 1990

DATE PROJECT ENDS: March 1994

PRINCIPAL INVESTIGATOR: Roger P. Rumenik, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: Demands for low-flow information in many areas of Florida exceed the capabilities of existing data-collection resources. To meet these demands, methods of estimating low-flow characteristics at sites with little or no streamflow data (ungaged sites) are needed. Methods using multiple regression analysis could provide significant benefits for managers responsible for protecting surface-water quality, and allocation of surface-water supplies. In addition, new measurement sites are needed in basins that lack an adequate number of low-flow measurement sites. This additional information is needed to establish an acceptable network of low-flow stations to support regional models or other methods of estimating low-flow characteristics.

OBJECTIVE: (1) To develop regional models using multiple-linear regression analysis to estimate the magnitude and frequency of low flows at sites where little or no streamflow information is available, (2) to develop alternate methods for estimating low-flow frequency data in areas where use of the models does not provide favorable results, and (3) to augment low-flow information by designing a network of low-flow data-collection stations. This network will increase the coverage of data available for regional analyses.

APPROACH: Analysis of variance (ANOVA) will be used to test approximately 10-15 basin characteristics for their significance to regional variability of low flow. Ordinary least squares and estimated generalized least-squares regression analysis will be used to estimate functional relations between low-flow characteristics and basin characteristics found to be significant by the ANOVA. Alternate methods of estimating low-flow characteristics at ungaged sites will be examined concurrently when testing regression techniques.

The adequacy of the data base, as it applies to each river basin, will be evaluated. The results of the evaluation will be used to design a data-collection network of selected sites where base-flow measurements are needed.

PROGRESS: Data were reviewed and updated in the USGS Streamflow and Basin Characteristics file for use in multiple-linear regression analyses. Coverages, as variables of basin characteristics, were developed through a Geographical Information System (GIS). Coverages for topography, soils, drainage area, basin slope, and environmental geology were tested for their significance to regional variability of low flow using ARC Info software. Preliminary model runs were made using regression analyses. Approximately 50 base-flow measurements were made during October 1991 and September 1992 at a network of low-flow sites in northern Florida.

(FL-515)

PLANS FOR THIS YEAR: Continue to quantify basin characteristics, including those having ground-water properties that may affect low streamflow, and test for their significance to regional variability of low flow. Collect additional low-flow data to augment data available for final analyses. Make final model runs. Develop alternate methods for estimating low-flow frequency data in areas where use of the model does not provide favorable results. Complete preliminary draft of report.

FL-516 UNSATURATED FLOW AND TRANSPORT UNDER RAPID INFILTRATION BASINS

DATE PROJECT BEGAN: October 1990

DATE PROJECT ENDS: October 1993

PRINCIPAL INVESTIGATOR: David Sumner, Orlando

COOPERATING AGENCY: Reedy Creek Improvement District

PROBLEM: Beginning in 1991, the Reedy Creek Improvement District will discharge up to 15 million gallons per day of treated sewage effluent into rapid infiltration basins (RIBS) southwest of Orlando. The effects of this practice on the quality and quantity of local surface-water and ground-water resources are unknown. Because infiltration is largely an unsaturated-flow process, a better understanding of unsaturated flow and transport in the soil and surficial aquifer system under and around the RIBS is necessary to predict the effect of the RIBS on local hydrology. What is known of unsaturated flow and transport in this area and their interaction with the regional ground-water system is principally derived from limited laboratory investigations or studies of the upper soil horizons only.

OBJECTIVE: (1) Characterize flow and transport in the unsaturated zone beneath RIBS in central Florida, (2) evaluate the long-term effects on chemical and physical properties of the surficial aquifer system beneath RIBS, and (3) assess the interaction of RIBS hydrology with local water-table and ground-water recharge.

APPROACH: (1) Two basins will be instrumented to measure the rate and quality of moisture moving vertically and horizontally through the surficial aquifer system during infiltration events, and to monitor changes in the water table and underlying aquifer system. Inverse problem techniques (advancing front, or others) will be applied to determine principal hydrologic characteristics that describe or control flow and transport (hydraulic conductivity function, soil moisture retention curves, among others) and the results will be compared to values determined from cores in laboratory tests. (2) Soil samples will be collected from six basins before discharge infiltration begins and after 2 years of normal operation. Changes in soil chemistry and physical properties will be related to the quality, duration, and intensity of inflow. (3) Observations of unsaturated flow and transport will be combined with regional ground-water flow models and hydrologic budgets to assess RIBS effects on subregional and local hydrology.

PROGRESS: The effect of disposing secondary-treated wastewater through rapid infiltration basins in conjunction with percolation through the vadose zone has been estimated through extensive aquifer and soil water sampling. Nutrient chemical transformations have been proposed to explain the collected data. The hydraulic response of the saturated and unsaturated hydrologic system was measured under field conditions. Numerical modeling is being used to simulate the response and thus develop a quantitative understanding of the hydraulic system.

(FL-516)

PLANS FOR THIS YEAR: The numerical model of RIBS hydraulics and unsaturated and saturated flow in the vadose zone, and the surficial and Floridan aquifers will be completed and applied to answer questions concerning flow directors and magnitudes, wastewater disposition, system controls, and future basin capacity. Analysis of chemical data collected from water and soil samples beneath the RIBS will be completed. A process-oriented explanation for observed nutrient transformations will be developed.

FL-517 A DIRECT METHODOLOGY FOR PREDICTING WETLAND RESPONSES TO HYDROLOGIC STRESSES

DATE PROJECT BEGAN: April 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Edward R. German, Orlando

COOPERATING AGENCIES: Volusia County and
St. Johns River Management District

PROBLEM: Deterministic models simulating ground-water/wetlands flow are usually mathematically complex, regional in scope, and require large amounts of time and expense to develop. Site-specific models to quickly evaluate effects of development on wetland hydrologic systems are often not practical for use by water-resources managers.

OBJECTIVE: To develop a direct, simple methodology for estimating the effects of development on wetland hydrology when given measurable, physical parameters and variables.

APPROACH: The overall design of the study is to use a surface-water and (or) ground-water simulation model, the parameters of which are controlled by experimental design, to provide results that can be analyzed by regression techniques to produce simple analytical tools useful for estimating the effects of hydrologic stresses on a wetland environment.

A calibrated flow model will be initially prepared, covering a wetlands area of Volusia County, an adjacent uplands area, and a surface-water outflow channel. After calibration, numerous model runs will be made, each time changing some of the parameter and external-variable values of the model, as directed by experimental-design techniques. Statistical methods (most likely linear regression analysis) will be used to analyze model output to generate simple equations, plots, and/or nomographs relating model results with input parameters and variables. These analyses represent the final product of this study and can be readily used by water-resource managers in place of further flow modeling to help evaluate the effects of hydrologic stresses on a site-by-site basis.

PROGRESS: Monitoring wells were installed in two areas where changes could affect the water table: Tiger Bay canal, where changes in the surface-drainage canal system are planned, and the proposed HW44 well field, where potable water will be withdrawn from the Upper Floridan aquifer. A conceptual model of the effects of pumping from the Upper Floridan aquifer on surficial-aquifer water levels was used to develop regression equations and nomographs relating lowering of water table to pumpage from the Upper Floridan aquifer.

PLANS FOR THIS YEAR: Continue to develop regression models to predict wetlands response to pumping from the Upper Floridan aquifer, for a range of surficial-aquifer thickness, gradients, and other properties. Develop regression models to predict wetlands response to surface drainage. Continue to monitor ground-water levels in two areas where developmental stresses could affect the water table.

FL-518 INFLUENCE OF TREATED MUNICIPAL WASTEWATER ON THE LEACHING AND RETENTION OF PESTICIDES IN THE UNSATURATED ZONE

DATE PROJECT BEGAN: January 1991

DATE PROJECT ENDS: December 1993

PRINCIPAL INVESTIGATOR: Amy Swancar, Tampa

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: Reuse of treated municipal wastewater for nonpotable uses, such as irrigation of public and private green areas, is expected to become an important part of sound water-conservation practices, especially in areas experiencing water shortages. The effect of humic and fulvic acids, surfactants, and other soluble organic compounds on the solubility, adsorption, degradation, and movement of pesticides in the unsaturated zone is poorly understood. This lack of information limits the ability of environmental scientists and regulators to wisely balance the need to reuse municipal wastewater for irrigation with the need to provide adequate protection of potable ground-water supplies.

OBJECTIVE: (1) To determine if selected pesticides applied to golf courses receiving treated municipal wastewater are leached into ground water, and (2) to evaluate the effect of treated municipal wastewater on leaching potential by studying the mechanisms of interaction between wastewater and pesticides.

APPROACH: In phase I, three pairs of golf courses will be selected. Each pair will consist of one golf course that uses municipal wastewater for irrigation and another golf course with similar hydrogeology and pesticide-application practices that does not receive wastewater. Monitoring wells will be installed and ground water will be sampled quarterly for 1 year for pesticides, nutrients, major ions, and trace elements. A limited number of tension lysimeters will be installed to sample water from the unsaturated zone for selected pesticides. In phase II, laboratory, green house, or test-plot experiments will be devised to study the mechanisms that increase or decrease the leaching of selected pesticides from the unsaturated zone. In phase III, three additional golf courses will be selected in northwest, north central, and southern Florida to evaluate pesticide leaching on the different hydrogeologic settings throughout the State.

