UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SUMMARY OF U.S. GEOLOGICAL SURVEY INVESTIGATIONS AND HYDROLOGIC CONDITIONS IN SOUTHWEST FLORIDA FOR 1979

OPEN-FILE REPORT 81-78

Prepared in cooperation with the
SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

ABBREVIATIONS AND CONVERSION FACTORS

Factors for converting inch-pound units to International System (SI) units and abbreviation of units

Multiply inch-pound unit	By	To obtain SI (metric) unit
inch (in)	25.40	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square foot (ft^2)	0.0929	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
gallon (gal)	3.785	liter (L)
million gallons (Mgal)	3,785	cubic meter (m^3)
gallon per minute (gal/min)	0.06308	liter per second (L/s)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
degrees Fahrenheit (°F)	(°F-32) x 0.556	degrees Celsius (centigrade) (°C)

* * * * * * * * * * * * * *

National Geodetic Vertical Datum of 1929 (NGVD of 1929).--A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

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By H. C. Rollins

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SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

Tallahassee, Florida

1981

UNITED STATES DEPARTMENT OF THE INTERIOR

CECIL D. ANDRUS, Secretary

GEOLOGICAL SURVEY

H. William Menard, Director

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325 John Knox Road, Suite F-240
Tallahassee, Florida 32303

CONTENTS

ILLUSTRATIONS

TABLES

SUMMARY OF U.S. GEOLOGICAL SURVEY INVESTIGATIONS AND HYDROLOGIC CONDITIONS IN SOUTHWEST FLORIDA FOR 1979

By H. C. Rollins

ABSTRACT

This report summarizes the hydrologic setting and the water-resources investigations in the Southwest Florida Water Management District performed by the U.S. Geological Survey, Water Resources Division, for fiscal year 1979. Hydrologic conditions in southwest Florida are described and illustrated by hydrographs of selected surface-water, ground-water, and lake-stage data-collection sites. In addition, summaries of water-use data and data on the regional observation monitor-well program are provided. The investigations are part of the Federal program of appraising the nation's water resources. The cooperative program for fiscal year 1979 included 37 investigations. Abstracts of 15 reports released during 1979 are included.

INTRODUCTION

Each year the Tampa Subdistrict of the Florida District, U.S. Geological Survey, collects large amounts of hydrologic data in southwest Florida. These data are collected routinely through the means of a data-collection network and in a nonroutine manner as a part of a program of specific hydrologic studies. Most data are published in the annual report "Water Resources Data for Florida, Water Year 1979: Southwest Florida," but an additional need exists to summarize the data and present results of published studies.

This report describes hydrologic conditions in southwest Florida during the 1979 water year (October 1978 to September 1979) and summmarized water-resources investigations being made by the U.S. Geological Survey. The report is a reference for professionals and laymen who are interested in water resources of the area. The report contains a tabulation of active water-resources investigations, a summary of water use in the District, and a discussion of hydrologic conditions. In addition, the report contains the abstracts of reports released by the U.S. Geological Survey during 1979 for southwest Florida.

This report was prepared in cooperation with the Southwest Florida Water Management District (SWFWMD).

Report Area and Investigations Program

The area covered by this report is about 10,000 mi^2 in size and is located in southwestern Florida (fig. 1). Boundaries of the area are those of the Southwest Florida Water Management District, which in this report will be referred to as the District. The area contains 10 counties and parts of 6 others. U.S. Geological Survey cooperative water-resources investigations in the District are performed by the Southwest Florida Subdistrict in Tampa and by the East-Central Florida Subdistrict in Orlando. Investigations are made in cooperation with federal, state, county, and local units of government.

Investigations in the District provide the following:

1. Hydrologic data for determination and evaluation of the quantity, quality, and use of water resources.
2. Results of analytical and interpretive water-resources appraisals that describe the occurrence and availability of water and the physical, chemical, and biological characteristics of water.
3. Results of investigations using modeling techniques to further understanding of hydrologic systems and to quantitatively predict response of the systems to natural or manmade stress.
4. Dissemination of water data and results of investigations and research through reports, maps, and other forms of public release.
5. Scientific and technical assistance in hydrology and related fields to federal, state, and local agencies.

Water-Resources Program

The U.S. Geological Survey maintains a diversified program that encompasses all aspects of water information needs in the District. The cooperative program for fiscal year 1979 included 37 investigations. Hydrologic data were obtained at about 1,500 sites.

Federal, state, county, city, and local agencies that contributed funds for investigations and data collection are as follows:

U.S. Army Corps of Engineers
U.S. Department of Housing and Urban Development
U.S. Geological Survey
Florida Department of Environmental Regulation
Florida Department of Transportation
Florida Department of Pollution Control
Southwest Florida Water Management District
West Coast Regional Water Supply Authority
Hillsborough County

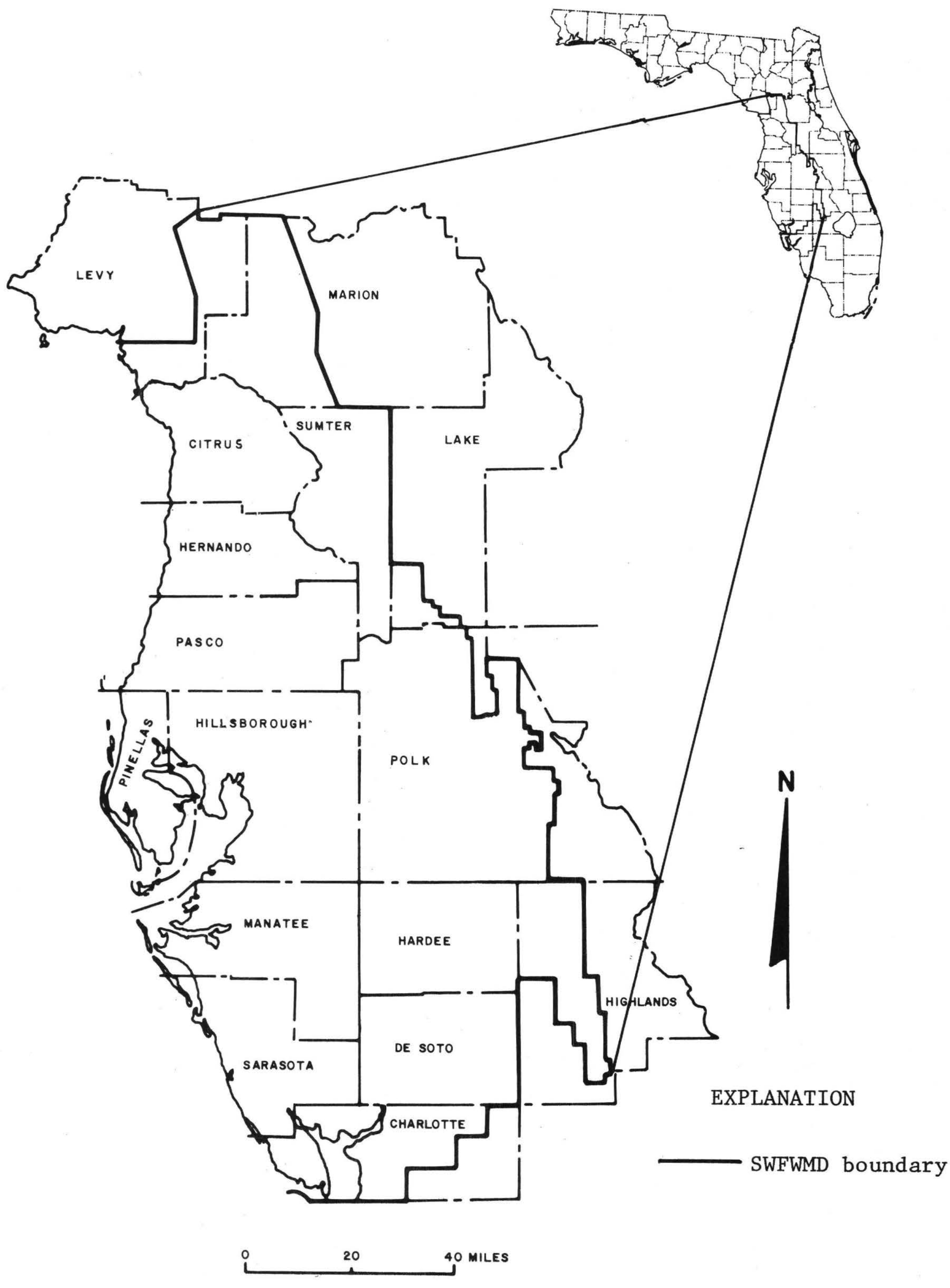


Figure 1.--Location of the Southwest Florida Water Management District.

Sarasota County
Pinellas County
City of Bradenton
City of Clearwater
City of St. Petersburg
City of Tampa
City of Sarasota
Englewood Water District
Winter Haven Boat Course District

Requests for data or information on investigations should be directed to:

District Chief
U.S. Geological Survey
325 John Knox Road, Suite F-240
Tallahassee, Florida 32303

Telephone: (904) 386-1118

Subdistrict Chief
Southwest Florida Subdistrict
U.S. Geological Survey
Tampa Commerce Mall
4710 Eisenhower Blvd., Suite B-5
Tampa, Florida 33614

Telephone: (813) 228-2124

Subdistrict Chief
East-Central Florida Subdistrict
U.S. Geological Survey
Suite 216, Federal Building
80 North Hughey Avenue
Orlando, Florida 32801

Telephone: (305) 420-6191

SUMMARY OF WATER-RESOURCES INVESTIGATIONS

Current and proposed investigations in the District are divided into 11 categories listed below. Proposed investigations in each category indicate long-range needs for water-resources information.

1. Hydrologic data base
2. Areal assessment
3. Quality and flow characteristics of streams
4. Hydrologic hazards
5. Water-quality characteristics of aquifers
6. Utilization of subsurface space
7. Land-use hydrology
8. Lake hydrology
9. Estuarine and wetland hydrology
10. Water atlas and lay-reader reports
11. Aquifer and stream-system evaluation

Hydrologic Data Base

Hydrologic data provide information on flow characteristics of streams, changes in ground-water storage and water use, and quality of ground and surface water. These data are needed for the appraisal, protection, and management of water resources. The effort consists of maintaining surface- and ground-water data-collection networks, and the collection and assembly of hydrologic records, such as water levels, geologic information, water use, and miscellaneous streamflow measurements. Current and proposed future studies are listed below.

HYDROLOGIC DATA-BASE STUDIES		Period of study				
		1979	1980	1981	1982	1983
FL-001	Surface-water records	——	——	——	——	——
FL-002	Ground-water records	——	——	——	——	——
FL-003	Quality-water records	——	——	——	——	——
FL-007	Water-use inventory	——	——	——	——	——
FL-179	Sarasota public water supply	——	——	——	——	——
FL-208	Technical assistance - SWFWMD	——	——	——	——	——
FL-232	Technical assistance - Hillsborough County	——	——	——	——	——
FL-256	Potentiometric maps	——	——	——	——	——
FL-257	Aquifer characteristics	——	——	——	——	——
FL-263	Remote data acquisition	——	- - -	- - -	- - -	
FL-280	Annual summary report	——	——			
FL-281	Technical assistance, Pinellas County	——	——	——	——	——
Proposed	Regional observation monitoring network		- - -	- - -	- - -	- - -
Proposed	Quality of rainfall, Tampa Bay Area		- - -	- - -	- - -	- - -

—————— Active   - - - - - - Proposed

Areal Assessment

Areal assessment studies provide base-line information for hydrogeologic studies and describe the areal and regional water-supply characteristics of aquifers and river basins. Current and proposed future studies are listed below.

AREAL ASSESSMENT STUDIES		Period of study				
		1979	1980	1981	1982	1983
FL-158	Hydrology of Englewood	———	———	———	———	———
FL-191	Well-field mapping	———	———	———	———	———
FL-210	Well-field evaluation	———	———	———	———	———
FL-301	Withlacoochee River basin assessment	———	———	- - -	- - -	- - -
FL-310	Southeast limestone aquifer	———	———	———	———	
Proposed	Ground water, Citrus and Hernando Counties		- - -	- - -	- - -	
Proposed	Shallow aquifers, Sarasota and Charlotte Counties		- - -	- - -	- - -	
Proposed	Hydrology of Sulphur Springs Quadrangle		- - -	- - -		
Proposed	River quality assessment		- - -	- - -	- - -	
Proposed	Trends in potentiometric surface		- - -			
Proposed	Water supply potential - streams			- - -	- - -	- - -
Proposed	Ground water, Pasco County		- - -	- - -		
Proposed	Shallow ground water, Pinellas County		- - -	- - -		
Proposed	Water resources, Hardee County		- - -	- - -		
Proposed	Hydrogeology of surficial aquifer, central Pasco County			- - -	- - -	- - -
Proposed	The hydrologic cycle, SWFWMD		- - -			
Proposed	Geohydrology of south-central Sarasota County			- - -	- - -	- - -

Quality and Flow Characteristics of Streams

Investigations of water quality and flow characteristics of streams provide information needed to define existing conditions and to predict changes in quality and flow characteristics under various plans of basin development. Several new proposals, currently being reviewed as future studies, are listed below.

STUDIES OF QUALITY AND FLOW CHARACTERISTICS OF STREAMS		Period of study				
		1979	1980	1981	1982	1983
Proposed	Low-flow studies - SWFWMD		- -	- -	- -	
Proposed	Braden River water supply				- -	- -
Proposed	Waste load assimilation - streams				- -	- -
Proposed	Charlotte Harbor estuarine hydrology			- -	- -	- -

Hydrologic Hazards

Investigations of drought and flood flows are made to define their frequency, duration, and magnitude. Information on the probability and extent of future floods is needed to reduce flood losses and to protect life and property, especially in areas of increased urbanization. Information on droughts is needed where streams are used for water supply and for protection of instream flows. Current and proposed future studies are listed below.

STUDIES OF HYDROLOGIC HAZARDS		Period of study				
		1979	1980	1981	1982	1983
FL-006	HUD flood studies	—	—			
FL-105	Small streams flood frequencies	—	—	—	—	—
FL-267	Watershed modeling	—	—			
FL-308	Geohydrology of sinkholes	—	—			
Proposed	Flood frequency of tidal streams				- -	- -
Proposed	Frequency and effects of droughts on water resources				- -	- -
Proposed	Impact of dam failure on flooding				- -	- -
Proposed	Small streams study - SWFWMD			- -	- -	- -

Water-Quality Characteristics of Aquifers

Water-quality investigations of aquifers are made to define areas of contamination, relation of ground water and surface water, and to predict changes in water quality. Current and proposed future studies are listed below.

STUDIES OF WATER-QUALITY CHARACTERISTICS OF AQUIFERS		Period of study				
		1979	1980	1981	1982	1983
FL-285	Saltwater encroachment	—	—			
FL-302	Radionuclides in ground water	—				
FL-320	Impact of ground-water from phosphate mining activities	—	—	—		
Proposed	Resistivity		- - -	- - -	- - -	- - -
Proposed	Occurrence and origin of mineralized ground water		- - -	- - -		
Proposed	Interconnection between Tampa Bay and Floridan aquifer		- - -	- - -		

Utilization of Subsurface Space

Investigations are made to evaluate the effects of injecting waste effluent into saline aquifers, to determine means of artificially recharging aquifers, and to evaluate the potential movement of stored fresh or wastewaters. Current and proposed future studies are listed below.

STUDIES OF UTILIZATION OF SUBSURFACE SPACE		Period of study				
		1979	1980	1981	1982	1983
FL-152	Subsurface disposal, Pinellas County	—				
FL-154	Subsurface waste storage, Federal	—	—			
FL-198	Subsurface storage, St. Petersburg	—	—			
FL-293	Regional effects of injection	—				
Proposed	Effects of long-term injection		- - -	- - -	- - -	

Land-Use Hydrology

Hydrologic investigations are needed to provide information on land-use planning and zoning, water-resources management, and evaluation of the effects of manmade alterations to the environment. Current and proposed future studies are listed below.

LAND-USE HYDROLOGY STUDIES		Period of study				
		1979	1980	1981	1982	1983
FL-107	Landfill sites, Hillsborough County	———	———	———	———	———
FL-219	Urban hydrology	———	———			
FL-316	Landfill and sewage effluent	———	———	———		
Proposed	Internally drained area, eastern Hillsborough County		- - - -			
Proposed	Hydrologic factors, land use, Pinellas County		- - - -			
Proposed	Effects of frost protection pumping, Hillsborough County		- - - -			
Proposed	Basin assessment studies			- - - -	- - - -	- - - -
Proposed	Water-quality evaluation of urban storm runoff			- - - -	- - - -	- - - -
Proposed	Evaluation of urban runoff and pollution control measures, Pinellas County			- - - -	- - - -	- - - -
Proposed	Hydrology of proposed mining areas, east Manatee, west Hardee, and west DeSoto Counties			- - - -	- - - -	- - - -
Proposed	Charlotte Harbor estuarine hydrology			- - - -	- - - -	- - - -

<u>Lake Hydrology</u>

Lake hydrology investigations provide an understanding of the role of lakes in the hydrologic system and define possible causes of changes in lake water quality and lake levels. Current and proposed future lake investigations are listed below.

LAKE HYDROLOGY STUDIES		Period of study				
		1979	1980	1981	1982	1983
FL-143	Lakes in southwest Florida	———	———	———	———	———
FL-278	Winter Haven Lakes	———				
FL-331	Regional lake-stage evaluation		———	———		
Proposed	Effects on lake water quality by adding ground water		- - -	- - -		

<u>Estuarine and Wetland Hydrology</u>

Investigations are conducted in estuaries and wetlands to determine hydrologic and water-quality conditions and to predict changes due to development. Current and proposed future studies are listed below.