PROGRESS: A project quality assurance plan was approved by the cooperator. Wells were installed at three pairs of golf courses. Samples were collected at phase I sites for two quarters. Three additional golf courses were selected for phase III.

PLANS FOR THIS YEAR: The remaining two quarters of sampling for phase I will be completed. Wells will be drilled for phase II sites. Phase II wells will be sampled for three quarters. Begin evaluation of phase I data and planning for phase II. Begin work on phase II.

FL-519 EVALUATION AND DESIGN OF GROUND-WATER MONITORING NETWORKS FOR BROWARD COUNTY, FLORIDA

DATE PROJECT BEGAN: January 1991

DATE PROJECT ENDS: June 1993

PRINCIPAL INVESTIGATORS: Roy Sonenshein and Eric D. Swain, Miami

COOPERATING AGENCIES: South Florida Water Management District
Broward County Office of Natural Resources Protection

PROBLEM: Networks to monitor saltwater intrusion, ground-water quality, and water-table elevation have been developed in Broward County, but these networks have not kept up with the growth in the county. Other networks, such as those set up by well-field operators for well-field protection, have not been included in a comprehensive ground-water monitoring system. New canals and water-management structures, changing land use, and expansion of municipal well fields have resulted in wells no longer monitoring the situations they were originally designed to monitor. Thus a need exists to evaluate the current ground-water monitoring network, develop criteria for future monitoring needs, and design optimal regional monitoring networks.

OBJECTIVE: (1) Develop criteria for monitoring saltwater intrusion, water-table elevation, well-field protection zones, and regional water quality; (2) develop methods for designing monitoring networks based on mathematical models and statistical techniques; and (3) design regional monitoring networks, with the ultimate objective of eliminating existing monitoring wells that do not meet criteria or are redundant, and determining the location and type of additional wells where data are lacking.

APPROACH: (1) Develop criteria for each of the monitoring requirements with officials of the cooperating agencies based on consideration of cost, well construction, quantities to be monitored, adequacy of past collected data, and predicted changes in water quality in important locations; (2) develop techniques for evaluating the monitoring network using geostatistical techniques, ground-water flow models, and GIS data; (3) evaluate existing network and design new network for Broward County using the criteria and techniques developed in the first two parts; and (4) prepare documentation reports describing the techniques developed and the results of the analysis. A final Water-Resources Investigations Report, tying together all the phases, will be prepared.

PROGRESS: A total of 201 monitor wells were inventoried with data entered into the National Water Information System (NWIS) data base. Analysis was begun on the ambient water-quality monitor network. A method was developed to analyze the water-level recorder monitor network. Final report is in preparation for the two types of network analyses.

PLANS FOR THIS YEAR: Complete analysis of water level and water quality monitoring networks using previously developed techniques. Complete draft of final report for review. Target date for approval is December 1993.

FL-520 NATIONAL WATER QUALITY ASSESSMENT PROGRAM: GEORGIA-FLORIDA COASTAL PLAIN NAWQA

DATE PROJECT BEGAN: October 1990

DATE PROJECT ENDS: December 1999

PRINCIPAL INVESTIGATOR: Edward T. Oaksford, Tallahassee

COOPERATING AGENCY: Federal Program

PROBLEM: There is a need to describe the status and trends of the water quality of the Nation's ground- and surface-water resources in order to provide a sound understanding of the natural and manmade factors affecting the usability of these resources. The Georgia-Florida Coastal Plain Study Unit is one of 60 representative areas chosen to comprise a national assessment. Within the study unit, water is generally of good chemical quality suitable for most uses, but in some areas quality has been impaired as the result of agricultural practices, mining, waste disposal, storage and use of toxic chemicals, stormwater disposal, and water withdrawals. Naturally occurring constituents and properties have also affected the usability of water locally. Saltwater in coastal areas has been induced to move into freshwater aquifers and rivers as these resources are developed for use.

OBJECTIVE: The three major objectives of the National Water Quality Assessment Program (NAWQA) are (1) to provide a consistent description of current water-quality conditions for a large part of the Nation's water resources; (2) define long-term trends (or lack of trends) in water quality; and (3) identify, describe, and explain, as possible, the major factors that affect observed water-quality conditions and trends.

APPROACH: During the first 2 years, a project team will be assembled, an extensive project work plan will be developed, and existing data will be summarized and analyzed. A 3-year period of intensive data collection, analysis, and interpretation will begin in 1993. A long-term monitoring network will be established for trend analysis, subbasins will undergo synoptic surveys to better define sources of pollutants, and selected sites will undergo intensive process-oriented study to provide a better understanding of the cause-and-effect relationship between land use and water quality. Intensive data-collection and interpretation efforts will be followed by a period of report writing and low-level sampling and analysis.

PROGRESS: A draft outlining the environmental setting of the study unit and a workplan and budget for fiscal years 1993 and 1994 has been completed. Data retrievals have been done for nutrients and pesticides and the data are being analyzed for the distribution and occurrence of these groups of constituents in ground water and surface water for the study unit. Ground-water, surface-water, and biological sampling designs have been completed. In the Georgia part of the study unit, 77 domestic wells have been located in the field as primary or alternate sampling sites for the ground-water study unit regional sampling. Bed sediment and tissue sampling was begun at some of the integrator sampling sites.

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PLANS FOR THIS YEAR: Drafts of three reports will be completed: a report estimating water use in the study unit for 1990, a report on the occurrence and distribution of nutrients in the study unit, and a report on the occurrence and distribution of pesticides in the study unit. Ground-water, surface-water, and biological sampling will be initiated. Ground-water sampling plans include sampling 60 wells for the study unit regional sampling and selection and sampling of 40-60 wells for the land-use studies. Surface-water sampling plans include the start of fixed station sampling and the water quality and ecologic synoptic surveys. Supplemental sampling at the National Stream Quality Accounting Network (NASQAN) integrator sites will also be initiated. Bed sediment and tissue sampling at integrator sampling sites will continue.

FL-521 RECOGNITION OF HYDROCHEMICAL PROCESSES IN THE UNCONFINED UPPER FLORIDAN AQUIFER USING ENVIRONMENTAL ISOTOPES, ANTHROPOGENIC TRACERS, AND GEOCHEMICAL REACTION MODELING

DATE PROJECT BEGAN: October 1990

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: Brian G. Katz, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: There is a substantial lack of knowledge regarding the hydrochemical processes that control the observed water chemistry in unconfined and semiconfined areas of the Upper Floridan aquifer. As a result, it is difficult to assess the susceptibility of these areas to contamination from surface sources. In north and central Florida, where significant recharge to the aquifer occurs from precipitation or direct input from the surface through sinkholes, there is a high potential for widespread contamination of the aquifer system. To more completely understand the processes that affect the rate and movement of water and solutes (contaminants) from land surface to the unconfined Upper Floridan aquifer, information on water chemistry and hydrogeology needs to be integrated with more specialized analyses of ground water, such as environmental isotopes and selected anthropogenic organic compounds.

OBJECTIVE: (1) Collect specialized information on environmental isotopes, anthropogenic tracers, and other water-quality parameters in unconfined and semiconfined areas of the Upper Floridan aquifer, and (2) integrate this information with hydrogeologic processes to better understand and quantify the geochemical processes that control the water chemistry along regional flow paths in these areas and to characterize waters moving vertically through the surficial aquifer and Upper Floridan aquifer.

APPROACH: Approximately 30 wells will be sampled along four selected flow paths in unconfined and semiconfined areas of the Upper Floridan aquifer and two vertical profiles in the surficial and the Upper Floridan aquifers. The relative age of water and its rate of movement at the six sites will be determined using analyses of chlorofluorocarbons in conjunction with detailed hydrogeologic information and analyses for tritium, deuterium, sulfur-34, carbon-13, carbon-14, and oxygen-18. Geochemical reactions along flow paths and vertical profiles will be evaluated from detailed chemical analyses of water from wells using the geochemical and flow models WATEQF, NETPATH, and PHREEQE. Samples of rainfall will be collected at a station in central Florida four times per year and will be analyzed for environmental isotopes. Chlorofluorocarbons will be measured on recent precipitation collected in the field during selected rainfall events and on selected surface-water sources. Minerals in samples of aquifer material will be analyzed for selected environmental isotopes.

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PROGRESS: Thirty-four samples of aquifer material from locations along ground-water flow paths were collected and analyzed for clay mineralogy, and isotopes of boron, carbon, lithium, and strontium. Four samples of precipitation (three-month volume-weighted composites) were collected and submitted for analysis of the content of sulfur-34, oxygen-18, and deuterium. Water from 12 wells located along vertical flow paths was collected and submitted for analysis of chlorofluorocarbons, environmental isotopes, major ions, nutrients, trace elements, and dissolved gases. Preliminary geochemical modeling of mass transfer reactions has begun using NETPATH and WATEQF for describing the chemical evolution of water along lateral and vertical flow paths.

PLANS FOR THIS YEAR: Process, integrate, and analyze information on environmental isotopes, chlorofluorocarbons, dissolved gases, major ions, nutrients, and trace elements. Continue to model mass transfer reactions along ground-water flow paths using NETPATH, WATEQF, and PHREEQE. Present results of study at scientific conferences. Prepare draft of final report on the processes controlling the chemical evolution of ground water along vertical and lateral ground-water flow paths.

FL-523 CHARACTERISTICS OF THE SECONDARY POROSITY OF CARBONATE INJECTION ZONES AND CONFINING UNITS UNDERLYING PENINSULAR FLORIDA

DATE PROJECT BEGAN: October 1990

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: A.D. Duerr, Tampa

COOPERATING AGENCY: Florida Department of Environmental Regulation

PROBLEM: For approximately the past 20 years, cavern porosity has been assumed to be the principal type of secondary porosity in most of the carbonate injection zones underlying peninsular Florida. Also, it has been assumed that an apparently dense dolomite above and within injection zones contained no vertically interconnected secondary porosity. However, a recent study (Safko and Hickey, WRIR 91-4168) concluded that, along the east coast of Florida, fracture porosity is the principal type of secondary porosity both within the injection zones and in the dolomite rocks that lie above and within injection zones. Because of these findings, the traditional assumptions about cavern porosity and the lack of fracturing in the dolomites should be reassessed.

OBJECTIVE: To determine the principal types of secondary porosity that occur in carbonate injection zones and confining units at subsurface-injection sites throughout peninsular Florida.

APPROACH: The selected injection sites will use borehole television surveys and other borehole data to characterize secondary porosity of carbonate rocks penetrated by test holes. Borehole data used in the approach will include drilling records, and caliper, flowmeter, and temperature logs. The goal of this approach is to identify secondary porosity features that are spatially interconnected beyond the immediate vicinity of a borehole. Such secondary porosity features would have their origin in geologic processes rather than being caused by drilling.

PROGRESS: Borehole data for eight sites were collected, analyzed, interpreted, and graphically displayed to characterize the effective secondary porosity at each site. The sites included injection wells at Palm Beach County System No. 9, Atlantic Utilities, Hercules, Miami-Dade, Sunrise, and Seacoast Utilities as well as test or exploratory wells at Manatee County Southwest and at Alligator Alley Test Site. Detailed written summaries of each site were completed. A first draft of the methodology section of the report was also completed.

PLANS FOR THIS YEAR: Borehole data for the Clearwater East Test Site will be collected, analyzed, interpreted, and graphically displayed to characterize the effective secondary porosity. The final report will be prepared and in review by March 1993.

FL-525 COMPARISON AND EVALUATION OF TECHNIQUES USED TO ESTIMATE STORMWATER RUNOFF FROM LOW-GRADIENT STREAMS IN WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: April 1991

DATE PROJECT ENDS: March 1995

PRINCIPAL INVESTIGATOR: John Trommer, Tampa

COOPERATING AGENCY: Sarasota County

PROBLEM: Low topographic relief, flat water-surface gradients, and prolonged or intense rainfall can produce recurring stormwater-flooding problems. Several techniques for estimating the volume of stormwater runoff exist; however, it is necessary to extrapolate empirical relationships beyond tested ranges to apply these techniques to the coastal lowlands of west-central Florida. The economic and environmental consequences of inaccurately estimating the volume of stormwater runoff can be substantial. If projects for carrying stormwater are underdesigned, property can be needlessly flooded. If projects are overdesigned, unnecessary tax dollars are spent for overabundant land acquisition, construction, and maintenance.

OBJECTIVE: Evaluate the reliability and accuracy of traditional techniques for estimating stormwater runoff by comparing computed estimates to field measurements. Define the range of watershed characteristics for which traditional techniques produce reliable results. Possibly develop techniques for estimating stormwater runoff from watersheds outside the range where traditional techniques can be applied.

APPROACH: Install six to eight new rainfall and discharge sites in low-gradient coastal basins in Sarasota County. Three or four basins would be developed basins and the remaining will be undeveloped basins. Use traditional engineering techniques and measured runoff results to estimate stormwater runoff for each basin. Using statistical techniques, evaluate the relative importance of basin characteristics on the accuracy of the estimated runoff.

PROGRESS: Raingages were installed in all study basins. During 1992, 114 storm discharge measurements were made at 7 sites. Stage-discharge ratings were established at all sites. Because of probable backwater effects, the stage recorder at one site was replaced with a velocity meter. Several software packages that are commonly used for estimating stormwater discharges have been acquired and installed for production use.

PLANS FOR THIS YEAR: Data collection will continue at study sites. Stormwater runoff estimates will be computed using at least three techniques for each basin.

FL-526 MODELING THE HYDRODYNAMICS AND SALINITY OF THE SEBASTIAN CREEK CONFLUENCE

DATE PROJECT BEGAN: August 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Robert A. Miller, Orlando

COOPERATING AGENCY: St. Johns River Water Management District

PROBLEM: Major surface-water inflows to the Sebastian Creek area occur from several directions. One canal tributary to Sebastian Creek is controlled, and waters released from the canal during periods of flooding could cause high discharges within Sebastian Creek. The results of such releases could have effects on the salinity of the Indian River that are difficult to anticipate.

OBJECTIVE: The objectives of this study are to (1) enhance the understanding of the hydraulics of the confluence, including the patterns of circulation within Sebastian Creek, (2) simulate the hydraulic and salinity changes within Sebastian Creek under extreme discharges (both large and small); and (3) use the calibrated and verified model to simulate the full range of flow and the direction of flow at all gaged locations.

APPROACH: The hydraulics and salinity of the Sebastian Creek confluence will be modeled using the U.S. Geological Survey model for two-dimensional hydrodynamic/transport - SWIFT2D. After acceptance of the boundary conditions and parameter values through calibration and verification, the model will be used to simulate responses to varied discharge at the Sebastian Creek stations, and varied tidal and salinity conditions at the open boundaries. Because of the interest in the effects on salinity produced by freshwater entering the confluence from the west, most of the work will involve high freshwater discharges.

PROGRESS: Construction of four sites was completed; two water-based stations and two land-based stations. Equipment was attached, including stage pipe with attached recorder housing, conductance and temperature probes, and data loggers. Some stations also included tipping bucket raingages, velocity meters, wind direction and speed sensors, and atmospheric pressure sensor. Data collection was started as soon as the equipment became operational. Data storage has started with the creation of programs and directories to handle the data. The Time Dependent Data Storage system has been activated and will be used for final storage of the data.

PLANS FOR THIS YEAR: Data collection and storage of the data will continue throughout the year. The two-dimensional model SWIFT2D will be calibrated and verified. The final report will be drafted.

FL-527 MEASUREMENT OF NON-POINT SOURCE NUTRIENT LOADING FROM EAST BAY TO HILLSBOROUGH BAY, FLORIDA

DATE PROJECT BEGAN: September 1991

DATE PROJECT ENDS: March 1994

PRINCIPAL INVESTIGATOR: Yvonne E. Stoker, Tampa

COOPERATING AGENCY: City of Tampa and Tampa Bay Regional Planning Council

PROBLEM: Hillsborough Bay has the most degraded water quality in the Tampa Bay system. Hillsborough Bay receives over half of the tributary freshwater runoff that enters Tampa Bay, has a large industrial complex with the seventh largest port in the country on it's shore, and receives about 60 million gallons per day of advanced-waste-treatment effluent. East Bay, a subembayment of Hillsborough Bay, contains a portion of the port with extensive fertilizer loading facilities, and receives freshwater inflow from the Tampa Bypass Canal, Delaney Creek, and from local stormwater runoff. Studies underway by the U.S. Geological Survey and other agencies are quantifying nutrient loading from the major tributaries to Tampa Bay but there is a lack of information on nutrient loading from East Bay to Hillsborough Bay. This information is essential for estimating a reasonable nutrient budget for Tampa Bay.

OBJECTIVE: Nitrogen and phosphorus loads from East Bay to Hillsborough Bay will be measured during selected periods. These data will be used to provide estimates of seasonal and annual loading for the period of data collection.

APPROACH: (1) Continuous discharge data will be computed from continuous velocity-index and stage measurements. Discharge measurements will be made to establish a mean velocity-index velocity relation, and will be made during the study to assure rating stability. (2) Water quality samples will be collected at the mouth of East Bay during various tide and freshwater inflow conditions to describe horizontal and vertical variability. (3) Continuous recording of specific conductance and temperature will be made at two depths. The measurements will be made near the index velocity station.

PROGRESS: An index velocity and stage gage was established at the head of East Bay to provide continuous measurement of velocity and direction of flow. An Acoustic Velocity Meter (AVM) is used to measure velocity along two paths in a portion of the cross section. More than 50 discharge measurements were made to relate the index velocity and stage to mean velocity and cross-sectional area. Using the relation established, continuous discharge will be computed. An index velocity and stage gage were established in the tidal portion of Delaney Creek for discharge computations. Specific conductance and temperature gages were installed at each site. Reconnaissance water quality samples were collected and evaluated to develop sampling protocols for the remainder of the study. Routine water quality sampling began in June 1992 and is continuing. Samples for total nutrients, specific conductance, turbidity, color, and suspended solids are collected at the head of East Bay, at the

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mouth of East Bay, and near the mouth of Delaney Creek. Field measurements of specific conductance, temperature, dissolved oxygen, and pH are made at the time of sample collection.

PLANS FOR THIS YEAR: Continue operation of all gages, make additional discharge measurements, define the index-velocity and stage-area relations for the head and mouth of East Bay and Delaney Creek, and continue water quality sample collection. Compute instantaneous discharge and nutrient loads based on available data. Establish procedure for estimating nutrient loads on a seasonal and annual basis, and compare loads between the head and mouth of East Bay. Begin preparation of report.