ESTUARINE AND WETLAND HYDROLOGY STUDIES		Period of study				
		1979	1980	1981	1982	1983
FL-159	Estuarine hydrology, Tampa Bay	———	———	- - -	- - -	- - -
FL-292	Freshwater inflow to estuaries	———				
Proposed	Charlotte Harbor estuarine hydrology			- - -	- - -	

<u>Water Atlas and Lay-Reader Reports</u>

Atlases and brochures will be prepared describing hydrology problems and principles to provide the public with a better understanding of the water resources of southwest Florida. Current and proposed reports are listed below.

WATER ATLAS AND LAY-READER REPORTS		Period of study				
		1979	1980	1981	1982	1983
FL-075	Florida water atlas	———	———	———	———	———
Proposed	District map atlas		- - -	- - -	- - -	- - -
Proposed	Lay-reader report		- - -	- - -	- - -	- - -

Aquifer and Stream-System Evaluation

Aquifer and stream-system model investigations are made to predict the effects of industrial, municipal, or agricultural developments on water resources. Current and proposed future studies are listed below.

AQUIFER AND STREAM-SYSTEM EVALUATION STUDIES		Period of study				
		1979	1980	1981	1982	1983
FL-264	Effect of ground-water development	———	———			
FL-265	Water supply, Hillsborough River	———	———			
Proposed	Ground-water development, Tampa area		- - - -	- - - -		
Proposed	Time-of-travel studies - stream		- - - -	- - - -		
Proposed	Mapping permeable zones, Floridan aquifer		- - - -	- - - -		
Proposed	Interrelation between Floridan aquifer and streams			- - - -	- - - -	- - - -
Proposed	Charlotte Harbor estuarine hydrology			- - - -	- - - -	- - - -

REPORTS RELEASED IN FISCAL YEAR 1979

Fifteen reports of investigations in the Southwest Florida Water Management District were released in FY79. These reports are on hydrologic and hydrogeologic investigations in southwest Florida. This section contains the abstract from each report.

Copies of reports listed in this section are available for inspection at the U.S. Geological Survey offices in Tampa, Tallahassee, Miami, and Orlando; at the U.S. Geological Survey Library in Reston, Va.; at libraries of the State University System of Florida; and at the Southwest Florida Water Management District office. For information about availability of reports, contact the U.S. Geological Survey, 325 John Knox Road, Suite F-240, Tallahassee, Fla. 32303 or the Southwest Florida Water Management District, Office of Communications and Information, 5060 U.S. Highway 41 South, Brooksville, Fla. 33512.

For annual bulletins, information circulars, map series, and reports of investigations published by the Florida Bureau of Geology, contact the Bureau of Geology, Florida Department of Natural Resources, 903 West Tennessee Street, Tallahassee, Fla. 32304. Florida Bureau of Geology publications are available for inspection at many public libraries throughout Florida.

A complete bibliography of reports published by the U.S. Geological Survey during the period 1933-78 that concern the Southwest Florida Water Management District are listed in U.S. Geological Survey Open-File Report 79-1257, "Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978." The reports are listed according to categories of investigations described in the section "Summary of Water-Resources Investigations."

Abstracts from reports released in 1979 follow:

Buono, Anthony, Spechler, R. M., and Wolansky, R. M., 1979, Generalized thickness of the confining bed overlying the Floridan aquifer, Southwest Florida Water Management District: U.S. Geological Survey Open-File Report 79-1171.

Abstract.--*This map report presents the thickness of the confining bed overlying the Floridan aquifer in the Southwest Florida Water Management District and adjacent areas. The bed separates the surficial aquifer from the underlying Floridan aquifer. Lithologic logs and information from quarries were used in conjunction with an unpublished map prepared during an earlier investigation to compile this map at 1:250,000 scale.*

Formations included in the upper confining bed are: clay, sandy clay and marl, undifferentiated with respect to age, the Hawthorn Formation, and the unconsolidated sections of the Tampa Limestone.

Causseaux, K. W., and Rollins, H. C., 1979, Summary of hydrologic data for Tampa Bypass Canal system, July 1974 to September 1976: U.S. Geological Survey Open-File Report 79-1297.

Abstract.--*The Tampa Bypass Canal is part of a flood-control project east of the city of Tampa under construction by the U.S. Army Corps of Engineers. It will divert floodwater from the Hillsborough River at points upstream from Tampa through a canal system to McKay Bay. The U.S. Geological Survey began a hydrologic data program in 1974 to evaluate the effects of canal construction. A network of surface-water and ground-water sites was designed to monitor changes in nutrients, trace metals, major inorganic constituents, pesticides, and benthic invertebrates along the canal system; to monitor changes in trace elements, common constituents, nitrates, specific conductance, and chlorides in the Floridan aquifer; and to monitor changes in the potentiometric surface of the Floridan aquifer.*

In 1974-75, the monitoring program consisted of drilling 12 monitor wells and initiation of the surface-water sampling program. In 1976, the program consisted of drilling five additional wells, continuation of the surface-water sampling, initiation of ground-water sampling program, and monitoring of discharge from springs.

Water-quality data for nine surface-water sites in the basin were collected at each of the control structure sites, in the tidal portion of the canal, and at each of the major tributaries to the canal system.

Fifteen ground-water sites were sampled annually to provide information on ground-water quality. Ten wells were sampled semiannually for dissolved chloride concentrations to provide information on the freshwater-saltwater interface. Ground-water levels were collected at 34 wells in the areas adjacent to the canal to monitor changes in the potentiometric surface in the Floridan aquifer.

Discharge measurements from springs along the canal system were made in 1969-73 and 1976 to provide data on the quantity of ground water entering the canal. A daily discharge station was operated at structure S-160 to determine quantity of water flowing from the canal system into the bay.

Duerr, A. D., 1979, Hydrologic data for the Morris Bridge well-field area, Hillsborough County, Florida, 1971-78: U.S. Geological Survey Open-File Report 79-1262.

Abstract.--*Well data are summarized for 102 wells constructed in the Morris Bridge well-field area in north-central Hillsborough County. Of the wells reported, 20 are public-supply wells that have yields averaging 1,800 gallons per minute and specific capacities that range from 36 to 346 gallons per minute per foot of drawdown. Also presented are 28 drillers' logs, 7 lithologic logs, and an index of 64 geophysical logs of 18 wells in the well-field area.*

The report also includes hydrographs of water levels of 10 observation wells, hydrographs of stream stage and streamflow of the Hillsborough River, and hydrographs of rainfall for two stations.

Knutilla, R. L., and Rollins, H. C., 1979, Summary of U.S. Geological Survey investigations and hydrologic conditions in the Southwest Florida Water Management District for 1978: U.S. Geological Survey Open-File Report 79-1257.

Abstract.--*This report summarizes water-resources investigations in the Southwest Florida Water Management District performed by the U.S. Geological Survey, Water Resources Division, for fiscal year 1978. The investigations are part of the Federal program of appraising the nation's water resources. The cooperative program for fiscal year 1978 included 37 interpretive investigations. Abstracts of 30 reports released during 1978 and a bibliography of reports released since 1933 are included. The hydrologic setting of southwest Florida and discussions of surface-water, ground-water, and quality-of-water conditions are given. Hydrologic conditions in southwest Florida are described and illustrated by hydrographs of selected surface-water, ground-water, and lake-stage data-collection sites. In addition, summaries of water-use data and data on the regional observation monitor-well program are provided.*

Seijo, M. A., Giovannelli, R. F., and Turner, J. F., Jr., 1979, Regional flood-frequency relations for west-central Florida: U.S. Geological Survey Open-File Report 79-1293.

Abstract.--*This report presents regional relations for estimating the magnitude and frequency of floods on streams in west-central Florida. Flood prediction equations derived cover 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence intervals.*

Annual floods for three geographic areas of west-central Florida were found to relate significantly to basin characteristics. Basin characteristics include drainage area, soils index, channel slope, and lake area. The average standard error of estimate for regional flood relations ranged from 38.4 percent to 52.1 percent with a mean of 43.5 percent. The average multiple correlation coefficient is 0.94. Regional relations apply to gaged and ungaged sites whose drainage areas are greater than 10 but less than 2,500 square miles.

Tables of maximum known floods for 64 streamflow stations used in the analysis are included. Tables comparing station, weighted, and regional flood-peak discharges are also included.

Sutcliffe, H., Jr., 1979, Hydrologic data from a deep test well, city of Sarasota, Florida: U.S. Geological Survey Open-File Report 79-1275.

Abstract.--*The city of Sarasota drilled a test well to a depth of 3,513 feet at the city's wastewater-treatment facility in downtown Sarasota. The test well was drilled to determine the feasibility of disposing of liquid waste from the city's secondary treatment plant. Drilling of the test well began in July 1973 and was completed in November 1974. A conventional circulation mud-rotary drilling method was used to a depth of 1,146 feet below land surface and a reverse circulation air-lift method was used to a depth of 3,513 feet. The greatest chloride concentration of water withdrawn from the test well was 31,000 milligrams per liter. The test well, uncased and open to dolomitic limestone between 2,006 and 3,513 feet, yielded 392 gallons per minute with a drawdown of approximately 100 feet.*

Sutcliffe, H., Jr., and Buono, Anthony, 1979, Hydrologic records, Verna well-field area, city of Sarasota, Florida, 1962-76 -- a data report: U.S. Geological Survey Open-File Report 79-1259.

Abstract.--*A short history of the development and operation of the Verna well field is presented. Also included are geological, drillers' and selected geophysical logs of test and production wells; chemical analyses; specific capacity tests; pumpage; physical dimensions of wells; and source for other data available as indicated.*

Turner, J. F., Jr., and Woodham, W. M., 1979, Evaluation of remote hydrologic data-acquisition systems, west-central Florida: U.S. Geological Survey Water-Resources Investigations 79-102.

Abstract.--*This study provides an evaluation of the hydrologic applications of a land-line and two satellite data-relay systems operated during 1977-78 in the Southwest Florida Water Management District. These systems were tested to evaluate operational and reliability characteristics. Telephone lines were used to relay data in the land-line system, and the Geostationary Operational Environmental Satellite (GOES) and Land satellite (Landsat) were used in the satellite system.*

The land-line system was tested for a period of 15 months at a streamflow site. Accurate data were obtained 94 percent of the time during the test period. Data losses are attributed to telephone-line interference, low-battery voltage, and vandalism.

The GOES system was tested at a rainfall site for a 17-month period. During this period, 79 percent of all Convertible Data Collection Platform (CDCP) transmissions from the station were relayed by the GOES system to the U.S. Geological Survey computer, resulting in successful processing of 88 percent of all possible rainfall observations. On the average, seven data transmissions were completed each day. Ninety-six percent of the time, at least one data transmission was completed each day, and 80 percent of the

time, an average of more than seven transmissions was completed each day. Data were available within about 8 hours after recording at the field site. Uncompleted transmissions were caused chiefly by hardware malfunctions at ground-receiving stations.

The Landsat system was tested at a rainfall site for about 17 months and for about 8 months at a streamflow site. During these periods of operation, only about 2 percent of all data observations for the stations were successfully relayed by the Landsat system to the U.S. Geological Survey computer. An average of about three data transmissions was completed each day for each site. Eighty-eight percent of the time, at least one transmission from each site was completed each day, and 80 percent of the time, an average of more than four transmissions was completed each day for each site. Data were available within about 12 hours after recording at field sites. Uncompleted transmissions are attributed to satellite orbit, hardware malfunction at ground-receiving stations, overloading of recording devices at the U.S. Geological Survey computer center, testing of equipment, battery failure, and vandalism.

Wilson, W. E., and Gerhart, J. M., 1979, Simulated changes in potentiometric levels resulting from ground-water development for phosphate mines, west-central Florida: Journal of Hydrology, Maxey Memorial Volume, Netherlands.

Abstract.--A digital model of two-dimensional ground-water flow was used to predict changes in the potentiometric surface of the Floridan aquifer resulting from ground-water development for proposed and existing phosphate mines during 1976-2000. The modeled area covers 15,379 square kilometers in west-central Florida.

In 1975, ground water withdrawn from the Floridan aquifer for irrigation, phosphate mines, other industries, and municipal supplies averaged about 28,500 liters per second. Withdrawals for phosphate mines are expected to shift from Polk County to adjacent counties to the south and west, and to decline from about 7,620 liters per second in 1975 to about 7,060 liters per second in 2000.

The model was calibrated under steady-state and transient conditions. Input parameters included aquifer transmissivity and storage coefficient; thickness, vertical hydraulic conductivity, and storage coefficient of the upper confining bed; altitudes of the water table and potentiometric surface; and ground-water withdrawals.

Simulation of November 1976 to October 2000, using projected combined pumping rates for existing and proposed phosphate mines, resulted in a rise in the potentiometric surface of about 6 meters in Polk County, and a decline of about 4 meters in parts of Manatee and Hardee Counties.

Wilson, W. E., and Gerhart, J. M., 1979, Simulated effects of ground-water development on potentiometric surface of the Floridan aquifer, west-central Florida: U.S. Geological Survey Open-File Report 79-1271.

Abstract.--A digital model of two-dimensional ground-water flow was used to predict changes in the potentiometric surface of the Floridan aquifer, 1976-2000, in a 5,938-square-mile area of west-central Florida.

In 1975, ground water withdrawn from the Floridan aquifer for irrigation, phosphate mines, other industries, and municipal supplies averaged about 649 million gallons per day. Rates are projected to increase to about 840 million gallons per day by 2000.

The model was calibrated under steady-state and transient conditions. Input parameters included transmissivity and storage coefficient of the Floridan aquifer; thickness, vertical hydraulic conductivity, and storage coefficient of the upper confining bed; altitudes of the water table and potentiometric surface; and ground-water withdrawals.

Simulation of May 1976 to May 2000, using projected combined pumping rates for municipal supplies, irrigation, and industry (including existing and proposed phosphate mines), resulted in a rise in the potentiometric surface of about 10 feet in Polk County, and a decline of about 35 feet in parts of Manatee and Hardee Counties. The lowest simulated potentiometric level was about 30 feet below the National Geodetic Vertical Datum of 1929. Simulated declines for November 1976 to October 2000 were generally 5 to 10 feet less than those for May 1976 to May 2000.

Wilson, W. E., Parsons, D. C., and Spechler, R. M., 1979, Hydrologic data for a subsurface waste-injection site at Mulberry, Florida, 1972-77: U.S. Geological Survey Open-File Report 79-683.

Abstract.--*Since October 1972, industrial liquid waste has been injected into a brine aquifer of limestone and dolomite at a depth of more than 4,000 feet below land surface. During 1977, the injection rate was about 8.8 million gallons per month. To determine what effect the injected waste has on the ground-water body, water levels have been measured and water samples collected from two monitor wells that tap different permeable zones above the injection zone, and from a satellite monitor well that taps the injection zone. The monitor wells are in the annulus of the injection well, and the satellite monitor well is 2,291 feet from the injection well.*

This report updates previous data reports and includes all hydrologic data collected by the U.S. Geological Survey during 1972-77. Included is a table of well-construction data, a graph showing the volume of waste injected each month, and hydrographs of the annulus monitor wells and the satellite monitor well. Tables show chemical analyses of samples from each well and of the waste.

Wolansky, R. M., Barr, G. L., and Spechler, R. M., 1979, Configuration of the bottom of the Floridan aquifer, Southwest Florida Water Management District: U.S. Geological Survey Open-File Report 79-1490.

Abstract.--*This map report presents the configuration of the bottom of the Floridan aquifer in the Southwest Florida Water Management District. The bottom of the aquifer generally corresponds to the beginning of vertically consistent intergranular evaporites occurring in either the Avon Park, Lake City, or Oldsmar Limestones of Eocene age. The altitude of the bottom of the aquifer varies from about 600 feet below the National Geodetic Vertical Datum of 1929 in the north to about 3,000 feet below the datum in the south.*

Wolansky, R. M., Mills, L. R., Woodham, W. M., and Laughlin, C. P., 1979, Potentiometric surface of the Floridan aquifer, Southwest Florida Water Management District and adjacent areas, May 1979: U.S. Geological Survey Open-File Report 79-1255.

Abstract.--*A May 1979 potentiometric-surface map of the Southwest Florida Water Management District depicts the annual low water-level period.*

Potentiometric levels decreased 4 to 21 feet between September 1978 and May 1979 in the citrus and farming sections of southern Hillsborough, northern Hardee, southwestern Polk, northwestern DeSoto, and Manatee Counties. Water levels in these areas are widely affected by pumping for irrigation and have the greatest range in fluctuations. Water-level declines ranged from 0 to 6 feet in coastal, northern, and southern areas of the Water Management District. Generally, potentiometric levels were higher than previous May levels due to heavy rains in April and May. In parts of Hillsborough, Pasco, and Pinellas Counties, May 1979 potentiometric levels were 18 feet higher than those of September 1978.

Wolansky, R. M., Spechler, R. M., and Buono, Anthony, 1979, Generalized thickness of the surficial deposits above the confining bed overlying the Floridan aquifer, Southwest Florida Water Management District: U.S. Geological Survey Open-File Report 79-1071.

Abstract.--*This map report presents the thickness of the surficial deposits overlying the upper confining bed of the Floridan aquifer in the Southwest Florida Water Management District. The surficial deposits range in thickness from less than 25 feet in the western part of the District to greater than 250 feet in the eastern part. The surficial deposits include sand, clayey sand, shell, and shelly marl that occur in the Holocene sand, Pleistocene marine terrace sand, and unconsolidated parts of the Fort Thompson Formation, Caloosahatchee Marl, Alachua Formation, and Bone Valley Formation. Lithologic logs and information from quarries were used in conjunction with an unpublished map prepared during an earlier investigation to compile this map at 1:250,000 scale.*

Wolansky, R. M., Yobbi, D. K., Mills, L. R., and Woodham, W. M., 1979, Water table in the surficial aquifer and potentiometric surface of the Floridan aquifer in selected well fields, west-central Florida, May 1979: U.S. Geological Survey Open-File Report 79-1350.