FL-528 HYDROLOGY OF THE WOLF BRANCH CREEK SINKHOLE BASIN, LAKE COUNTY, EAST-CENTRAL FLORIDA

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: April 1994

PRINCIPAL INVESTIGATOR: Donna Schiffer, Orlando

COOPERATING AGENCY: Lake County Water Authority

PROBLEM: The Wolf Branch sinkhole is a direct conduit through which surface water can enter the Upper Floridan aquifer, the principal source of water for public and domestic supplies in north Lake County, central Florida. Although the basin is undeveloped at present, the potential exists for degradation of the aquifer from surface contaminants from roads and some businesses in the area. Possible plans to protect the aquifer from this potential contamination include partial or total plugging of the sinkhole. However, the hydrology of the basin is not understood well enough to predict the degree and extent of flooding which may result from such plugging.

OBJECTIVE: (1) Quantify the surface-water hydrology (flow frequency, duration, and volume) of the Wolf Branch basin and estimate the possible effects of sinkhole plugging on flooding in the lower basin, assuming a normal range of rainfall and discharge conditions. (2) Define the general relation of the sinkhole to the ground-water hydrology of the area, and estimate the direction and rate of movement, and the dispersion of a conservative contaminant entering the Upper Floridan aquifer at the sinkhole. This information will help water managers better understand the present contamination potential and possible effects of alterations to the sinkhole or Wolf Creek basin.

APPROACH: (1) Evaluate surface-water hydrology by monitoring rainfall and surface-water discharge in the basin and determine a runoff-rainfall relation for the basin, then estimate long-term flow characteristics from existing rainfall record for the area. (2) Evaluate flooding potential resulting from plugging of the sink by evaluating the hydraulic conductivity of the sinkhole and estimating the rates at which the sinkhole would receive water when the conductivity is reduced by plugging. Based on these rates, estimate water levels in the basin using topographic maps and additional topographic data obtained during the study. (3) Inventory Upper Floridan aquifer wells in the basin, and summarize available data on ground-water quality and geology from previous studies. (4) Construct local potentiometric-surface maps of the Upper Floridan aquifer for both wet and dry periods and determine gradients in the area. (5) Determine direction and rate of travel, and dispersion (if possible) of potential contaminants through one or two dye studies.

PROGRESS: Rain-gage and stream-gage sites were installed and instrumented. Eleven wells in the basin were measured in May and September 1992, to estimate the potentiometric surface of the Floridan aquifer system. A staff gage was installed at a site in the upper part of the basin, and two additional sites were selected for staff gages. These additional staff gages will provide information about wetland storage areas in the basin. A Floridan aquifer system well was drilled about 800 feet east-southeast of the sink, and hourly water level data are being recorded at the site. A crest-stage indicator and

transducer were installed in the sink. There has not been sufficient rainfall in the basin to generate flows in the stream this year, which has prevented the development of the rainfall/runoff relation and the dye study. No continuous flow has occurred through the entire stream to the sink since September 1992.

PLANS FOR THIS YEAR: Because of the uncertainty of rainfall sufficient to generate flows in Wolf Branch, the decision was made to reduce the scale of the study for FY93. Work during FY93 will include the collection of data from the staff gages, ground-water monitoring well, raingage, and streamgage flows. A dye study might be conducted if flows are sufficient.

FL-529 ESTIMATED QUANTITY AND QUALITY OF UPPER FLORIDAN AQUIFER DISCHARGE TO THE MAIN STEM OF THE LOWER ST. JOHNS RIVER, NORTHEAST FLORIDA

DATE PROJECT BEGAN: August 1991

DATE PROJECT ENDS: February 1993

PRINCIPAL INVESTIGATOR: Rick M. Spechler, Orlando

COOPERATING AGENCY: U.S. Army Corps of Engineers

PROBLEM: The quantity and quality of natural ground-water inflow to the lower St. Johns River is unknown. This has caused difficulties with the implementation of State regulatory agencies' management plans to control point and nonpoint sources of various types of effluents that are discharged to the lower St. Johns River because some of the discharges contain constituents, such as chloride and sulfate, that are also present in Floridan ground water that leaks into the river. It is believed that in some areas of the river, ground-water inflow from the Upper Floridan aquifer is likely to be mineralized. It is possible that some constituent loads in the river caused by Upper Floridan ground-water inflow are greater than that caused by man.

OBJECTIVE: Estimate the quantity and quality of Upper Floridan aquifer ground water that discharges naturally (upward leakage and spring flow) into the main stem of the lower St. Johns River.

APPROACH: Obtain spring-flow data and confining bed leakances from existing, approved regional aquifer systems analysis (RASA) ground-water flow models. Use aquifer-river and aquifer-water-table head differences and leakance values to estimate upward leakage from the Upper Floridan aquifer. Use existing maps of water quality in the Upper Floridan to estimate the likely range of concentrations of selected chemical constituents in the inflow waters. Compute constituent loading for selected reaches of the lower St. Johns River using computed inflow rates and estimates of constituent concentrations.

PROGRESS: Report is in review.

PLANS FOR THIS YEAR: Final report will be completed and submitted for Director's approval.

FL-530 **LOCATIONS OF PREVIOUSLY UNDETERMINED UPPER FLORIDAN AQUIFER DISCHARGE TO THE ST. JOHNS RIVER, JACKSONVILLE AREA AND VICINITY, NORTHEAST FLORIDA**

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: March 1994

PRINCIPAL INVESTIGATOR: Rick M. Spechler, Orlando

COOPERATING AGENCY: City of Jacksonville and
U.S. Army Corps of Engineers-Jacksonville

PROBLEM: Potentiometric-surface maps of the Upper Floridan aquifer show extensive depressions along the St. Johns River south of Jacksonville and in the vicinity of Green Cove Springs. Previous notions of other natural spring flows or upward leakage from the Upper Floridan that would help explain the potentiometric-surface depressions have been dismissed because of the presence of relatively thick confining beds that should hydraulically isolate the Floridan aquifer system from overlying aquifers and surface-water bodies. However, it is possible there are unknown submerged springs as well as a substantial amount of diffuse upward leakage.

OBJECTIVE: (1) Locate and attempt to quantify Upper Floridan aquifer discharges to the St. Johns River in the Jacksonville-Greencove reach. (2) Determine the quality of Upper Floridan aquifer water that is being discharged as springs or upward leakage.

APPROACH: Refine maps of the Upper Floridan potentiometric surface in order to verify and better define the cone of depression in the Jacksonville-Greencove reach. Collect subsurface geologic and structural information by geophysical methods. Attempt to locate submerged springs by using remote sensing and by performing vertical and horizontal temperature and specific conductivity traverses to determine significant differences in river-water quality that may be due to ground-water discharge.

PROGRESS: Thermal infrared imagery survey was conducted on the St. Johns River from Jacksonville to Green Cove Springs to locate possible areas of Upper Floridan ground-water discharge. A detailed well inventory for Upper Floridan aquifer wells was completed and water levels collected.

PLANS FOR THIS YEAR: Plans for the upcoming year will focus on the reconnaissance of the St. Johns River to determine whether Upper Floridan aquifer springs exist. Conduct continuous marine seismic reflection surveys which will be used to further define the geology and subsurface features in the river. Additional water level data will be collected and potentiometric surface maps constructed. Start draft of final report.

FL-531 DISTRIBUTION AND SOURCES OF SULFATE IN THE UPPER FLORIDAN AQUIFER, WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: September 1995

PRINCIPAL INVESTIGATOR: Laura A. Sacks, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District and City of Sarasota

PROBLEM: Zones of ground water with elevated sulfate concentrations occur in parts of the Upper Floridan aquifer. Dissolution of aquifer minerals such as gypsum and anhydrite adds sulfate to the ground water, particularly at the base of the Upper Floridan aquifer. Upward movement of this water could result in elevated sulfate concentrations in upper zones of the aquifer. Other sources of sulfate include mixing with present-day seawater, saline water originating in the Lower Floridan aquifer, and rainwater recharged to the aquifer. Sulfur isotope data combined with hydrologic and geochemical data can be used to identify the sources of sulfate within the aquifer. Sulfate sources might differ depending on the vertical sampling interval and the location in the flow system.

OBJECTIVE: To describe the distribution and sources of sulfate in the Upper Floridan aquifer in west-central Florida. The study will focus on two areas where anomalously high sulfate concentrations occur within the aquifer. Isotopic and geochemical data will be used to characterize sources of sulfur species vertically and spatially within the aquifer.

APPROACH: Geochemical and isotopic data will be collected from two study regions, one which is in Sumter and Marion Counties and the other which is in the vicinity of the Peace and Myakka Rivers. Data collection will include sampling of ground water spatially and from different vertical intervals for major ions, trace metals, sulfur isotopes, and selected stable isotopes. Potential sulfate sources will also be sampled, including deep mineralized ground water, recent recharge, water from the saltwater mixing zone, and sulfate minerals occurring within the aquifer. Geochemical mass-balance and reaction path models will be used to test hypotheses of sulfate sources within the aquifer.

PROGRESS: Approximately 55 samples were collected for chemical and isotopic analysis in the southern study area, in the vicinity of the Peace and Myakka Rivers. Wells with discrete open intervals in the Upper Floridan and intermediate aquifers were sampled to characterize vertical distribution of sulfur sources. Samples were collected along three regional flow paths and supplemented by spatially distributed data points. Several deep wells were sampled that are finished in zones known to contain sulfate bearing minerals.

PLANS FOR THIS YEAR: Approximately 45 samples will be collected for chemical and isotopic analysis. Most of the sampling will be focused in the northern study area, in the vicinity of Marion and Sumter Counties. Sulfur-bearing

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minerals from rock cores will be analyzed for sulfur isotope ratios. Chemical and isotopic data will be compiled for the southern study area, including areal and vertical distribution of sulfur species and sulfur isotope ratios within the Upper Floridan and intermediate aquifers. Saturation states of waters with respect to mineral phases will be computed. Prepare draft of interpretive report comparing results from the two study sites.

FL-532 THE POTENTIAL FOR WATER-QUALITY DEGRADATION OF INTERCONNECTED AQUIFERS IN WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Patricia A. Metz, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: Hundreds of wells in west-central Florida are constructed open to both the Upper Floridan aquifer and the overlying intermediate aquifer. When wells are not pumping, internal flow in the borehole transmits water from the aquifer with the highest head to that with the lowest head. This becomes a problem in areas where the Upper Floridan aquifer contains high concentrations of sulfate and chloride and water moves upward through the open borehole and contaminates the intermediate. Other problems occur where high levels of radium-226 in the intermediate aquifer contaminates the Upper Floridan aquifer by moving down through the boreholes in areas of downward head gradient.

OBJECTIVE: Delineate geographical areas where there is a potential for ground-water quality degradation caused by aquifer interflow in wells that tap multiple permeable zones.

APPROACH: Borehole flow measurements made in wells open to interconnected aquifers will be used to calculate interaquifer flow rates. Geophysical logs and a borehole video camera will aid in the determination of these flow measurements. Water quality data will be collected from individual flow zones in the boreholes to delineate differences in the quality of ground water from specific contributing zones. The borehole flow measurements and water-quality data will be used to delineate areas where hydraulic head or water quality are likely to be affected by interaquifer flow. A concerted effort will be made to identify and document all boreholes where interaquifer flow could occur. Based on this inventory a sufficient number of field measurements of internal flow will be made to permit a reasonable estimate of the total exchange of water. This data base will be entered into an existing ground-water flow model of the Hardee-DeSoto County area to simulate water-level changes that might occur with respect to well plugging.

PROGRESS: A detailed planning document was prepared. Previous work in the study area was reviewed, including water quality and hydrogeologic framework. A well inventory was conducted to locate wells open to multiaquifer flow. Approximately 35 wells were logged to determine internal flow characteristics.

PLANS FOR THIS YEAR: Continue well inventory and borehole flowmeter surveys. Begin report preparation.

FL-533 DETERMINATION OF ROUGHNESS COEFFICIENTS FOR STREAMS, DRAINAGE CHANNELS, AND OVERBANK AREAS IN WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Denis F. Gillen, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: Previous studies for the field verification of roughness coefficients have not included the low gradient channels and densely vegetated overbank areas that are so characteristic of west-central Florida.

OBJECTIVE: To examine current techniques for determining roughness coefficients for streams, drainage channels, and overbank areas in west-central Florida. By comparing Manning's n values computed from existing discharge measurements with Manning's n values derived through the field verification and quantification of factors, such as slope, vegetation type and density, size of bed material, etc., affecting the flow resistance in low gradient, densely vegetated streams and overbank areas, a determination of the effectiveness of the currently accepted methods for estimating Manning's n values as applied to west-central Florida conditions can be made.

APPROACH: The roughness coefficient of 10-12 streams and(or) channels in west-central Florida will be determined through the collection of field data at selected reaches. Previous discharge measurements made at these sites will be used to calculate a roughness coefficient. Manning's roughness coefficient will also be determined for these same sites through field determinations of slope, cross-section area, and all other physical characteristics (vegetation density, and bed material) as outlined in Survey manuals. A comparison of the findings will be used as an indicator of the reliability of the methodology used to determine Manning's n values for conditions found in west-central Florida.

PROGRESS: Completed installation of a network of water-surface profile data collection sites consisting of 35 crest-stage gages.

PLANS FOR THIS YEAR: Final selection of study sites will be made. Crest-stage gages will be installed at sites to determine slope at selected reaches. Cross-section surveys will be run at each site. Computation of Manning's n values from past current meter discharge measurements will commence.

FL-534 DEVELOPMENT AND COMPARISON OF ALTERNATE METHODS FOR WETLAND REPRESENTATION IN GROUND-WATER MODELS

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Eric Swain, Miami

COOPERATING AGENCIES: South Florida Water Management District

PROBLEM: There are three general conditions related to wetlands in Dade County for which enhancements to the present digital models are needed: (1) wetlands commonly alternate between wet and dry conditions but the MODFLOW model does not allow for rewetting cells; (2) although river models have been linked to ground-water models and ground-water models can represent areas as aquifer blocks, there is no technique for linking the river models directly to the wetland areas; and (3) the ground-water models have no capability for simulation of tidal boundaries in south Dade County.

OBJECTIVES: To (1) modify the existing MODBRANCH model for wetland-canal aquifer interactions; (2) couple the two-dimensional surface-water flow model SWIFT2D to the three-dimensional ground-water flow model MODFLOW to simulate wetland-aquifer interactions; (3) construct, calibrate and verify the modified MODBRANCH and coupled SWIFT2D-MODFLOW models using field data collected in and available in south Florida; and (4) compare the two methods of wetland representation, aquifer blocks and free-surface flow cells, and determine the relative merits of each to different hydrologic situations.

APPROACH: The investigation involves incorporation of modifications to existing digital models followed by construction, calibration, and verification of two wetland-aquifer schematizations and final comparison of methods to determine appropriate uses and areas of applicability for the different types of representation. The investigation will include the following: (1) MODBRANCH model modifications: modifications to the MODBRANCH model will represent wetland areas as aquifer blocks. (2) SWIFT2D-MODFLOW coupling: SWIFT2D model will be thoroughly surveyed for the most efficient format for communication with the MODFLOW model. (3) MODBRANCH and SWIFT2D-MODFLOW model construction, calibration, and verifications: the modified models will be used to simulate aquifer-wetland-canal interactions in southern Dade County and the eastern Everglades National Park. (4) Comparison of the aquifer block and free-surface representations: results of the two models will be compared and contrasted for the south Florida study areas. Comparison for different types of wetland situations, flooded, seasonal, and tidally affected, will indicate which representations are most appropriate for different situations.

PROGRESS: The modifications to MODBRANCH have been made to allow wetland-canal-aquifer interactions in the new connection package. The steady-state model of Dade County has been constructed with all the model options. Work has begun on the transient model. A paper entitled "Incorporating hydraulic structures in an open channel model" was presented at Water Forum 1992 (August 1992).

(FL-534)

PLANS FOR THIS YEAR: Finish and calibrate transient model and begin use of SWIFT2D model. Continue preparation of report and journal article on wetland connections and begin work on model report and journal article on wetland rewetting.

REPORTS RELEASED:

Swain, E.D., 1992, Incorporating hydraulic structures in an open channel model, Proceedings of the Hydraulics Division at Water Forum '92, Baltimore, Maryland, August 3-6, 1992.

FL-535 HYDROGEOLOGY OF THE INTERMEDIATE AQUIFER SYSTEM WHERE THE VENICE CLAY EXISTS IN SARASOTA COUNTY, FLORIDA

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Gerald L. Barr, Tampa

COOPERATING AGENCY: Southwest Florida Water Management District

PROBLEM: Ground water in Sarasota County, in coastal southwestern Florida, is principally being developed from the surficial aquifer and the upper permeable zones of the intermediate aquifer system. Deeper permeable zones of the intermediate and Floridan aquifer systems are not used for drinking because water contains high concentrations of dissolved solids. Continued withdrawal from surficial and intermediate aquifers can cause upconing of saline water and result in degradation of freshwater. The confining units of the intermediate aquifer system retard movement of water between the various permeable zones. The Venice Clay is a significant confining unit within the intermediate aquifer system. Many supply wells tap permeable zones above and below the Venice Clay, allowing for movement of water between the zones. The areal extent, thickness, and hydraulic properties of the Venice Clay are important hydrogeologic characteristics that can be used to manage the water resources. Maps of depth to the top and thickness of confining units of the intermediate aquifer system would assist in designing production well casing depths and screened intervals. Hydraulic properties of the confining units control the interconnection between permeable zones, and hence, vertical leakages.

OBJECTIVE: To evaluate the hydrogeology of the intermediate aquifer system in Sarasota County, particularly where deposits of the Venice Clay exist. This will be accomplished by: (1) mapping the intermediate aquifer system where the Venice Clay exists; (2) describing hydrogeology of the intermediate aquifer system in Sarasota County, including lithostratigraphy, mineralogy, age, and depositional environment at three selected sites; (3) determining the thickness of the freshwater zone at two core sites; and (4) compiling and evaluating hydraulic properties, and water-quality and water-level data from existing sources at selected representative sites.