Abstract.--*The water table in the surficial aquifer and the potentiometric surface of the Floridan aquifer in a 1,200-square-mile area in west-central Florida are mapped semiannually by the U.S. Geological Survey. Maps are prepared showing water levels measured in wells each May to coincide with seasonal low levels and each September to coincide with seasonal high levels.*

The mapped area shows 16 well fields which supplied 128 million gallons to municipalities on May 15, 1979. The water is withdrawn from the Floridan aquifer, the major aquifer in Florida. The effect of localized withdrawal of ground water is shown on the maps as depressions in both the potentiometric and water-table surfaces.

Water levels were significantly higher in May 1979 than in May 1978 because of unusually heavy rains on May 7 and 8th that deluged the well-field areas with 2 to 18 inches of rain. The maximum increase in water levels from May 1978 to May 1979 was more than 8 feet at the Eldridge-Wilde well field.

HYDROLOGIC SETTING

Water is one of the major factors in maintaining a balanced ecologic system for southwest Florida. Rainfall averages 49 to 55 inches per year and is the primary source of freshwater for recharging aquifers and providing streamflow. Ninety percent of southwest Florida's water supply for domestic, industrial, and agricultural purposes is obtained from ground water and the remaining 10 percent from surface water. Ground water is obtained from three principal aquifers: the unconfined surficial, the confined minor artesian, and the confined Floridan (fig. 2).

Climate

The climate of southwest Florida is subtropical and is characterized by warm, humid summers and mild winters. Some rainfall normally occurs during each month of the year, but there is a distinct rainy season extending from May through September and a low rainfall season extending from October through April. About 70 percent of the annual rainfall occurs during the rainy season. Winter rainfall is relatively light because Florida is the normal southern limit of winter frontal systems, the causative factor of winter rainfall. Summer rainfall is derived principally from convectional storms that usually occur in the afternoon and early evening. Spatially, summer rainfall is highly variable; areas only a few miles apart often receive widely differing amounts of rain.

The average annual temperature at Lakeland, which typifies the District, is 72.5°F. Average monthly temperatures range from 61°F in January to 82°F in August. Rainfall at Lakeland averages 49.4 inches annually. Figure 3 shows annual rainfall departures from normal for the period 1941-79.

Topography and Drainage

Southwest Florida is characterized by relatively flat, generally swampy lowlands in the coastal areas and by flat to gently rolling hills in inland areas. Except for a coastal ridge in central Pinellas County that has altitudes of as much as 100 feet above the National Geodetic Vertical Datum of 1929 (NGVD of 1929), coastal areas are less than 50 feet in altitude (fig. 4). Most inland areas range between 50 and 100 feet in altitude. A series of eroded ridges trending northwest in Pasco, Hernando, and Citrus Counties, however, range between 100 and 150 feet in altitude and in places exceed 200 feet. In the east-central part of the District, most altitudes exceed 100 feet. In Polk County, altitudes exceed 150 feet in several places; the maximum is 305 feet.

More than two-thirds of the 10,000 mi^2 in the District is drained by nine rivers (fig. 5). The two largest basins are the Peace River basin, 2,400 mi^2, and the Withlacoochee River basin, 2,000 mi^2. The western part of the District is drained by numerous coastal streams. A ridge exists in the eastern part of

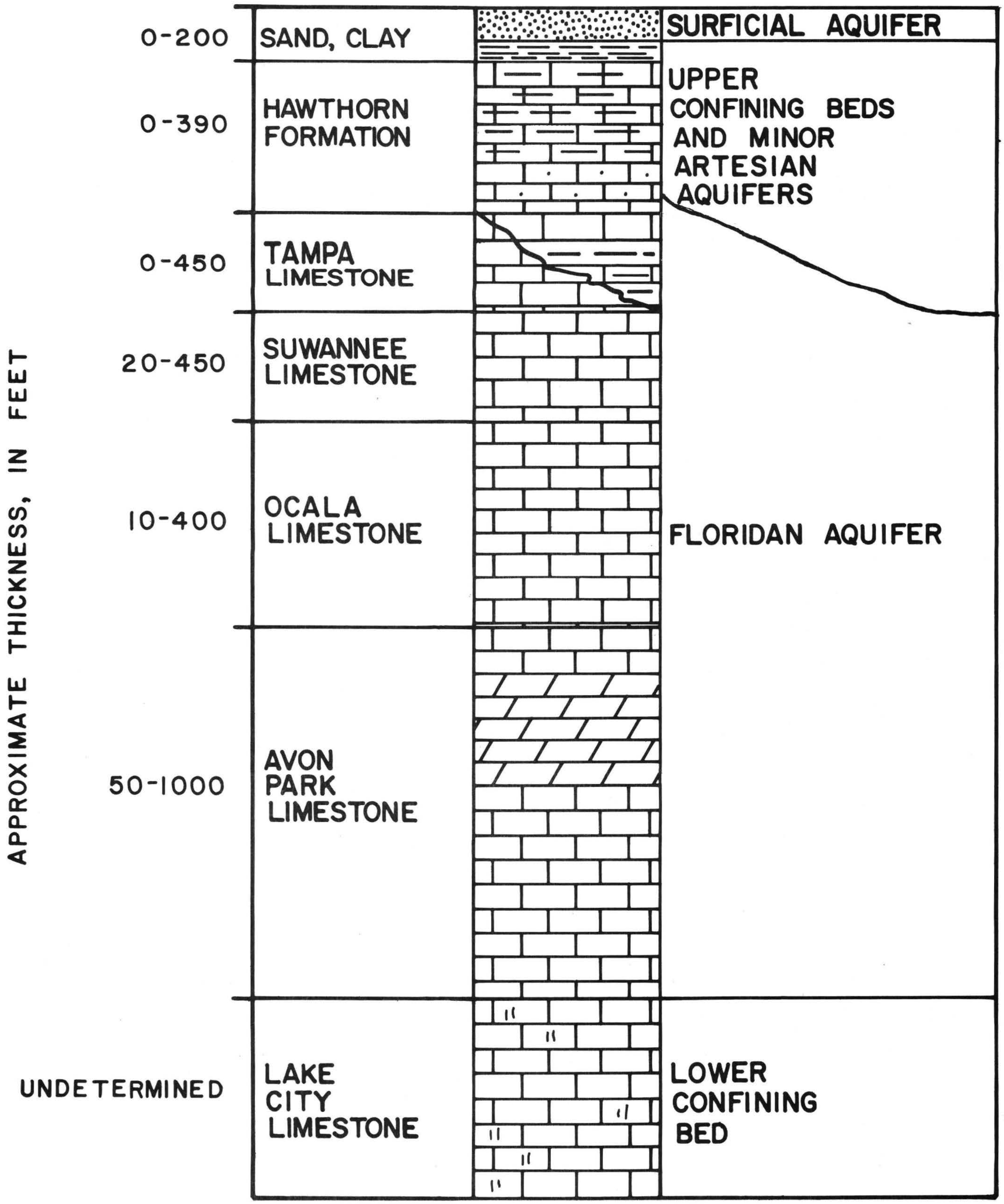


Figure 2.--Generalized hydrogeologic section for southwest Florida.

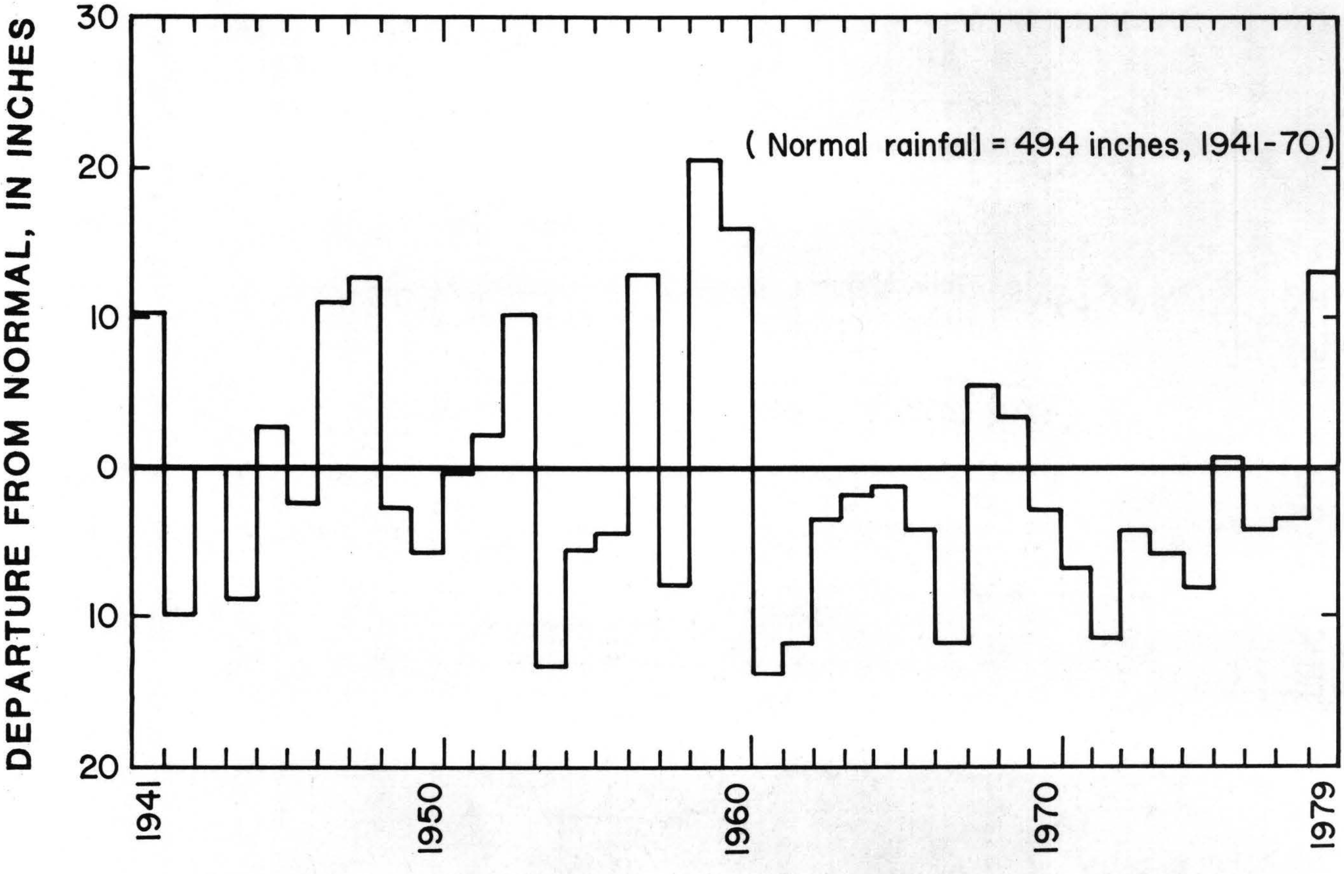


Figure 3.--Annual rainfall departures from normal at Lakeland, 1941-79.

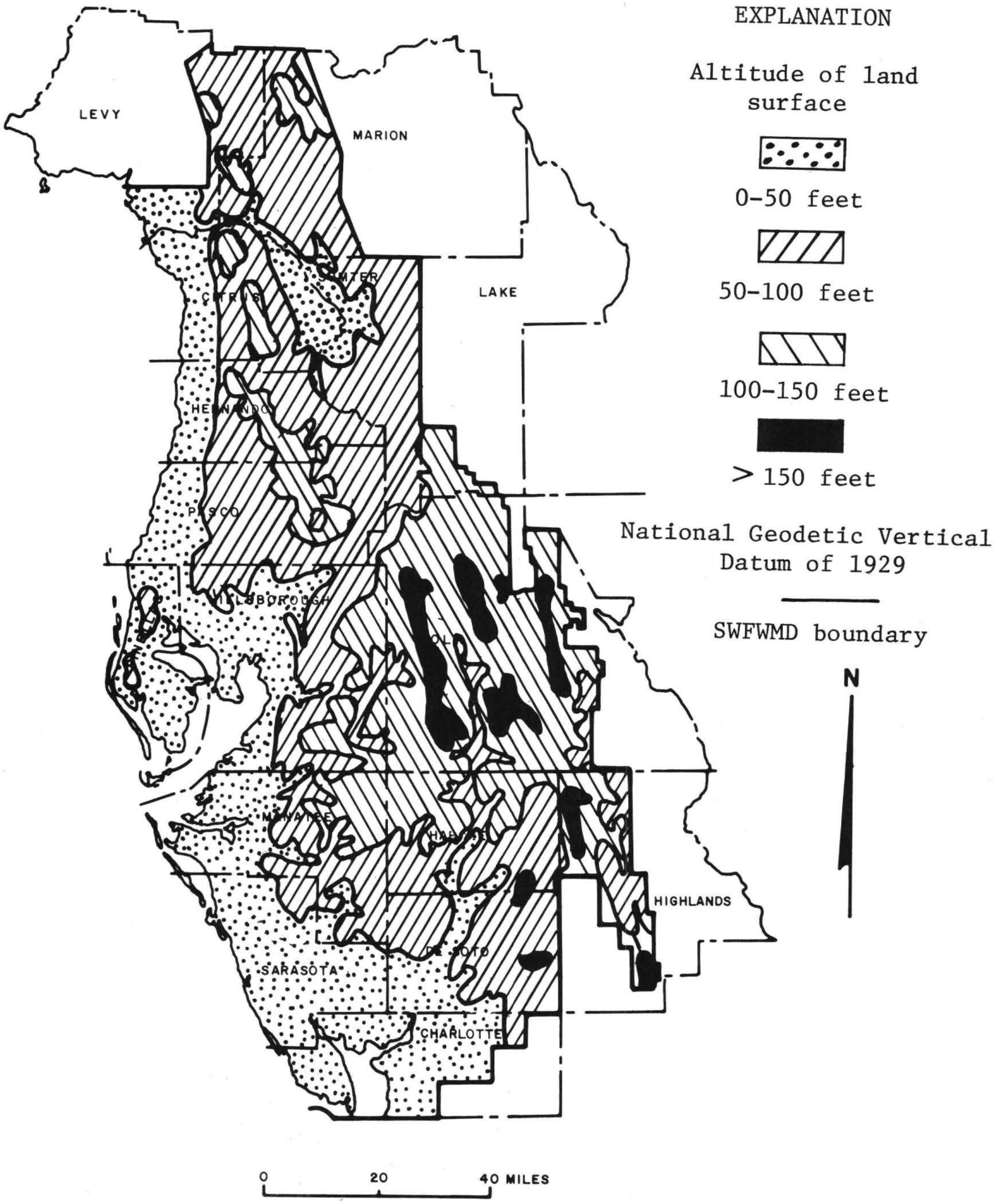


Figure 4.--Topography of southwest Florida.

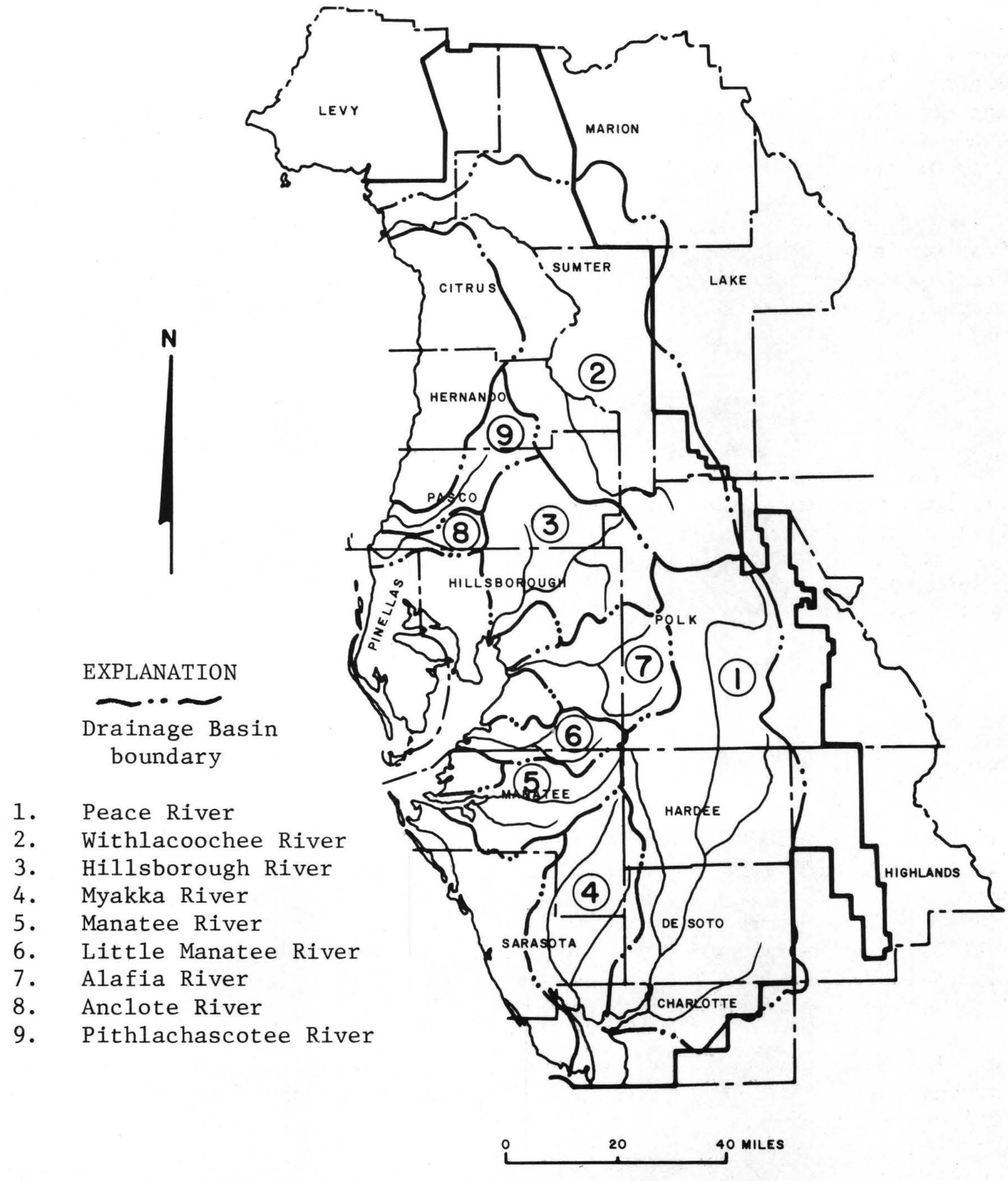


Figure 5.--Major drainage basins in southwest Florida.

the District and forms a drainage divide in Polk and Highlands Counties. Generally, runoff on the western slope of the ridge flows to the Peace River, whereas runoff on the eastern slope flows to streams outside the District. The drainage pattern is dendritic and is characterized by many small lakes, ponds, and marshlands. Stream density and runoff vary from low in the central highlands to high along the coast where discharge from numerous springs provide most of the streamflow.

Most major streams are sustained during periods of dry weather by discharge from springs or inflow from the surficial aquifer. The major streams are free flowing, except for occasional dams that form lakes or impoundments for water supply. Stream channels are generally shallow and fairly well defined.

Surficial Aquifer

The surficial aquifer (fig. 2) occurs throughout most of southwest Florida and consists predominantly of fine sand and clayey sand. Thickness of the sandy material generally ranges from zero to 50 feet, but is as much as 200 feet thick in the eastern part of southwest Florida. Depths to the water table from land surface range from zero to 50 feet. Water is withdrawn from the surficial aquifer in small volumes, primarily for domestic supply.

Upper Confining Beds and Minor Artesian Aquifers

Principal formations beneath the surficial aquifer and overlying the Floridan aquifer are the Hawthorn Formation and, in places, unconsolidated sections of the Tampa Limestone (fig. 2). These formations range from about 50 to 700 feet in thickness and consist of a heterogeneous mixture of limestone, dolomite, sand, and clay. Permeable zones within the carbonate rocks of these sections form minor confined aquifers that are capable of producing several hundred gallons of water per minute from individual wells. The relatively impermeable, interbedded clay deposits act as confining beds for these aquifers and for the Floridan aquifer.

The Hawthorn Formation is absent in areas north of an east-west line through central Pinellas, Hillsborough, and Polk Counties, and confining material overlying the Floridan aquifer is relatively thin or missing. This allows a greater interaction between the Floridan aquifer and the overlying surficial aquifer north of this generalized line. In areas south of the line, the Hawthorn Formation and unconsolidated sections of the Tampa Limestone are as thick as 700 feet and effectively inhibit vertical movement of water into or out of the Floridan aquifer.

Floridan Aquifer

The Floridan aquifer (fig. 2) is predominantly limestone and is the principal source of ground water in southwest Florida. The aquifer is defined as including all or parts of the Avon Park Limestone, Ocala Limestone, Suwannee Limestone, Tampa Limestone, and permeable parts of the Hawthorn Formation that are in hydraulic contact with the rest of the aquifer (Parker and others, 1955, p. 189). These units may be more than 1,000 feet thick.

The top of the Floridan aquifer ranges from land surface in the northern part of the District to as much as 500 feet below land surface in the southern part. Water in the aquifer occurs in faults, joints, solution cavities, and fractures. Zones of different permeability occur within the aquifer. The most productive zones are in the uppermost limestone (Hawthorn Formation and Tampa Limestone). Wells tapping the Floridan aquifer may yield as much as 5,000 gal/min.

Aquifer Recharge

The surficial aquifer is recharged by rainfall that infiltrates and percolates downward under the influence of gravity. Recharge to the Floridan aquifer occurs primarily by percolation. Recharge to minor artesian aquifers occurs from percolation and leakage through confining beds. However, recharge also occurs where sinkholes create direct connection between aquifers, where streams flow in contact with the aquifer, or where there is surface outcrop of the aquifer.

HYDROLOGIC CONDITIONS DURING THE 1979 WATER YEAR

Climatic Conditions

Rainfall was above normal, exceedance probability of 70 percent or greater, for most of the District during the 1979 water year (fig. 6). However, normal rainfall occurred in Sarasota and Manatee Counties and the western parts of Hernando and Pasco Counties. Figure 7 illustrates the median monthly and 1979 water-year monthly rainfall for selected basins within the District.

Rainfall during the "dry season," October through April, was near normal throughout the District (fig. 8); however, rainfall for December and January was above normal. Rainfall during the "wet season," May through September, was above normal for most of the District except for Manatee and Sarasota Counties, which had near normal rainfall (fig. 9). The District had excessive rainfall in May, August, and September with deficient amounts in June and July.

The most notable rainfall event of the year occurred on May 8, 1979. An upper air disturbance developed off the coast of Texas and moved slowly across the Gulf of Mexico bringing large amounts of moisture from the tropics. The system moved slowly inland along Florida's west coast on May 8th and temporarily stalled. Heavy rains fell over most of Florida as a result of this disturbance with extremely high intensity rains falling in Pinellas, southern Pasco, and northwestern Hillsborough Counties. More than 10 inches of rainfall occurred in some coastal areas in less than 12 hours. Relatively dry conditions prior to the storm resulted in minimal rural flooding, but numerous roads and homes were flooded in urban areas.

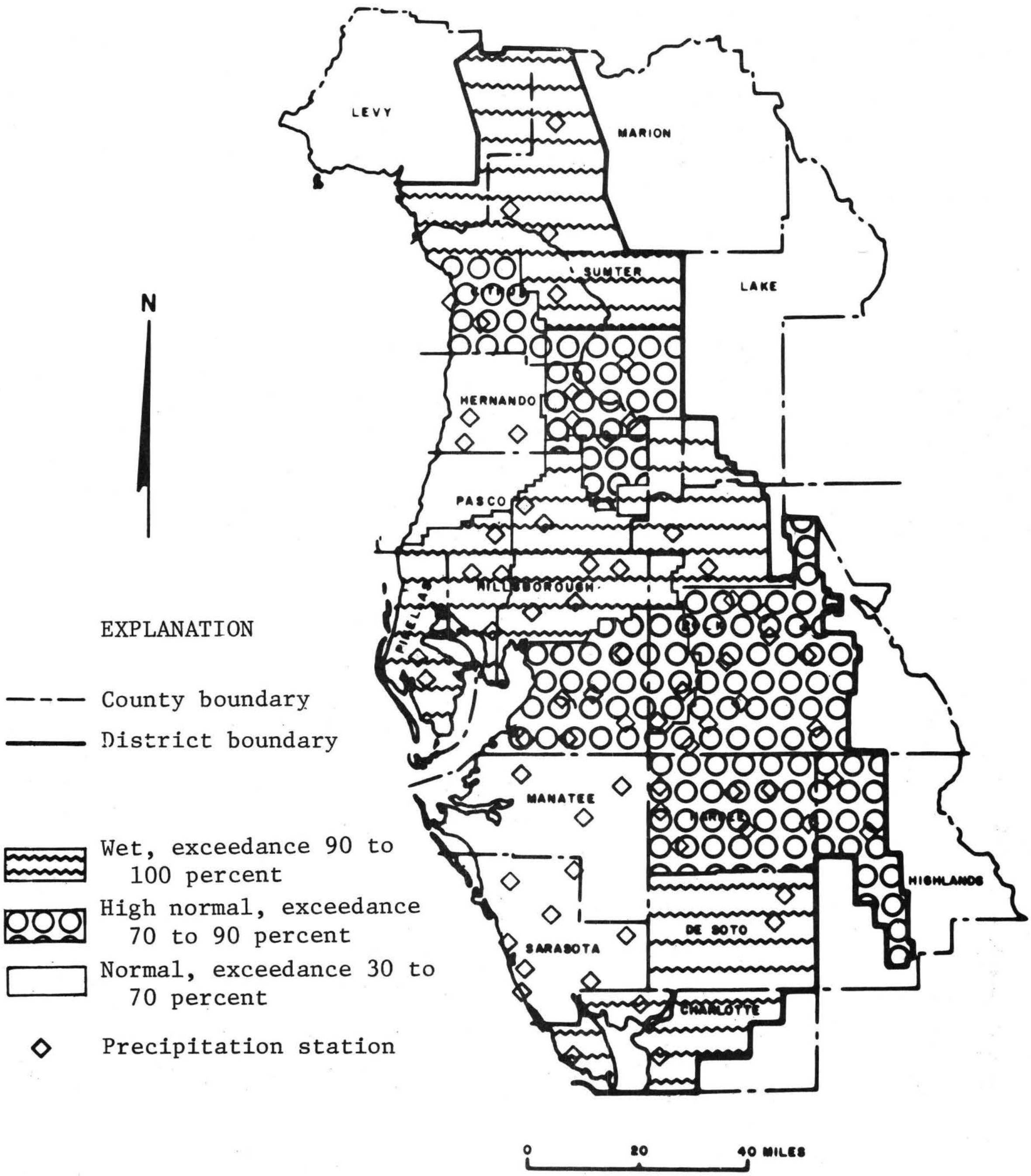


Figure 6.--Precipitation during the 1979 water year.

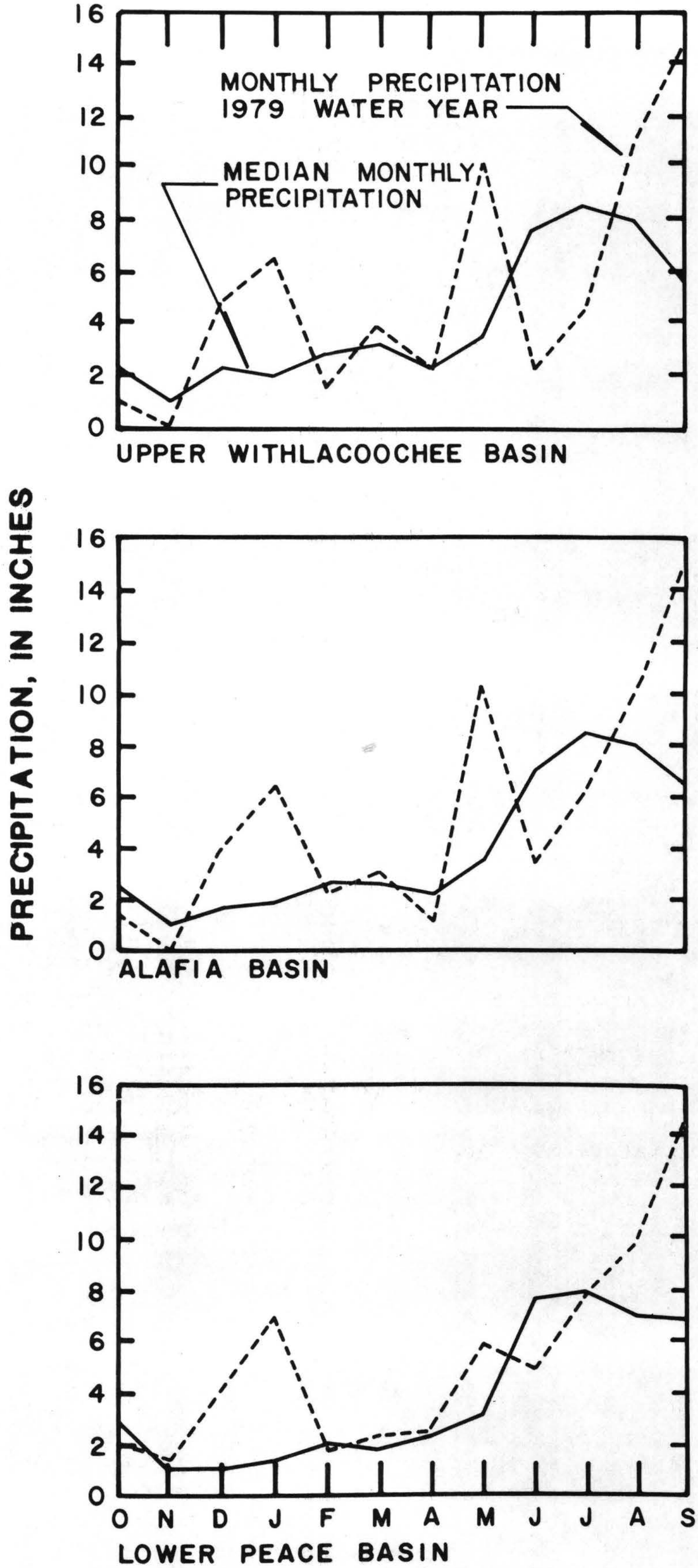


Figure 7.--Median monthly precipitation and monthly precipitation for the 1979 water year (from the Southwest Florida Water Management District).

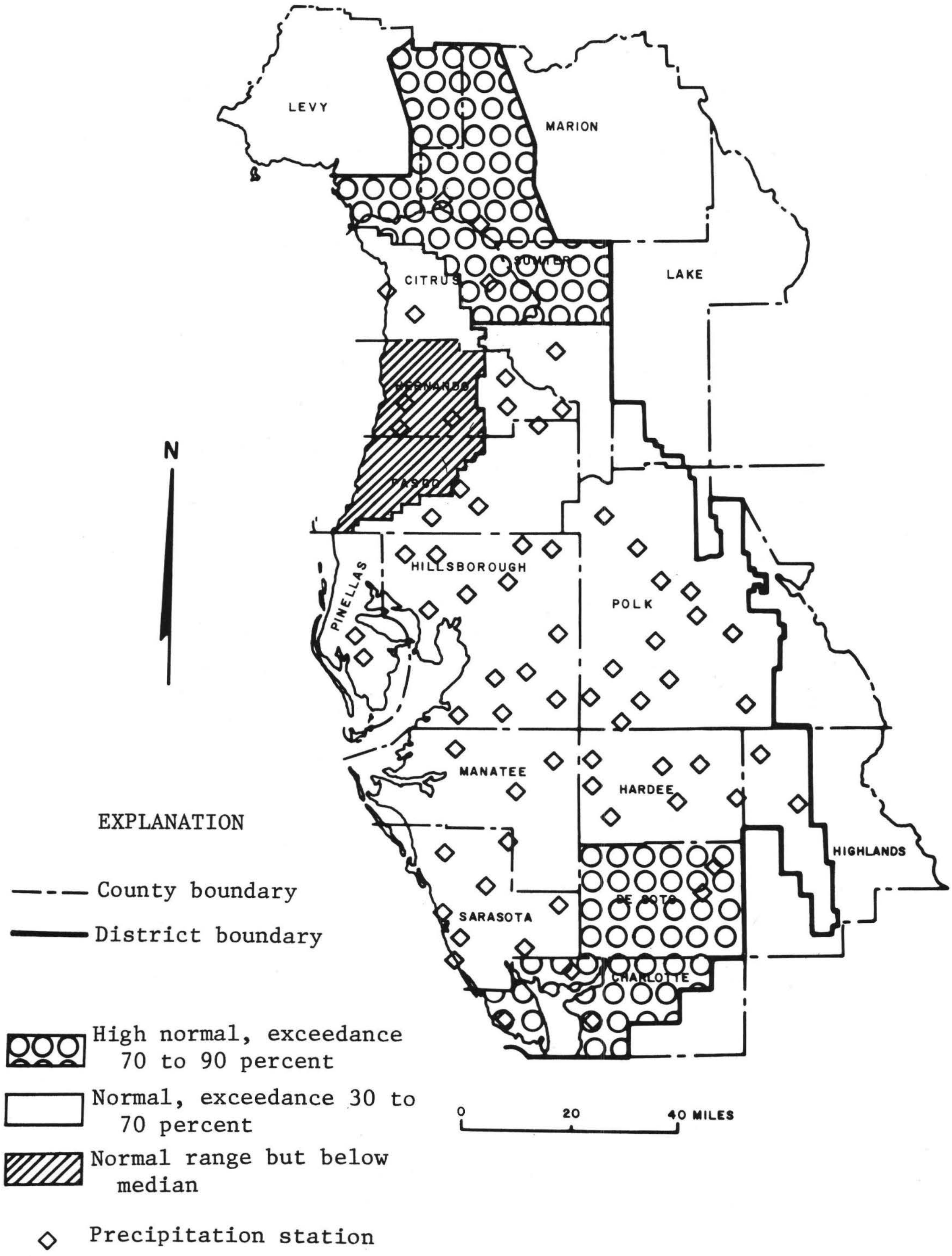


Figure 8.--Precipitation patterns during the dry season (October through April), 1978-79.