APPROACH: Compile a data base of gamma-ray and electric geophysical logs and lithostratigraphic descriptions that identify units of the intermediate aquifer system. Correlation techniques and cross sections will be used to identify permeable zones and confining units. Use core samples from one existing site and two new cores to be drilled as part of the study to describe the hydrogeology. Correlation will be made between the three core sites. Geophysical logs will be collected and used to establish benchmark geophysical profiles of the intermediate aquifer system. Compute existing hydrogeologic information from the Venice and other well fields in Sarasota County. Maps and cross-sections will be prepared that depict the intermediate aquifer system and the areal extent of the Venice Clay.

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PROGRESS: Test core holes were drilled by the Florida Geological Survey at sites in the Carlton Reserve and in south Venice to depths of 580 and 701 feet, respectively. Analyses of the Carlton Reserve core samples were partially completed by the Florida Geological Survey and U.S. Geological Survey. Water-quality analyses of 14 pore-water samples from the Carlton core were completed by the U.S. Geological Survey Ocala Laboratory. Compilation was begun of hydrogeologic data including hydraulic properties and water quality from the files of the U.S. Geological Survey, Southwest Florida Water Management District, and Sarasota County. Preliminary maps have been prepared that include locations of available geophysical and lithologic data, and some geologic cross sections.

PLANS FOR THIS YEAR: Results of the core analyses will be completed by the Florida Geological Survey and U.S. Geological Survey, Geologic Division. Compilation of geophysical and lithologic data will be completed early in the year. Compilation of the hydrogeologic data will be completed. Evaluation of all core analyses, geophysical, lithologic, and hydrogeologic data will be completed. Preparation of interpretive report for publication by USGS will continue.

FL-536 AQUIFER STORAGE AND RECOVERY FOR REDUCTION OF PHOSPHATE IN CANAL WATER, LAKE OKEECHOBEE, FLORIDA

DATE PROJECT BEGAN: April 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Vicente Quinones-Aponte, Miami

COOPERATING AGENCIES: South Florida Water Management District

PROBLEM: The Lake Okeechobee Technical Advisory Committee (LOTAC) was formed in 1985 with the commitment of searching for solutions to reduce the increasing contamination trend of Lake Okeechobee. At present, the most serious contamination problem to the lake is posed by the increasing phosphorus and nitrogen loads from contributing canal systems. This creates the threat of accelerated eutrophication and degradation of lake water. LOTAC recommended a study of the feasibility of aquifer storage and recovery (ASR) among other remedial techniques to eliminate the phosphate contamination problem.

OBJECTIVE: To (1) assess the feasibility of ASR as a mechanism for reducing phosphate loads in the canal water; (2) study the chemical behavior of the canal and native-aquifer waters mix during ASR, focusing on the fate of phosphate; and (3) estimate the recovery efficiency of the well or aquifer system for different well or aquifer configurations. The location of the study site is on the northern part of Lake Okeechobee, Florida. The study is limited to some flow zones within the Upper Floridan aquifer. The recovered water is intended for agricultural purposes.

APPROACH: Conduct three to four ASR tests where water samples will be collected from the injection well and two observation wells (nested wells) located at 560 feet from the injection well. One of the observation wells is open to the injection zone and the other is open to an upper confining unit. The water samples will be analyzed and the results will be used to study the chemical behavior of the mix of injected canal water and native aquifer water. Geochemical models (WATEQF and PHREEQE) will be applied to extend the study on a theoretical basis focussing on the fate of orthophosphate. A model capable of simulating density dependent flow and solute transport (HST3D) will be applied to study the feasibility of ASR for different well or aquifer configurations.

PROGRESS: All four field ASR tests were completed. The analysis of the chemical data was completed and one short paper describing the chemical analysis is in review and a second short paper covering other aspects of the chemical analysis is in preparation. A generalized solute transport model was assembled.

PLANS FOR THIS YEAR: Complete ASR modeling to assess recoverability of water for different well or aquifer configurations. Continue to prepare report and complete and publish papers on chemical analysis.

FL-537 A METHOD TO ESTIMATE NONSTEADY-STATE LEAKAGE FROM COASTAL CANALS IN THE SURFICIAL AQUIFER SYSTEM, SOUTHEAST FLORIDA

DATE PROJECT BEGAN: October 1991

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Eric Swain, Miami

COOPERATING AGENCIES: South Florida Water Management District

PROBLEM: Previous research into field determination of reach transmissivity has relied on steady-state conditions for the field measurements (Chin 1990). However, tidal fluctuations can propagate far enough to affect the ground water near the structures at these sites, and when the structures are opened, unsteady conditions will persist in the aquifer for significant portions of the measurement periods. The unsteady flow will invalidate the assumptions previously used that the leakage flow rate is constant between the canal and the characteristic distance to where transmissivity is measured. Thus, the standard direct determination of reach transmissivity by application of Darcy's law over the characteristic distance would be invalid.

OBJECTIVE: The objectives are to: (1) develop a method of quantifying water exchange between canals and aquifer under estuarine-tidal conditions and varying water-management practices at selected surface-water controls, and (2) determine the effects of these canals on the ground-water system.

APPROACH: At the start of this investigation, water-level recorders will be installed at the salinity controls and about 1 mile upstream. Additional water-level monitoring wells will be installed at about 5 and 500 feet from the canal on both sides of the canal. Canal discharge measurements by ultrasonic velocity meter (UVM) will be made when the salinity controls and the upstream station controls are open. The difference in discharge measured at two points in the canals will give the leakage in or out of the canal. These measurements will be used to determine reach transmissivity upstream from the controls.

PROGRESS: The field equipment has been installed and tested. Measurements have been made and quality checked.

PLANS FOR THIS YEAR: Make necessary repairs to damaged equipment that resulted from Hurricane Andrew. Continue field measurements and algorithm development. Begin interpretative report on methods and results.

FL-539 FACTORS AFFECTING THE MOVEMENT OF THE SALTWATER INTERFACE IN RESPONSE TO PUMPING AT A NEAR-SHORE WELL FIELD, WEST-CENTRAL FLORIDA

DATE PROJECT BEGAN: March 1992

DATE PROJECT ENDS: February 1995

PRINCIPAL INVESTIGATOR: James L. Robinson, Tampa

COOPERATING AGENCY: City of Sarasota

PROBLEM: The City of Sarasota operates a downtown well field consisting of six production wells. The water from the well field, which is high in chlorides and sulfates, is treated by Reverse-Osmosis (RO). Well withdrawal is about 6 million gallons per day, which yield 4.5 million gallons of potable water. An additional production well and two standby wells are planned for adequate water supply. The increased stress to the system of overlapping cones of depression needs to be addressed.

OBJECTIVE: Define the balance between pumping from a coastal well field and saltwater intrusion. Evaluate of how historical pumping has affected ground-water levels by studying history of water use, defining the hydrogeologic framework, and analyzing the quality of ground-water. Models will be utilized to assess potential movement of saltwater towards wells. Evaluate possible courses of action to maintain quality and yield.

APPROACH: An inventory of existing wells within the cone of depression of the well field will be made. Hydrogeologic framework will be determined from drill cuttings, water quality samples, and geophysical logs. Core samples from the confining units will be analyzed in the lab for hydraulic conductivity. Specific capacity tests at new production wells will be conducted. Hydrologic units and producing zones will be delineated. Ground-water quality will be evaluated. Models will be used to estimate how increasing pumpage will affect yield and movement of saltwater interface.

PROGRESS: A well inventory of existing wells and a data base of lithologic, geophysical, and water quality information has been compiled.

PLANS FOR THIS YEAR: The data collection will be completed. Aquifer testing will be completed. Numerical modeling of the groundwater flow system will begin.

FL-540 INVESTIGATION OF POTENTIAL METALS CONTAMINATION OF GROUND WATER AND UNSATURATED SEDIMENTS IN SMALL-ARMS FIRING RANGE, MACDILL AIR FORCE BASE, FLORIDA

DATE PROJECT BEGAN: April 1992

DATE PROJECT ENDS: September 1992

PRINCIPAL INVESTIGATOR: Mario Fernandez, Tampa

COOPERATING AGENCY: MacDill Air Force Base

PROBLEM: Defense-related activities at the small-arms firing range at MacDill Air Force Base might have released contaminants that could adversely affect the environment. Such activities specifically could affect the saturated and unsaturated sediments and the surface- and ground-water chemistry at the site.

OBJECTIVE: To determine the extent of contamination of the unsaturated sediments and ground water by heavy metals at the Base firing range.

APPROACH: The extent of heavy metals contamination at the Base will be quantified by sample analysis of the ground water at the site. Sediment characteristics will be determined through grain-size distribution analysis and metal-leaching capacity using U.S. Environmental Protection Agency (USEPA) method 1311 (40 CFR Part 261, Appendix II, "TCLP" (Toxicity Characteristics Leaching Procedure)). Ground water will be analyzed for the presence of metals.

PROGRESS: Fifteen shallow wells were installed, measurements were made at low tide, and a water table map was prepared. Water samples were collected and analyzed for six of the wells. Nine soil samples were collected and analyzed for leachable metals. An administrative report was prepared for the Air Force.