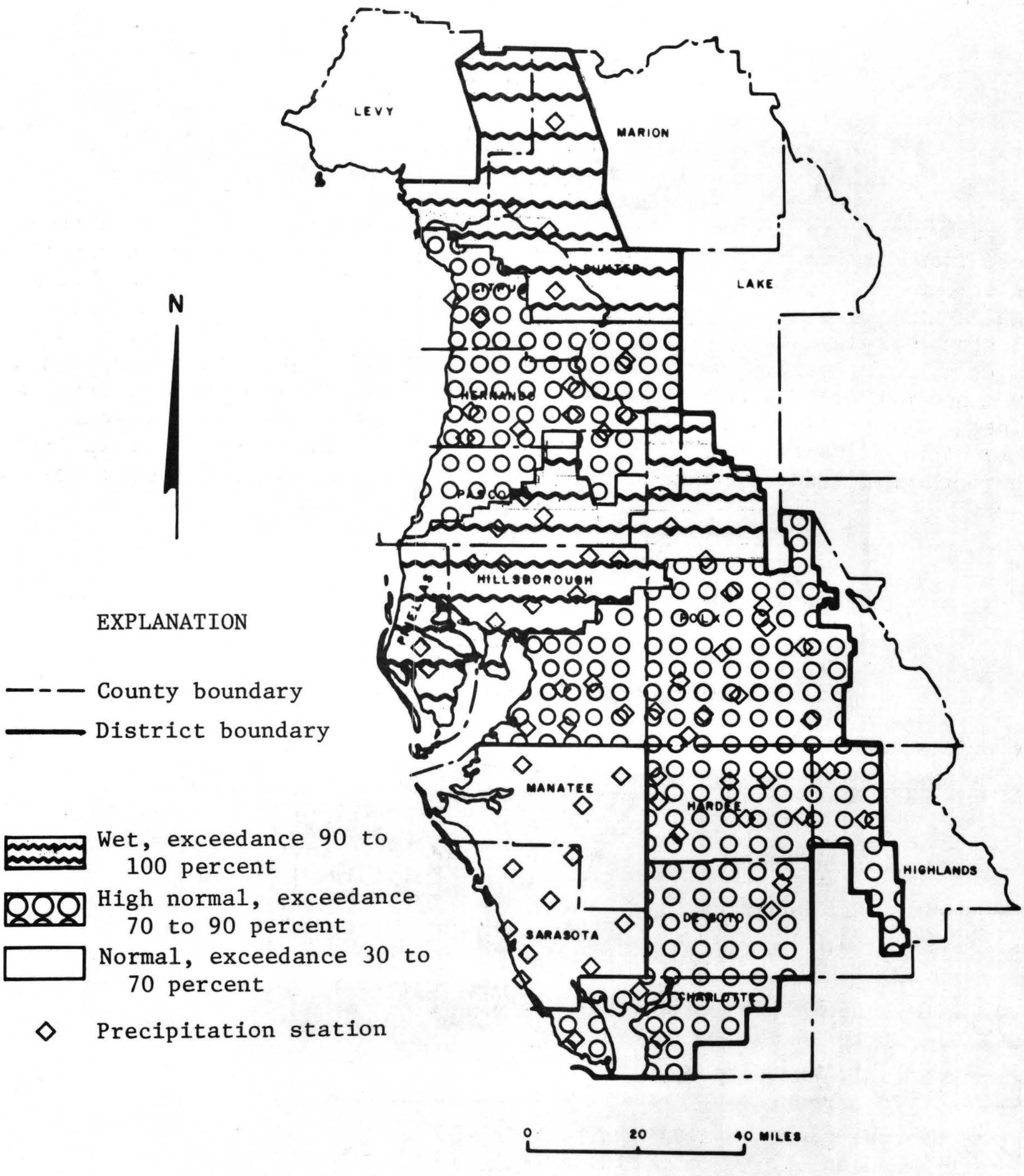


Figure 9.--Precipitation patterns during the wet season (May through September), 1979.

Based on records at Lakeland, monthly average temperatures were within a degree of the long-term averages except for November, December, and July, which ranged from 2 to 4°F above average (fig. 10).

Surface Water

Stream-Gaging Network

Streamflow data were obtained to provide information on flow characteristics, including drought and flood flows; to provide background information where streams are used for water supply or waste assimilation; and for bridge design, recreation, preservation of instream flow, and esthetics. A network of 63 stream-gaging stations was operated by the U.S. Geological Survey in the District during the 1979 water year (fig. 11). These stations were supplemented by a network of 40 stream sites where periodic stage and discharge data were obtained. Streamflow data are included in an annual report "Water Resources Data for Florida, Water Year 1979, Volume 3A: Southwest Florida." Data from the network were used to describe streamflow conditions as given in the following section.

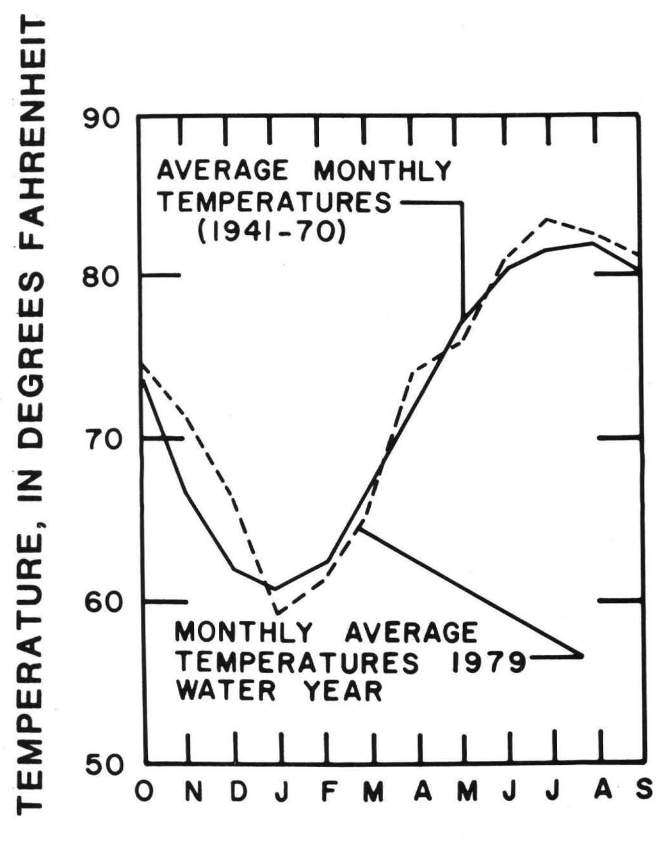
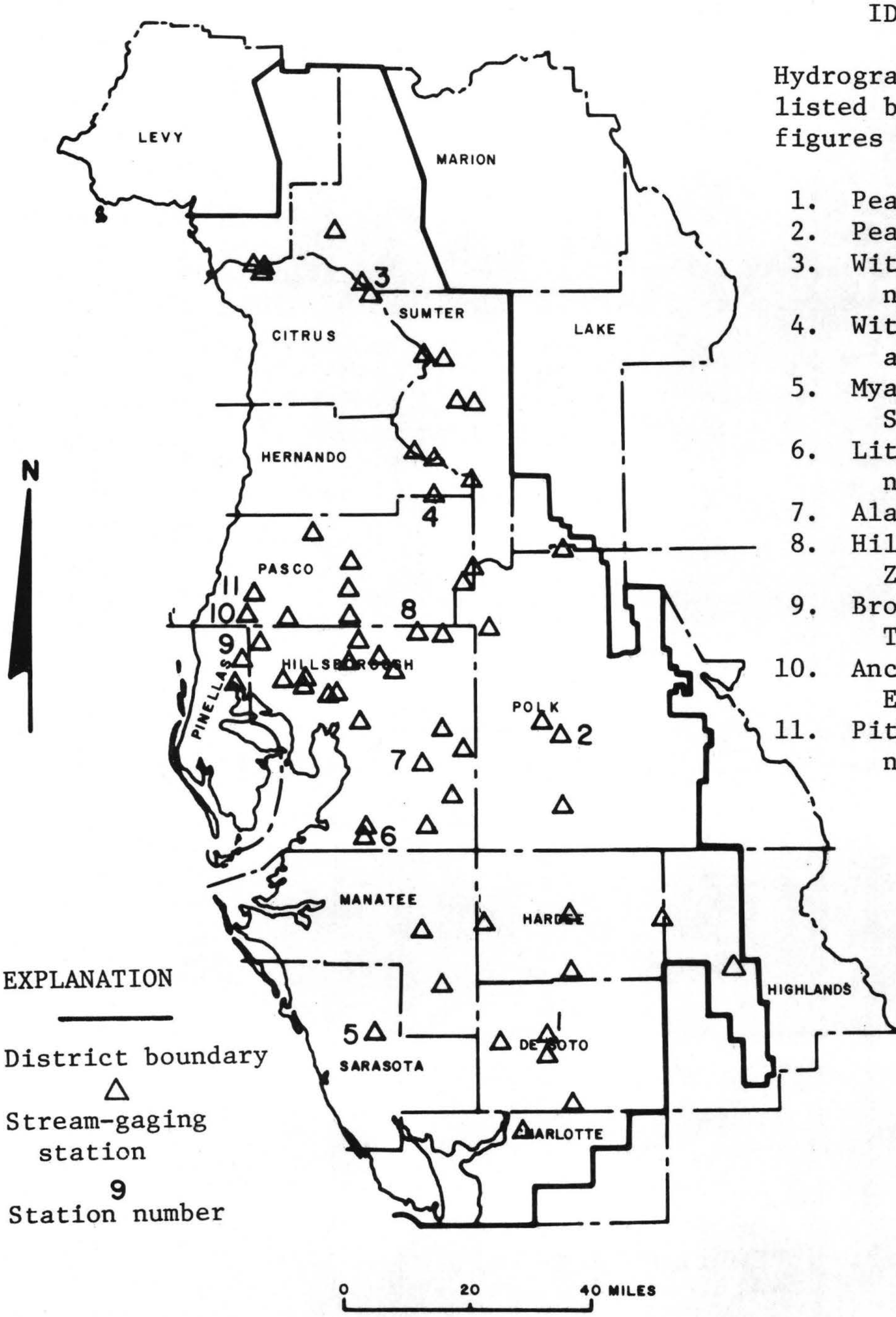


Figure 10.--Average monthly temperatures and monthly average temperatures for the 1979 water year for Lakeland.



IDENTIFICATION

Hydrographs for stations listed below are shown in figures 14-19.

1. Peace River at Arcadia
2. Peace River at Bartow
3. Withlacoochee River near Holder
4. Withlacoochee River at Trilby
5. Myakka River near Sarasota
6. Little Manatee River near Wimauma
7. Alafia River at Lithia
8. Hillsborough River near Zephyrhills
9. Brooker Creek near Tarpon Springs
10. Anclote River near Elfers
11. Pithlachascotee River near New Port Richey

Figure 11.--Locations of stream-gaging stations.

Streamflow Conditions

Streamflow in the southern part of the District varied considerably during the 1979 water year, as shown in figure 12 by the hydrographs of mean monthly and monthly mean discharge for 1979 water year at Peace River at Arcadia (site 1, fig. 11). Streamflow at the beginning of the water year was well below average, but increased abruptly in January and remained above average through March. Streamflow patterns reversed sharply in April when streamflow fell substantially below average. In May, streamflow rose well above average, but gradually receded in June and remained below average through August. In September, streamflow rose sharply and was significantly above average at the end of the year.

Streamflow in the central part of the District was very erratic during the year, as reflected by the hydrographs of monthly mean discharge (fig. 12) for Hillsborough River near Zephyrhills (site 8, fig. 11). Streamflow was substantially below average October to December, June, and July. Streamflow was close to average in January, February, and April. In March, May, August, and September, streamflow was well above average. The monthly mean discharge for September was the highest since September 1960.

Streamflow in the northern part of the District was below average for most of the year, as indicated by the hydrograph of monthly mean discharge (fig. 13) for Withlacoochee River near Holder (site 3, fig. 11). The two exceptions were March and April when streamflow was near average and May and June when it was above average. Flow of springs in the northern portion of the District for the year is illustrated by the hydrograph of monthly mean discharge for Silver Springs near Ocala (fig. 13). Discharge of Silver Springs was below average for the entire year. The Silver Springs station is located outside the District, but is representative of springs in the northern part of the District.

Figures 14 to 19 are hydrographs of monthly mean discharge for selected stations in the District. The hydrographs illustrate annual and long-term variability of streamflow. The stations were selected for areal coverage and on the basis of river size and importance. Locations of the stations are shown in figure 11.

Peace River basin

Streamflow conditions in the Peace River basin during 1960-79 are illustrated (fig. 14) by hydrographs of monthly mean discharge for gaging stations at Arcadia and Bartow (sites 1 and 2, fig. 11). Average discharge of the Peace River at Arcadia for 1979 was 910 ft^3/s, 78 percent of the long-term average of 1,164 ft^3/s (1931-79) and 172 ft^3/s less than experienced in 1978. Average discharge of the Peace River at Bartow was 244 ft^3/s for 1979, 96 percent of the long-term average of 254 ft^3/s (1940-79). Average streamflow at Bartow was 56 ft^3/s more than that experienced in 1978. Streamflow was extremely low at the beginning of the year but increased to well above average at the end of the year.

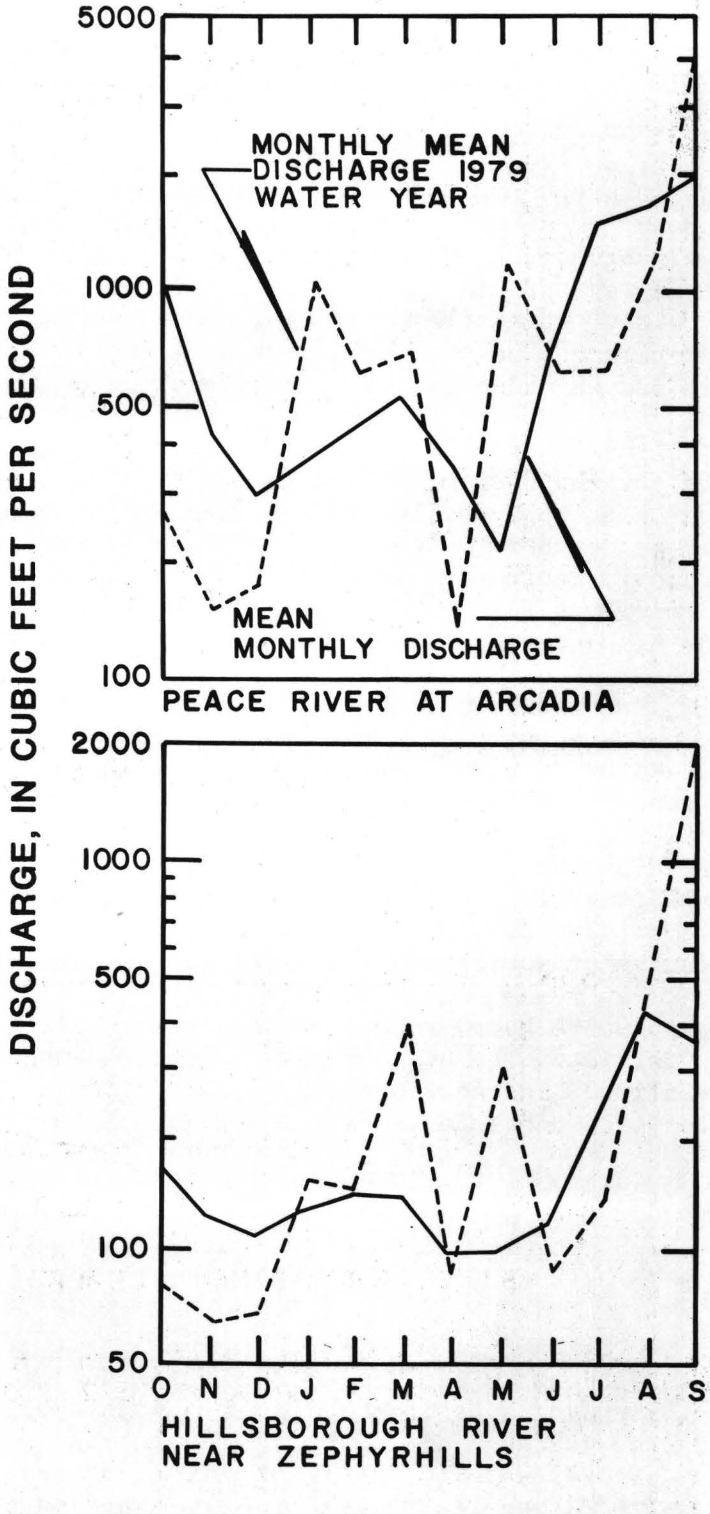


Figure 12.--Mean monthly discharge and monthly mean discharge for 1979 water year at Peace River at Arcadia and Hillsborough River near Zephyrhills.

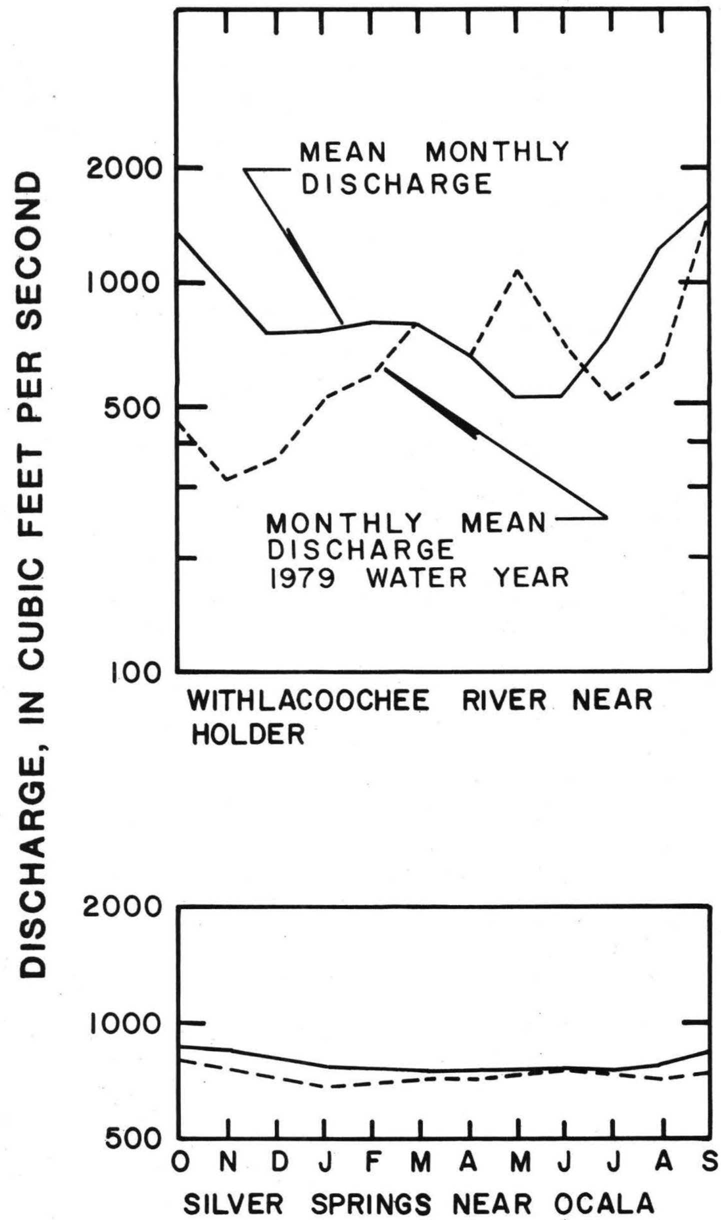


Figure 13.--Mean monthly discharge and monthly mean discharge for 1979 water year at Withlacoochee River near Holder and Silver Springs near Ocala.

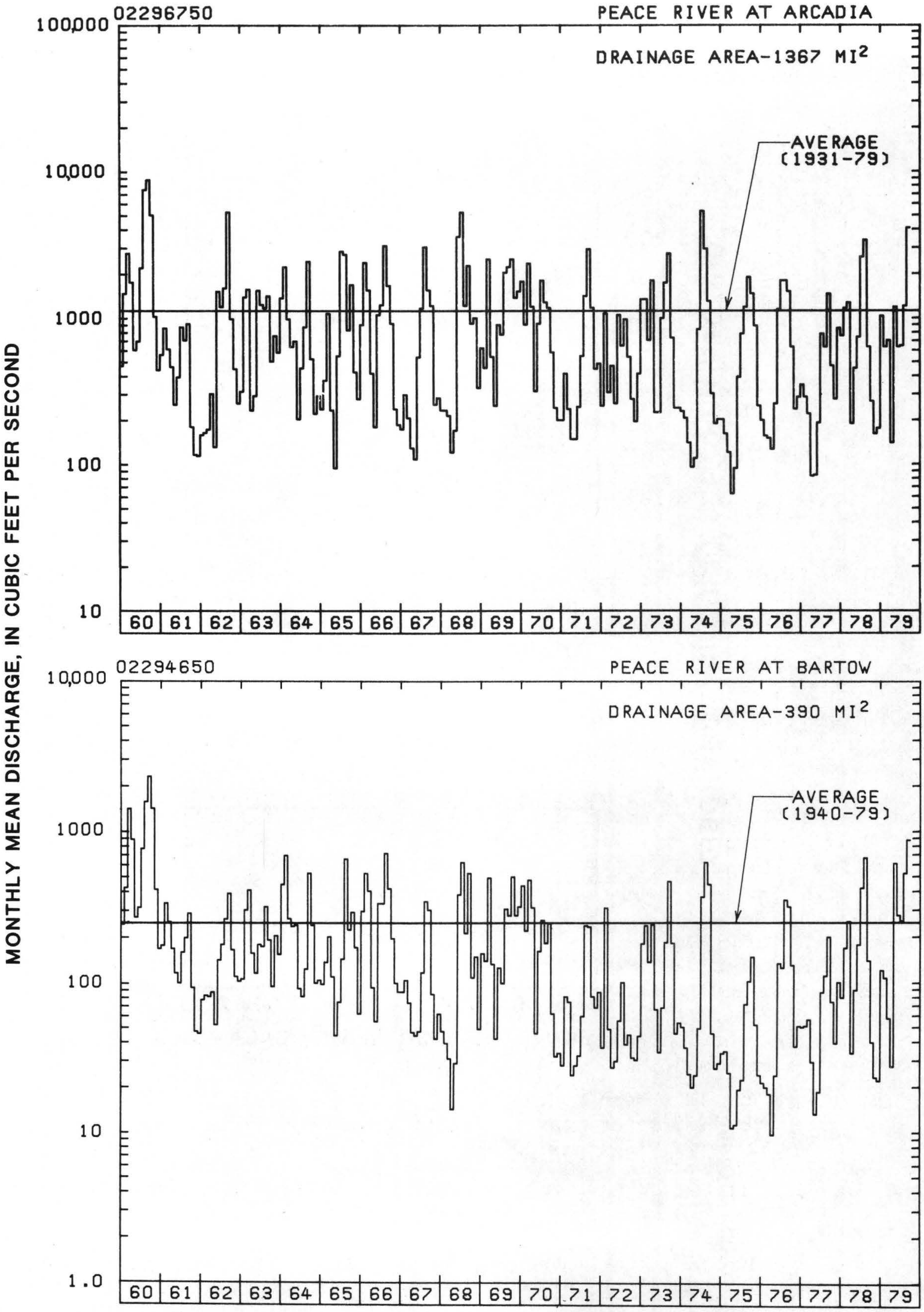


Figure 14.--Discharge hydrographs for Peace River at Arcadia and Bartow.

Withlacoochee River basin

Streamflow conditions in the Withlacoochee River basin are illustrated in figure 15 by hydrographs for gaging stations near Holder and at Trilby (sites 3 and 4, fig. 11). Average discharge for Holder during 1979 was 681 ft^3/s, 62 percent of the long-term average of 1,095 ft^3/s (1932-79). Average discharge at Trilby during 1979 was 307 ft^3/s, 85 percent of the long-term average of 362 ft^3/s (1931-79), and was slightly higher than that of 1978. During September, heavy rains caused higher than average streamflow at both Holder and Trilby. Otherwise, streamflow followed the normal seasonal patterns throughout 1979. High flows at Trilby are affected by diversions to the Hillsborough River, and low flows are affected by wastewater from ground-water supplies.

Coastal and central areas

Streamflow conditions in the coastal and central areas of the District during 1960-79 are illustrated by hydrographs in figures 16-19 for Myakka River near Sarasota, Little Manatee River near Wimauma, Alafia River at Lithia, Hillsborough River near Zephyrhills, Brooker Creek near Tarpon Springs, Anclote River near Elfers, and Pithlachascotee River near New Port Richey (sites 5, 6, 7, 8, 9, 10, and 11, fig. 11). The average discharge for the Myakka River for 1979 was 204 ft^3/s and, for the Little Manatee River, was 164 ft^3/s (fig. 16). Both streams were below their long-term and 1978 water year averages. Below average discharges are attributed to sustained low flows in the fall and the months of June and July.

Discharge of the Myakka River ranges widely between wet and dry seasons, reflecting little sustained flow from ground water. The Little Manatee River has fairly uniform flow that is affected slightly by diversions by the Manatee Power Plant located 3.3 miles upstream of the station.

Average discharge of the Alafia River during 1979 was 472 ft^3/s, 129 percent of the long-term average of 367 ft^3/s (1932-79), and nearly twice the average discharge for 1978 (fig. 17). Similarly, average discharge for the Hillsborough River during 1979 was 325 ft^3/s, or 123 percent of long-term average of 265 ft^3/s (1939-79) and was much higher than that of 1978 (fig. 17). Both streams have relatively high base flow, reflecting ground-water inflow during dry periods and contributions from springs. High flows during May, August, and September resulted in higher than average flow for the year for both streams.

The Brooker Creek basin is north of Tampa Bay; much of the area is swamps or lakes. Streamflow is highly variable (fig. 18). Average discharge during 1979 was 23.6 ft^3/s, or about 107 percent of the long-term average of 22.0 ft^3/s (1950-79), and was about twice as much as that for 1978.

Average discharge for the Anclote River near Elfers during 1979 was 91.6 ft^3/s, or about 123 percent of the long-term average of 74.3 ft^3/s (1946-79), and was about twice as much as in 1978 (fig. 18). As elsewhere in the central part of the District, above average rains in May, August, and September resulted in higher monthly flows. The Anclote River drains an area that is primarily wooded flatlands and pasture.

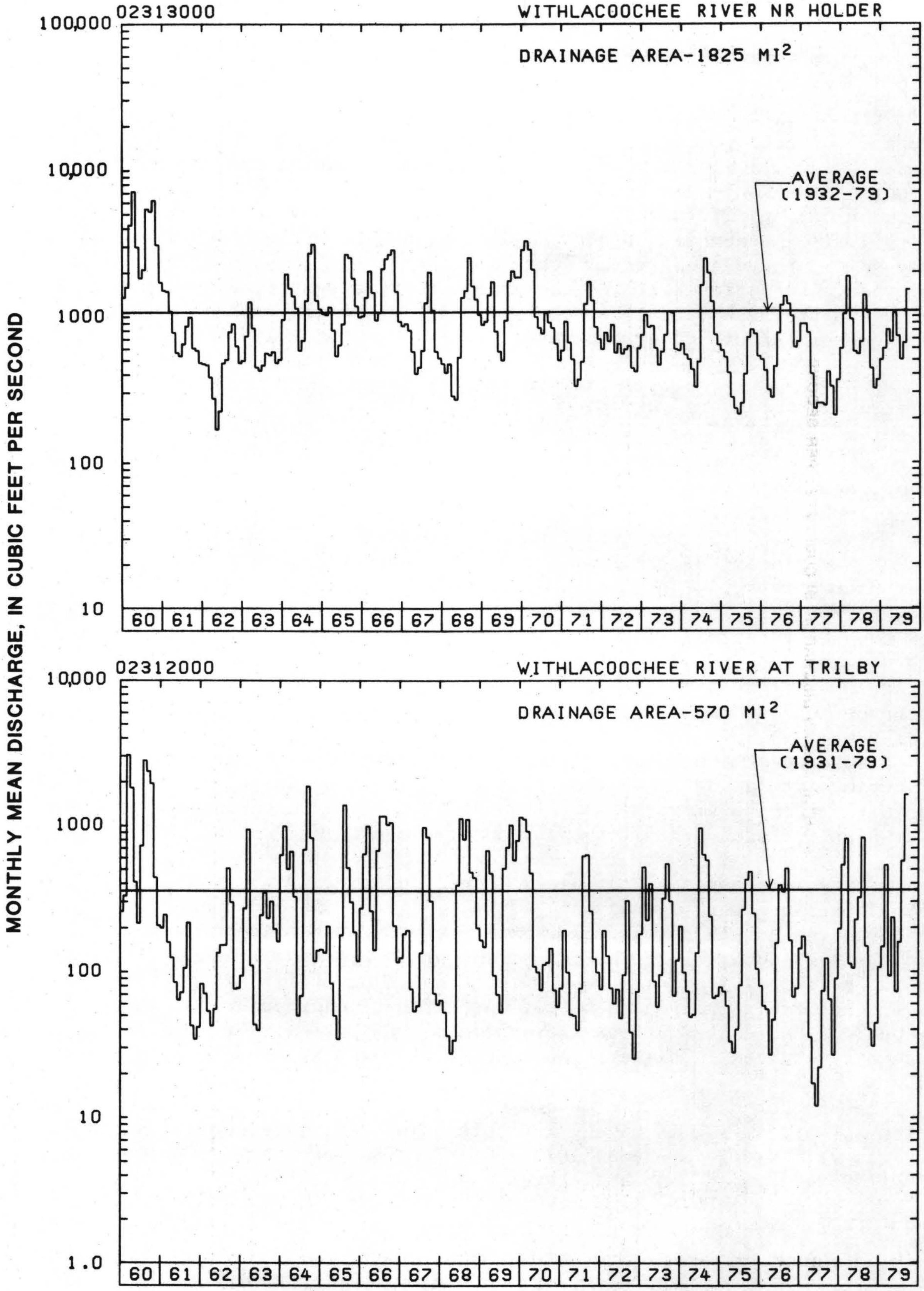


Figure 15.--Discharge hydrographs for Withlacoochee River near Holder and at Trilby.

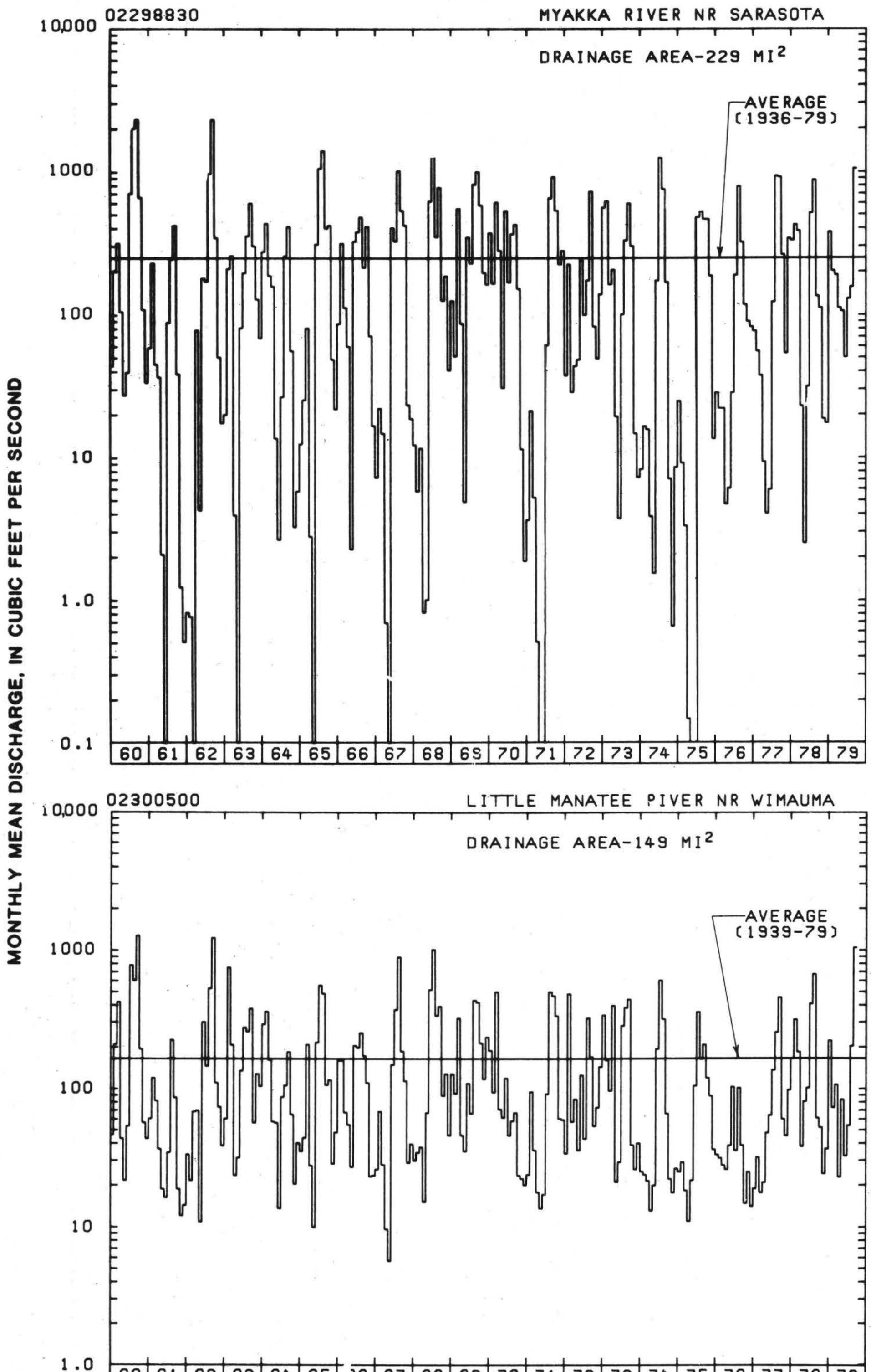


Figure 16.--Discharge hydrographs for Myakka River near Sarasota and Little Manatee River near Wimauma.

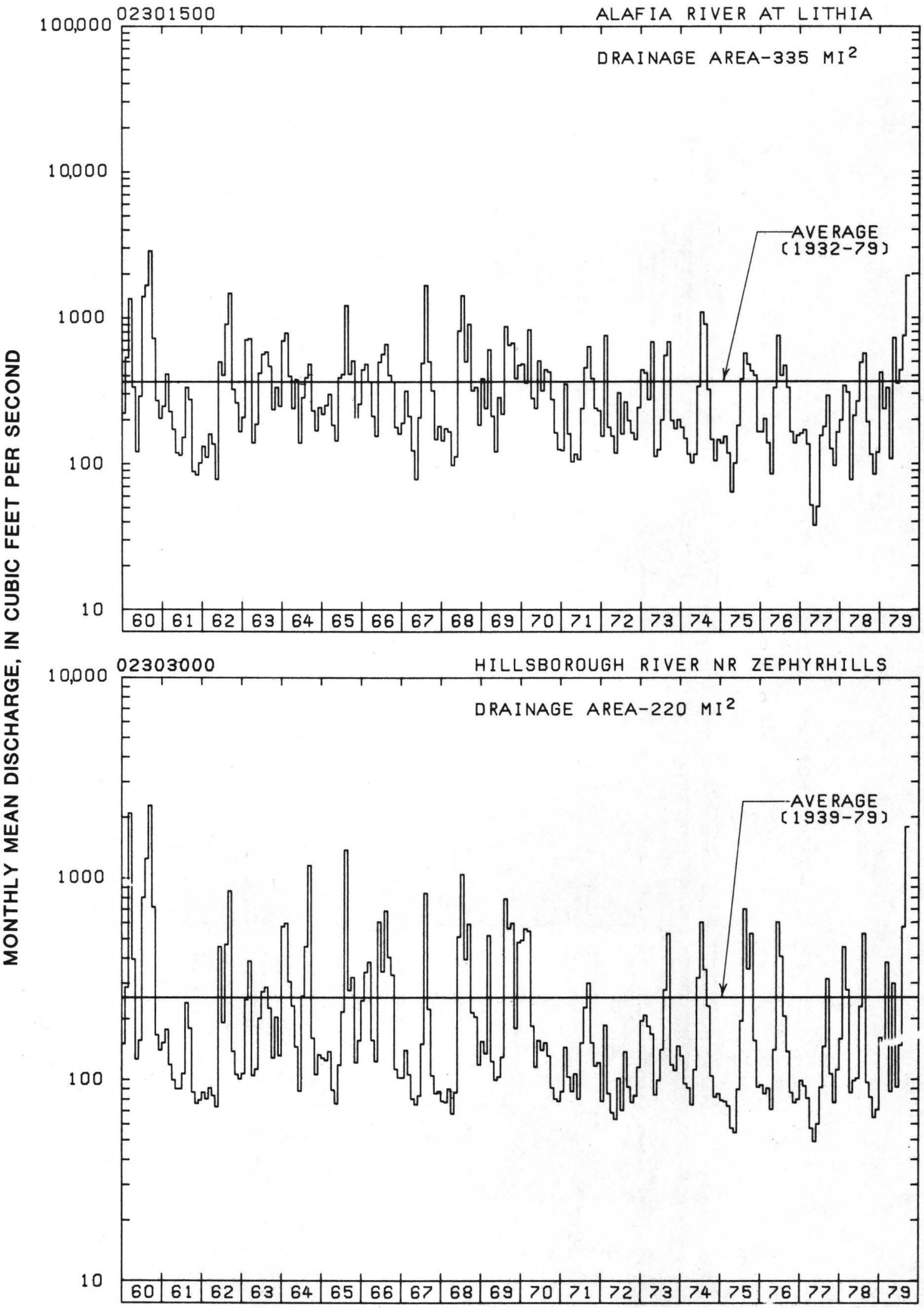


Figure 17.--Discharge hydrographs for Alafia River at Lithia and Hillsborough River near Zephyrhills.