FL-541 SIMULATION OF GROUND-WATER FLOW AND ASSESSMENT OF TRANSPORT OF CONTAMINANTS AT OPERABLE UNIT #1, OIL AND SOLVENTS DISPOSAL PITS AREA, JACKSONVILLE NAVAL AIR STATION

DATE PROJECT BEGAN: June 1992

DATE PROJECT ENDS: September 1995

PRINCIPAL INVESTIGATOR: James H. Davis, Tallahassee

COOPERATING AGENCIES: U.S. Navy, Charleston, South Carolina

PROBLEM: Organic and inorganic EPA priority pollutants have been discovered in ground water, sediments, and surface water surrounding Operable Unit #1 (OU#1) at Naval Air Station (NAS), Jacksonville. As part of the Installation Restoration Program, the NAS is planning remedial-action alternatives to control the movement of these pollutants from the site. However, insufficient quantitative hydrological information exists to evaluate the movement of these pollutants in the ground to the adjacent St. Johns River.

OBJECTIVE: Develop an understanding of ground-water flow in the surficial aquifer in the immediate vicinity of OU#1. The study will determine, by use of a computer model, paths of ground-water flow that should delineate the directions of contaminant transport. The final report for the study will provide a discussion of the modeling procedures, the source of input data, and the flow paths for ground-water movement.

APPROACH: (1) Review existing hydrogeologic and water-quality data collected by previous investigators at NAS Jacksonville; (2) identify locations for additional wells to define the water table within the modeled area; (3) construct a preliminary 2D ground-water model based on data at hand; (4) refine ground-water model after final data collection by ABB consultants (under separate contract to the Navy); and (5) produce flow paths of probable contaminant travel.

PROGRESS: Preliminary modeling of the ground-water flow system at OU#1 has been completed using the U.S. Geological Survey MODFLOW model. Ground-water flow paths were projected using the preliminary model. Based on these results, suggested locations for additional water-level monitoring wells were made to the Navy.

PLANS FOR THIS YEAR: Additional modeling will be conducted using data collected by ABB Environmental Services, Inc., as part of their ongoing work at the site. The additional modeling will include both ground-water flow and solute transport. A report will be written detailing procedures and results.

FL-543 VERTICAL HYDRAULIC DIFFUSIVITY OF SELECTED ZONES IN THE FLORIDAN AQUIFER SYSTEM, COCOA WELL-FIELD AREA, EAST ORANGE COUNTY, FLORIDA

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: April 1995

PRINCIPAL INVESTIGATOR: Gertrude G. Phelps, Orlando

COOPERATING AGENCY: South Florida Water Management District

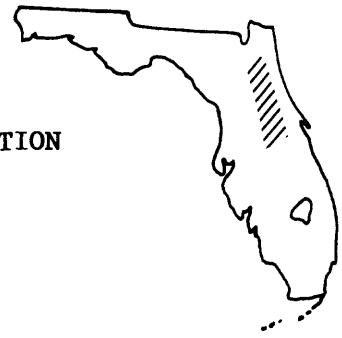
PROBLEM: In east Orange County, Florida, upper zones of the Floridan aquifer system contain freshwater but lower zones contain brackish water. The Cocoa well-field pumps about 24 million gallons per day (Mgal/d) and expansion is planned. No field-derived quantitative information is available to estimate the rate at which salty water can move upward into the freshwater zone.

OBJECTIVE: Determine the vertical hydraulic diffusivities of aquifer materials at selected depths beneath pumped zones of the Floridan aquifer system in east Orange County.

APPROACH: A series of aquifer tests will be conducted using selected supply wells as pumped wells. Pressure transducers will be used to measure head changes in five aquifer zones tapped by existing monitor wells. Data will be analyzed using the Neuman-Witherspoon method. Sample calculations of vertical times-of-travel will be made for several ranges of vertical diffusivity, aquifer porosity and specific storage, and withdrawal rates and locations.

PROGRESS: New project.

PLANS FOR THIS YEAR: Synthesize existing hydrogeologic data for the site. Design a series of aquifer tests. Order and install recording pressure transducers for monitor wells and a meteordigital station. Begin conducting a series of aquifer tests.



FL-544 SCALING ENERGY-BUDGET TIME SERIES TO REGIONAL WATER-BALANCE ESTIMATES OF ACTUAL EVAPOTRANSPIRATION

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: September 1995

PRINCIPAL INVESTIGATOR: William S. Gain, Orlando

COOPERATING AGENCY: South Florida Water Management District and St. Johns River Water Management District

PROBLEM: Though the physics of evaporation are well known, physically based model results are not always related to actual evapotranspiration (AET). Physical measurements of AET--contained volume of soil (lysimeter)--provide only small-scale, localized measurements of evapotranspiration (ET) which might not be representative of larger site or regional-scale phenomena. Drainage basins for which hydrologic inputs can be precisely measured can be equated to regional-scale lysimeters; however, delays in the response of most hydrologic fluxes to evaporation at a basin scale make the determination of short time-scale AET rates difficult.

OBJECTIVE: The general objectives of this study are to improve regional estimates of AET by combining small-scale energy-budget and regional water-balance approaches. This will include the following three specific objectives: (1) determine the minimum differencing interval for computation of accurate water-balance ET rates using ground-water storage and other delayed effects; (2) develop a stochastic model for AET (transfer function) relating energy-budget and water-balance ET estimates; and (3) examine spatial and temporal trends in the relation of energy-budget and water-balance ET rates.

APPROACH: This study will look at time-series data for two spring basins in Florida (Silver and Rainbow Springs), for which principal hydrologic fluxes have been accurately measured for more than 40 years. Spectral analysis and other autocorrelative time-series analyses will be used to filter the delay effects of rainfall and other hydrologic fluxes on AET computed by budget-residual analysis. Filtered AET (resolved to the shortest time-scale practicable) will be related to available climatic data for the period of record and will be examined for trends. Filtered AET estimates will also be related to results from physical models (Bowen ratio) for a test period of 18-months. An empirical model will be developed to relate filtered AET to model ET.

PROGRESS: New project.

PLANS FOR THIS YEAR: (1) Install equipment for Bowen ratio evaporation measurements at two sites; (2) monitor evaporation and hydrologic balance (rainfall, ground-water levels, and discharge) for Silver and Rainbow Springs basins; and (3) optimize ground-water flow model to estimate evaporation and recharge from existing data.

FL-545 DELINEATION OF GROUND WATER RECHARGE AREAS IN ESCAMBIA AND SANTA ROSA COUNTIES, FLORIDA

DATE PROJECT BEGAN: August 1992

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: Trey Grubbs, Tallahassee

COOPERATING AGENCY: Florida Department of Environmental Regulations

PROBLEM: Information on ground-water recharge areas at a large scale is needed by the State of Florida for implementing various ground-water programs. Delineation of recharge and accompanying rates is required for assessing the effects of ground-water development on a subregional and local basis. Recharge mapping in Escambia and Santa Rosa Counties is needed to support ongoing flow-modeling efforts being used in defining zones of contributions for public supply needs.

OBJECTIVE: (1) To delineate recharge areas for the surficial and Upper Floridan aquifer at a scale of 1:100,000 and (2) to define the recharge areas as high and low rate.

APPROACH: Recharge areas will be separated from discharge areas by (1) identifying all wetlands and major surface-water drains as discharge areas for the surficial aquifer (using topographic maps) and (2) by identifying discharge areas from the Upper Floridan aquifer as those areas where the potentiometric surface of the Upper Floridan is above the water table. Recharge rates to the surficial aquifer will be determined through hydrograph separation and regression analysis techniques. Recharge rates to the Upper Floridan aquifer will be determined from hydrogeologic data and aquifer properties determined from regional modeling studies.

PROGRESS: New project

PLANS FOR THIS YEAR: Correlate recharge estimates with basin characteristics. Use the results of this correlation analysis to estimate recharge in areas that lack streamflow data and distribute recharge within basins that have recharge estimates. Estimate recharge to the Upper Floridan aquifer using hydrogeologic property data derived from regional modeling studies, and potentiometric surface data. Prepare final report.

FL-546 A COUPLED SOIL-WATER DYNAMICS AND CLIMATIC EVALUATION OF EVAPOTRANSPIRATION AND AQUIFER RECHARGE RELATIONS

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: September 1996

PRINCIPAL INVESTIGATOR: David M. Sumner, Orlando

COOPERATING AGENCY: St. Johns River Water Management District and South Florida Water Management District

PROBLEM: An understanding of the magnitude and temporal patterns of evapotranspiration and phrenetic aquifer recharge is hampered by the lack of a physics-based integration of soil-water dynamics, plant stomatal response, and meteorological forcing.

OBJECTIVE: (1) Development of one-dimensional numerical model of evapotranspiration/recharge processes. (2) Instrumentation of field site to calibrate and test model. (3) Application of the model to evaluate patterns of evapotranspiration and phrenetic aquifer recharge.

APPROACH: Penman-Monteith formulation for evapotranspiration will be linked to Richard's equation for unsaturated soil-water transport, along with mass budgeting of rainfall between canopy reservoir storage and infiltration.

PROGRESS: New project

PLANS FOR THIS YEAR: Lysimeter construction, meteorological and soil moisture instrumentation installed.

FL-547 **EFFECTS OF DIVERTED STORMWATER RUNOFF FROM DRAINAGE WELLS ON RECHARGE TO THE UPPER FLORIDAN AQUIFER, ORANGE COUNTY, FLORIDA**

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: September 1995

PRINCIPAL INVESTIGATOR: Laura A. Bradner, Orlando

COOPERATING AGENCY: Orange County Utilities

PROBLEM: Drainage wells have the potential to adversely impact water quality in the Floridan aquifer system, the source of drinking water in Orange County. Two remedial options are pretreatment of the inflow prior to discharge into the wells and closure of the wells. Quantitative information is needed to evaluate the feasibility of closure of 23 non-critical wells.