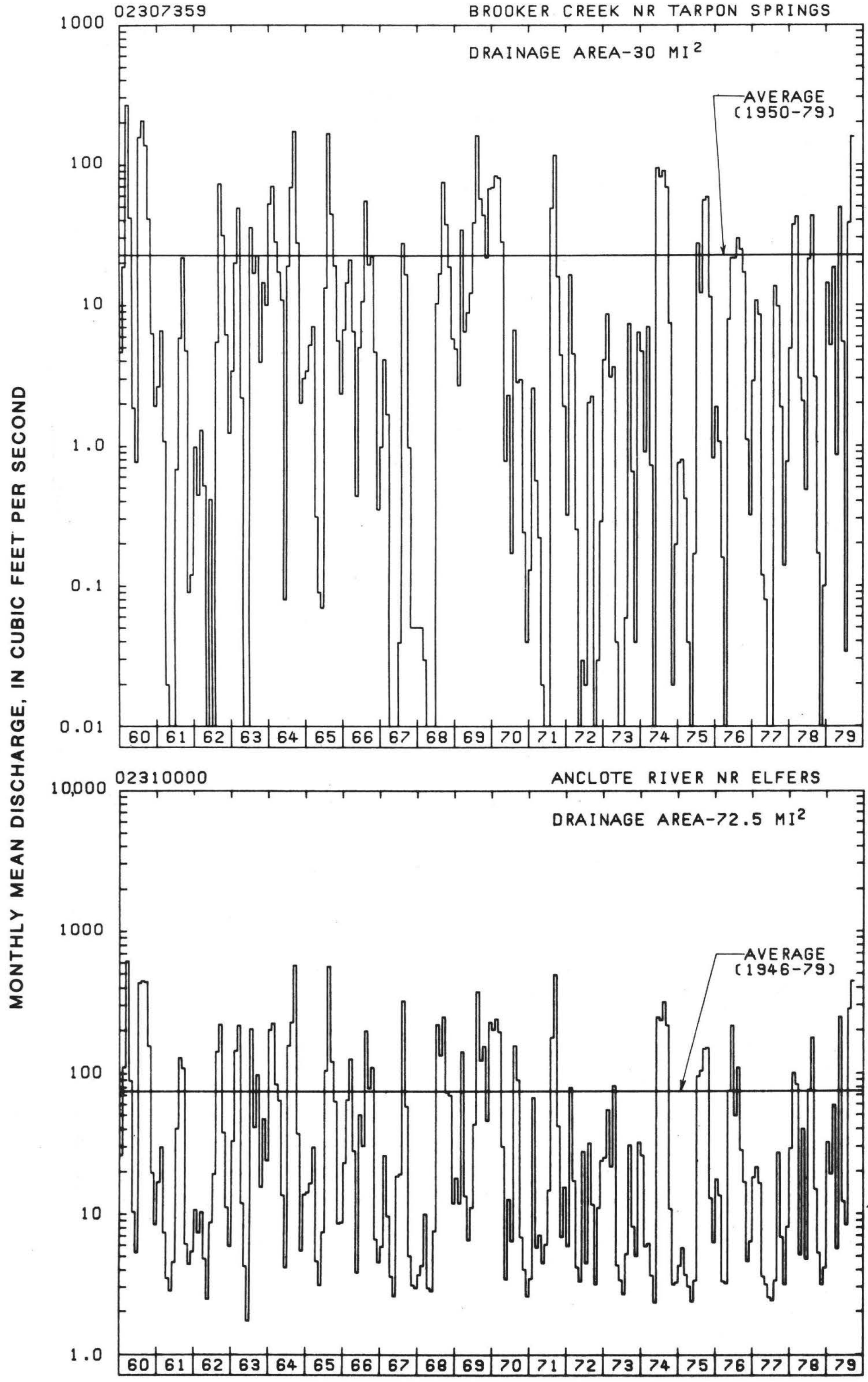


Figure 18.--Discharge hydrographs for Brooker Creek near Tarpon Springs and Anclote River near Elfers.

The Pithlachascotee River drains an area of swamps in the coastal plains and typifies flow characteristics of a coastal stream. A hydrograph of monthly mean discharges for the station located near New Port Richey is shown in figure 19. Average discharge for the station near New Port Richey for 1979 was 39.5 ft^3/s, or about 127 percent of the long-term average of 31.2 ft^3/s (1963-79), and was nearly twice that for 1978. The high annual flow for 1979 is attributed to higher than average discharge during May, August, and September. The mean discharge for May 1979 was higher than any previous May in the period of record.

Many coastal streams in the northern part of the District are sustained by springs or spring clusters. Principal springs are Weeki Wachee and Chassahowitzka in western Hernando County and Homosassa Spring and the Crystal River spring complex in Citrus County. Discharge from the springs varies little from year-to-year or during any year. The range of measured discharge for Weeki Wachee during 1979, for example, was between 148 and 182 ft^3/s. The range during 1978 was between 143 and 195 ft^3/s. Discharges during the year may have been higher or lower than that reflected by the measurements, but the range is indicative of the uniformity of flow. The maximum measured discharge of Weeki Wachee for the period of record is 275 ft^3/s, the minimum is 101 ft^3/s, and the average of 397 measurements made during this period is 175 ft^3/s.

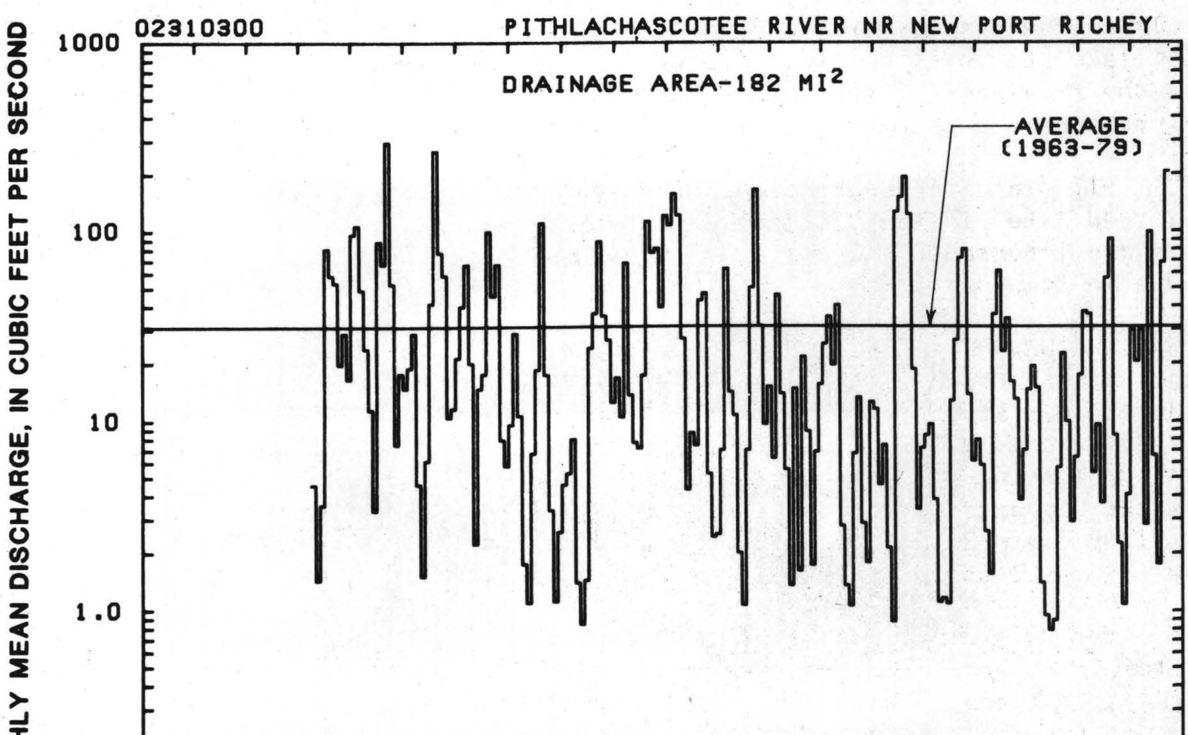


Figure 19.--Discharge hydrograph for Pithlachascotee River near New Port Richey.

Lake-Gage Network

A network of 110 lake stations was operated by the U.S. Geological Survey in the District during the 1979 water year (fig. 20). Lake-stage data are needed to help local agencies manage lakes where stage schedules have been established; to define fluctuations in stage in response to climatic and hydrologic factors; to define fluctuations as affected by regulation of inflow and outflow and by withdrawals and diversions; and to define relationships between lakes and aquifers. Lake-stage data are published in the report "Water Resources Data for Florida, Water Year 1979, Volume 3A: Southwest Florida."

Lake stages

Stages of inland lakes in the northern part of the District were generally below average early in the water year, near average during January and February, and above average for the remainder of the water year. The stage hydrograph (fig. 21) for Lake Harris at Leesburg (site 10, fig. 20) illustrates the typical pattern. Although the lake is outside of the District, it is representative of lakes in the northern part of the District.

In the southern part of the District, lake stages were also below average early in the water year. By January, stages rose to average or above average. Most lake stages in the southern part of the District remained above average for the remainder of the year. Lake Howard at Winter Haven (site 1, fig. 20) illustrates the general pattern of lake-stage change (fig. 21).

Following are descriptions of annual and long-term variations in stages of selected lakes in the District. Lakes were selected on the basis of relative size and importance and for areal coverage. Locations of lakes described are shown in figure 20.

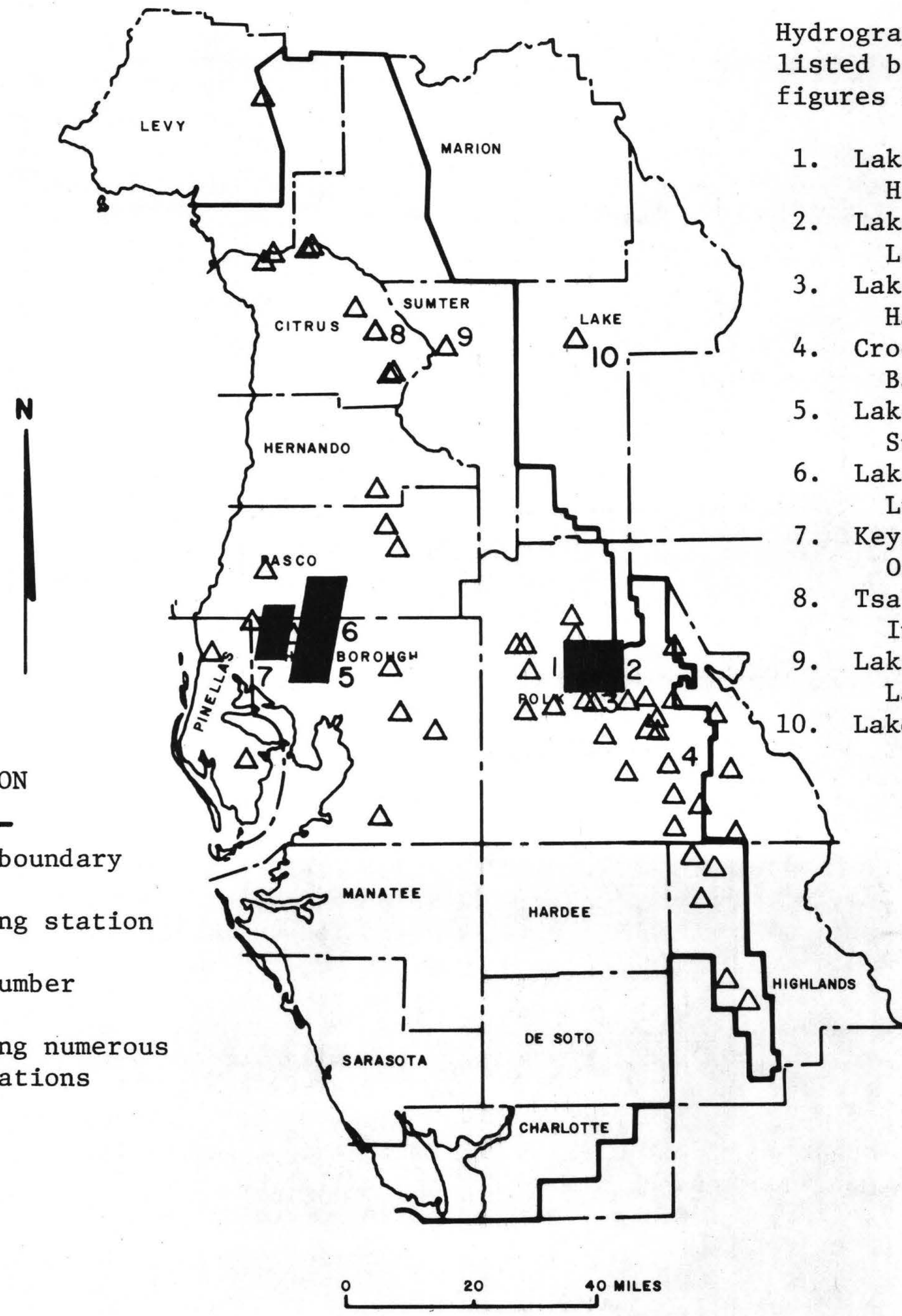
Lake Howard and Lake Hamilton.--Lake Howard (site 1, fig. 20) is in the Winter Haven Chain of Lakes and its stage is controlled to some extent by a concrete dam at the outlet of Lake Lulu, a downstream lake in the chain. Lake stages during 1979 were near average until the end of the water year when September rains occurred almost daily. The month-end stage for September 1979 was the highest for that month since 1953 (fig. 22). The stage for Lake Hamilton (site 2, fig. 20) is regulated by control structure P-8. Stages for the lake were above average for the entire year (fig. 22).

Lake Otis and Crooked Lake.--The stages of Lake Otis (site 3, fig. 20) at Winter Haven were near average for most of 1979 (fig. 23). However, in mid-August, lake stage began increasing and continued to the end of the water year. The month-end stage for September was approximately 3.5 feet higher than the 1978 September month-end stage. Stages of Crooked Lake near Babson Park (site 4, fig. 20) were below average for the entire year (fig. 23). This is the second year in a row that a record minimum stage was not reached, possibly indicating some stability after a 16-year period of gradual recession.

IDENTIFICATION

Hydrographs for stations listed below are shown in figures 21-26.

1. Lake Howard at Winter Haven
2. Lake Hamilton near Lake Hamilton
3. Lake Otis at Winter Haven
4. Crooked Lake near Babson Park
5. Lake Carroll near Sulphur Springs
6. Lake Magdalene near Lutz
7. Keystone Lake near Odessa
8. Tsala-Apopka Lake at Inverness
9. Lake Panasoffkee near Lake Panasoffkee
10. Lake Harris at Leesburg



EXPLANATION

District boundary

△ Lake-gaging station

3 Station number

Area having numerous lake stations

Figure 20.--Locations of lake stations.

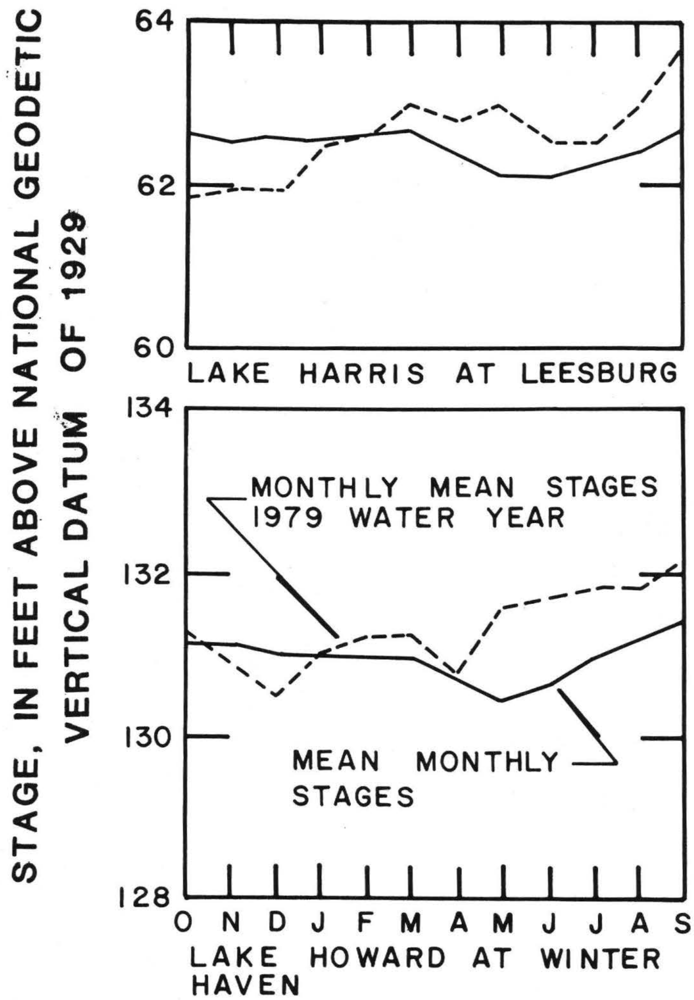


Figure 21.--Mean monthly stage and monthly mean stage for 1979 water year at Lake Harris and Lake Howard.