OBJECTIVE: (1) Quantify recharge through 23 non-critical drainage wells; (2) evaluate effects of recharge on the potentiometric surface of the Upper Floridan aquifer; and (3) evaluate effects of land disposal of rerouted stormwater on recharge rates to the surficial and Floridan aquifer systems.

APPROACH: (1) Estimate inflow to the 23 non-critical wells by establishing stage-discharge and rainfall-runoff relationships. Estimates of evapotranspiration may have to be used to separate ground-water inflow; and (2) use ground-water flow model to simulate well closure and rerouted inflow to selected areas in western Orange County.

PROGRESS: New project.

PLANS FOR THIS YEAR: Install surface-water equipment. Estimate inflow quantities to wells.

FL-548 **HYDROLOGIC IMPACT OF TREATED WASTEWATER DISPOSAL THROUGH RAPID INFILTRATION BASINS AND CITRUS IRRIGATION, WEST ORANGE AND SOUTH LAKE COUNTIES, FLORIDA**

DATE PROJECT BEGAN: April 1992

DATE PROJECT ENDS: September 1996

PRINCIPAL INVESTIGATOR: David M. Sumner, Orlando

COOPERATING AGENCY: Reedy Creek Improvement District

PROBLEM: The long-term effects of disposal of treated wastewater through rapid infiltration basins and citrus irrigation on the surficial aquifer system in central Florida is unquantified.

OBJECTIVE: To (1) estimate the movement of treated wastewater applications through the ground-water system; (2) define the surface-water response to present and future disposals; and (3) define the response of hydraulic head and flow paths within the Upper Floridan aquifer.

APPROACH: (1) Multi-layer areal ground-water flow model of the surficial and Upper Floridan aquifer is developed; (2) model will be used to address questions of rates and directions of flow and lake-level response, upon model calibration.

PROGRESS: New project.

PLANS FOR THIS YEAR: Formulate model and data collection; drill exploratory surficial aquifer wells; determine surficial aquifer potentiometric surface map; generate model grid and structure.

FL-549 TRENDS IN WATER QUALITY AT PUBLIC SUPPLY WELLS IN THE TAMPA BAY AREA, FLORIDA

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Miguel A. Corral, Jr., Tampa

COOPERATING AGENCY: West Coast Regional Water Supply Authority and Pinellas County

PROBLEM: Ground-water quality in west-central Florida, particularly along the coast of the Gulf of Mexico, appears to be deteriorating. In the last decade water from public supply wells that draw water from the transition zone between freshwater inland and saltwater from the Gulf has had increased concentrations of dissolved solids (Clearwater, Venice, and Englewood). Additionally, long-term increases in nutrient concentrations of water discharging from springs could be caused by human activity.

OBJECTIVE: To tabulate the ambient water quality of the Upper Floridan aquifer at pumping centers in Hillsborough, Pinellas, and Pasco Counties and evaluate whether long-term changes in water quality are occurring.

APPROACH: A compilation of water-quality data from the files of U.S. Geological Survey, Southwest Florida Water Management District, West Coast Regional Water Supply Authority, County Public Health Departments, and other governmental agencies that can supply reliable information on raw-water quality will be graphed and interpreted to assess water quality trends of selected wells used for municipal supply.

PROGRESS: New project.

PLANS FOR THIS YEAR: Begin data compilation. Complete graphing and interpretation of data. Prepare the interpretative report.

FL-550 CONTAMINATION ASSESSMENT OF THREE OIL AND WATER SEPARATORS, MACDILL AIR FORCE BASE, FLORIDA

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: September 1993

PRINCIPAL INVESTIGATOR: Mario Fernandez, Jr., Tampa

COOPERATING AGENCY: MacDill Air Force Base

PROBLEM: The three oil and water separators, located in various parts of MacDill Air Force Base serviced three facilities with distinct functions. These facilities were the (1) washrack at the landfill; (2) jet-engine test cell; and (3) the aircraft rinse facility. Discharge from these facilities was through drainage canal, drainage ditch, and drainage field, respectively. Though there is information on the existence of contamination at the washrack and test cell facilities there is none available to relate the problem of contamination to the oil/water separators. There is no information on contamination at the aircraft rinse facilities; therefore the presence of contamination should not be assumed without a proper investigation.

OBJECTIVE: Determine the extent if any of ground-water or soil contamination in the vicinity of the three oil and water separators especially by activity-related metals and organic compounds.

APPROACH: Prepare site safety and quality assurance plans; install monitor wells for water level measurements; establish altitude of monitor wells' measuring point; soil-gas and ground-water reconnaissance for volatile organic compounds, install ground-water monitor wells, collect ground-water and sediment samples for chemical analysis.

PROGRESS: New project.

PLANS FOR THIS YEAR: Prepare quality assurance plan. Install well and collect and analyze data. Continue to prepare the report.

FL-551 HYDROGEOLOGIC FRAMEWORK AND DISTRIBUTION OF SALINITY IN THE FLORIDAN AQUIFER SYSTEM, SOUTHERN FLORIDA

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: September 1994

PRINCIPAL INVESTIGATOR: Ronald Reese, Miami

COOPERATING AGENCY: South Florida Water Management District

PROBLEM: The growing population of southern Florida has prompted a need to find supplemental sources for public water supply. The virtually untapped Floridan aquifer system can potentially be used to assist in this need. Salinity in the aquifer system is high, and the produced water must be treated or blended with freshwater. The hydrogeologic framework and distribution of salinity need to be defined and better understood in order to efficiently plan the development of this resource.

OBJECTIVE: This study is to include the lower portion of the intermediate aquifer system (lower Hawthorn aquifer) as well as the Floridan aquifer system. The objectives of this study are as follows: (1) establish a hydrogeologic framework; (2) delineate hydrochemical zones based on salinity and map the top, base, and, in some cases, the thickness of these zones; and (3) map the areal distribution of salinity in hydrogeologic units.

APPROACH: Correlation of important hydrogeologic units will be done using geophysical logs such as the gamma ray and flowmeter logs and by using lithologic data. The hydrologic framework will be displayed by constructing geologic sections and subsurface maps. Delineation of hydrochemical zones will be done using geophysical logs, mainly the resistivity and porosity log responses, and water sample analyses. Sources of water-quality data from samples are to include: (1) previously collected USGS data (QWDATA); (2) samples obtained during the deep well plugging program by South Florida Water Management District and USGS; (3) samples obtained from deep wastewater injection well system; (4) samples obtained from deep oil field wells; (5) samples obtained from production or test wells; and (6) samples obtained from key wells as part of this study. Head data from wells and zones will be collected for the purpose of relating to hydrochemical boundaries. Wells selected for use in this study will be entered into GWSI system if not already present. Geophysical logs will be digitized for the purpose of correlation and construction of geological sections. A GIS system will be used for the construction of a base map and subsurface maps.

PROGRESS: New project.

PLANS FOR THIS YEAR: Inventory existing wells and geophysical logs, lithologic logs, core data, head data, aquifer tests and water quality data.

FL-553 HYDROLOGIC CONDITIONS IN FLOOD-PLAIN HABITATS OF APALACHICOLA RIVER

DATE PROJECT BEGAN: October 1992

DATE PROJECT ENDS: September 1995

PRINCIPAL INVESTIGATOR: Helen M. Light, Tallahassee

COOPERATING AGENCY: Northwest Florida Water Management District

PROBLEM: The current controversy over water allocation in the Apalachicola-Chattahoochee-Flint (ACF) Rivers involving the city of Atlanta, the States of Georgia, Alabama, and Florida, and the U.S. Army Corps of Engineers is a strong signal that water resources in this basin are limited and competition for water is increasing. Florida's needs for the water resources of the ACF basin are primarily ecosystem based and relate to the healthy maintenance of the river, flood plain, and estuary. Relationships between river flow and flood-plain habitats need to be defined to understand the potential impacts of increased upstream water withdrawals on the Apalachicola River-flood-plain system.

OBJECTIVE: To describe how Apalachicola River flood-plain habitats and the biological communities known to utilize those habitats might be expected to change if river flows are altered by upstream withdrawals.

APPROACH: The 3-year study will include 2 years of research and analysis and 1 year of interpretation and report writing. During the first 2 years: (1) field data collections will be made to document the hydrologic conditions in selected flood-plain habitats; (2) limited statistical analysis of historical flow and stage will be conducted; and (3) literature research on the biological communities of flood-plain habitats in the Apalachicola and other river systems will be performed. In the final year, results of the field data, hydrologic analysis, and biological literature review will be combined in a report discussing the changes in flood-plain habitats and associated biological communities that may occur under various hypothetical low-flow scenarios.

PROGRESS: New project.

PLANS FOR THIS YEAR: Begin field work during low flow periods to describe habitats, how they are connected to the river, and how that connection will change with changes in low flow. Begin literature research on biological communities of flood-plain habitats. Begin hydrologic analysis of historical flow, river bed degradation, and historical stage.

*U.S. Government Printing Office: 1993 — 733-120/60017