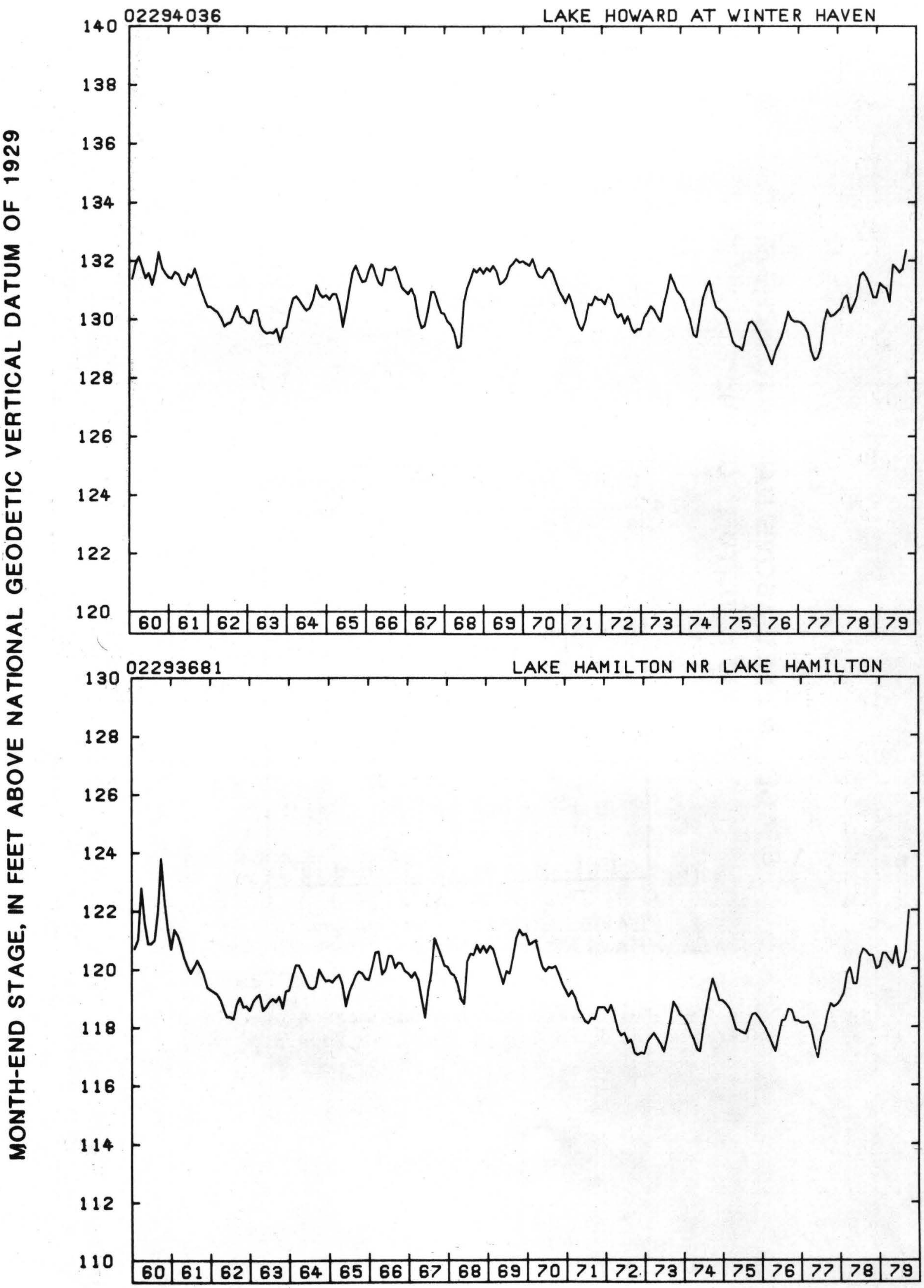


Figure 22.--Stage hydrographs for Lake Howard at Winter Haven and Lake Hamilton near Lake Hamilton.

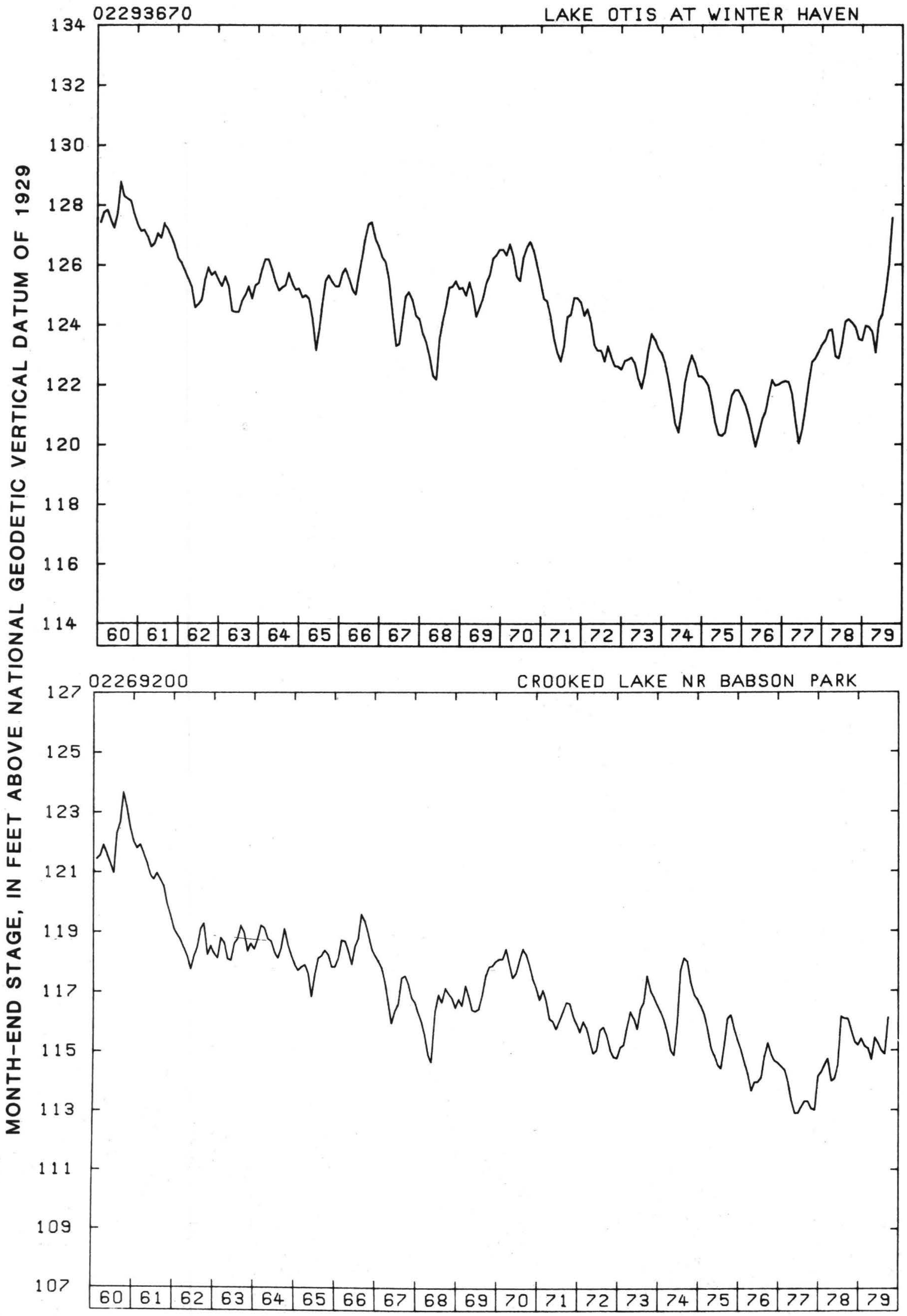


Figure 23.--Stage hydrographs for Lake Otis at Winter Haven and Crooked Lake near Babson Park.

Lake Carroll and Lake Magdalene.--The stages of Lake Carroll near Sulphur Springs and Lake Magdalene near Lutz (sites 5 and 6, fig. 20) began the year slightly below average and remained fairly stable through early May (fig. 24). Heavy rains on May 8th caused the lake stages to rise approximately 1.5 feet in a 24-hour period. The stages remained high for the remainder of the year and were 2 to 3 feet higher than average end-of-year stages. The maximum stages the lakes reached in September were the highest observed since March 1960. Stages for Lake Carroll and Lake Magdalene are partially regulated by control structures on their outlets.

Keystone Lake.--The stages of Keystone Lake near Odessa (site 7, fig. 20) were near average from the beginning of the year until late summer (fig. 25). Afternoon thunderstorms that began in mid-August continued through the water year. Keystone Lake rose approximately 2.5 feet during this period. The end-of-year stages for 1979 ranked among the highest 10 percent of long-term end-of-year stages. Keystone Lake is in the headwaters of Brooker Creek and its outflow is regulated by a control structure.

Tsala Apopka Lake and Lake Panasoffkee.--Tsala Apopka Lake is a large, discontinuous series of shallow interconnected lakes, ponds, and marshes alongside the Withlacoochee River in the northern part of the District. The open water of Tsala Apopka Lake occurs in three separate pools or lake areas. They are the Floral City Pool (highest), the Inverness Pool (middle, reported here), and the Hernando Pool (lowest). Inflow and outflow from the pools are regulated by control structures. Stages of the lakes system (fig. 26), as reflected in the Inverness record (site 8, fig. 20), were near average and fluctuated very little through August of the 1979 water year. Heavy rains in September caused the lake stage to rise 1.5 feet and to be above average at the end of the year. The stages of Lake Panasoffkee (site 9, fig. 20) were slightly below average throughout the year (fig. 26). Stages of Lake Panasoffkee are affected at times by backwater from the Withlacoochee River.

Ground Water

Ground-Water Monitoring Network

A network of 216 continuous and 251 periodic ground-water observation wells was operated by the U.S. Geological Survey in the District during the 1979 water year (fig. 27). Data from this network were supplemented by a network of approximately 800 observation wells where water-level data were obtained two times per year to define the water table and the potentiometric surface of the Floridan aquifer. Data from the networks provide information necessary for determining the effects of ground-water withdrawals for municipal, industrial, and agricultural supplies on water levels; to define the availability of water for municipal, industrial, and agricultural supply; to define the interrelationship between surface-water and ground-water resources and the effects of pumpage on surface-water bodies; to define the fluctuations in ground-water levels due to climatic and hydrologic factors; and to assure that the resource is being protected and used in a reasonable and beneficial manner. Data on ground-water levels are included in the report "Water Resources Data for Florida, Water Year 1979, Volume 3B: Southwest Florida."

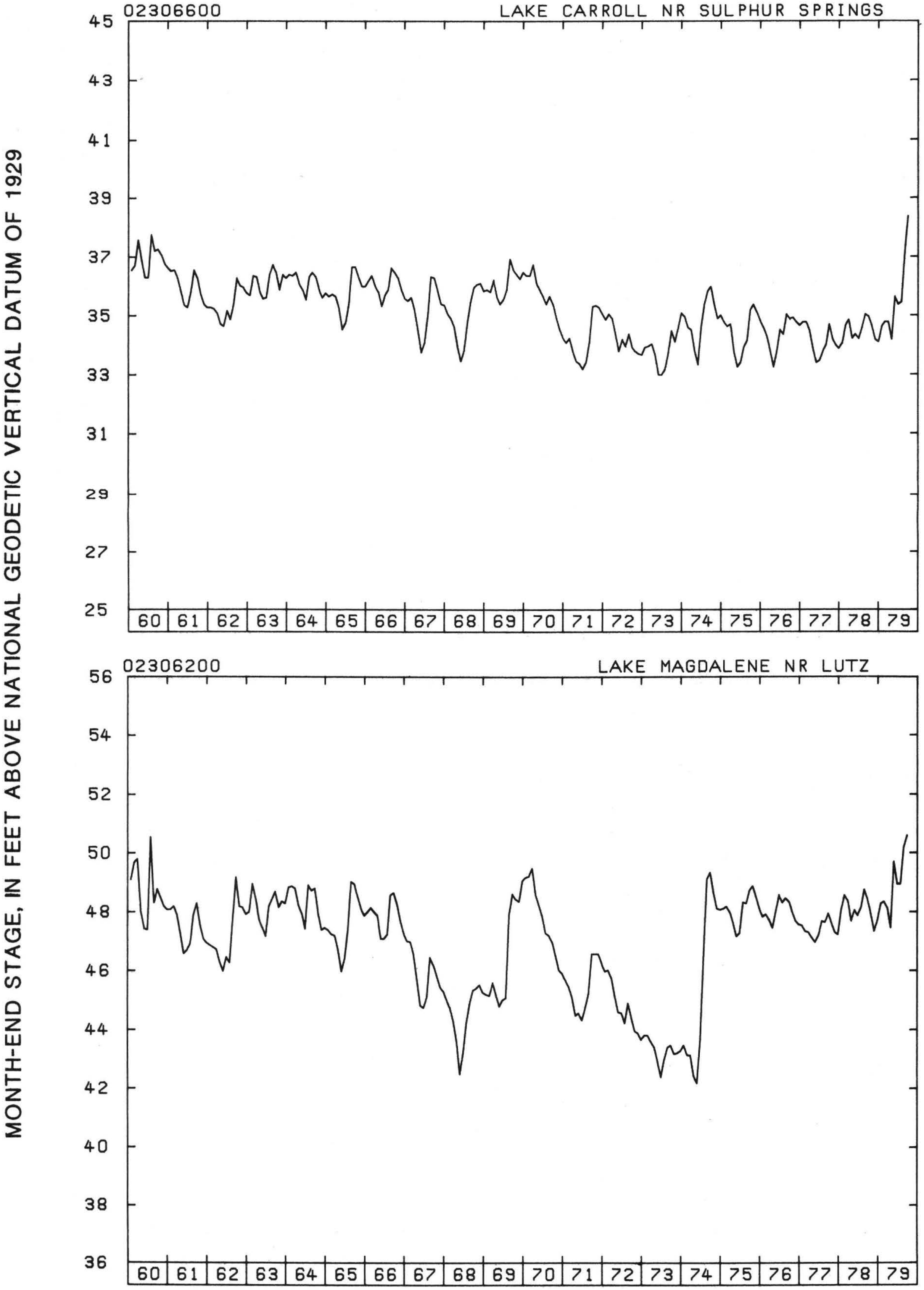


Figure 24.--Stage hydrographs for Lake Carroll near Sulphur Springs and Lake Magdalene near Lutz.

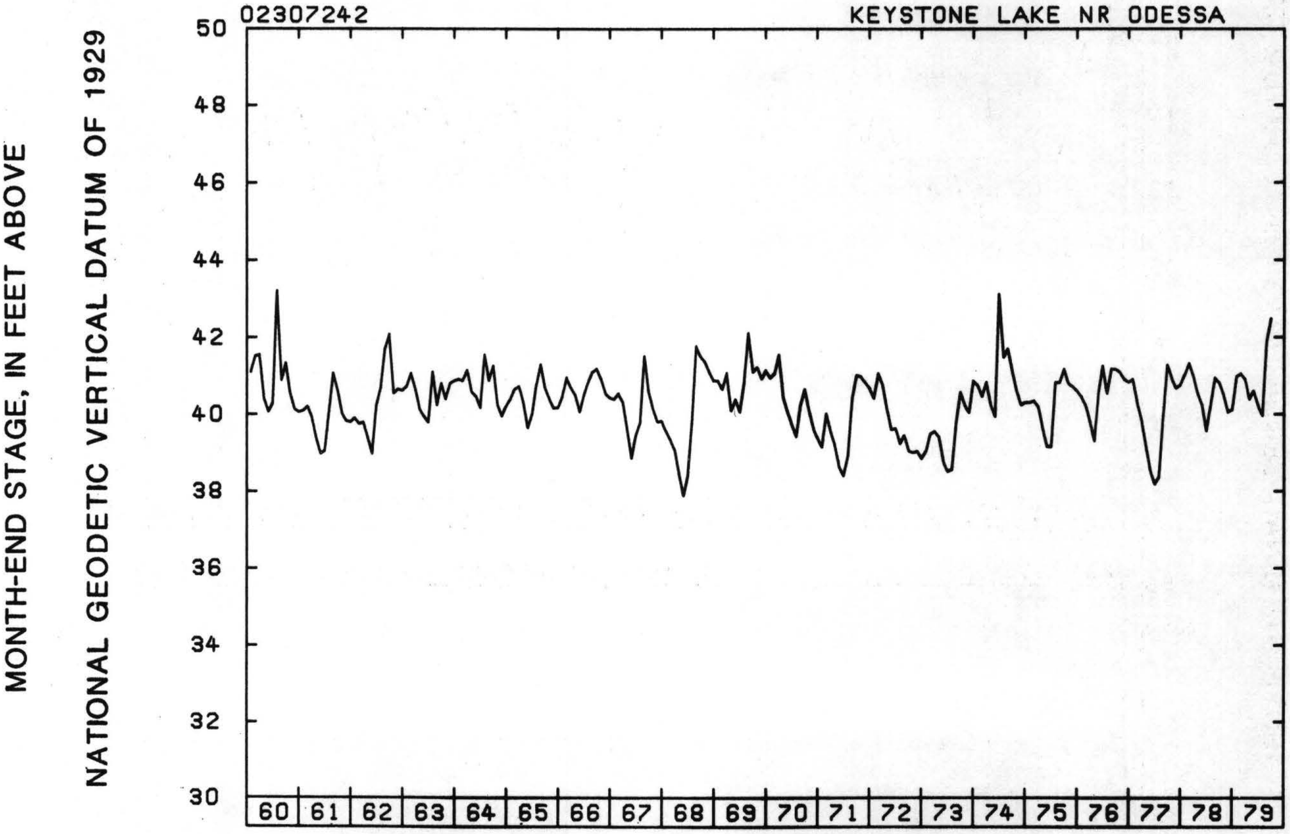


Figure 25.--Stage hydrograph for Keystone Lake near Odessa.

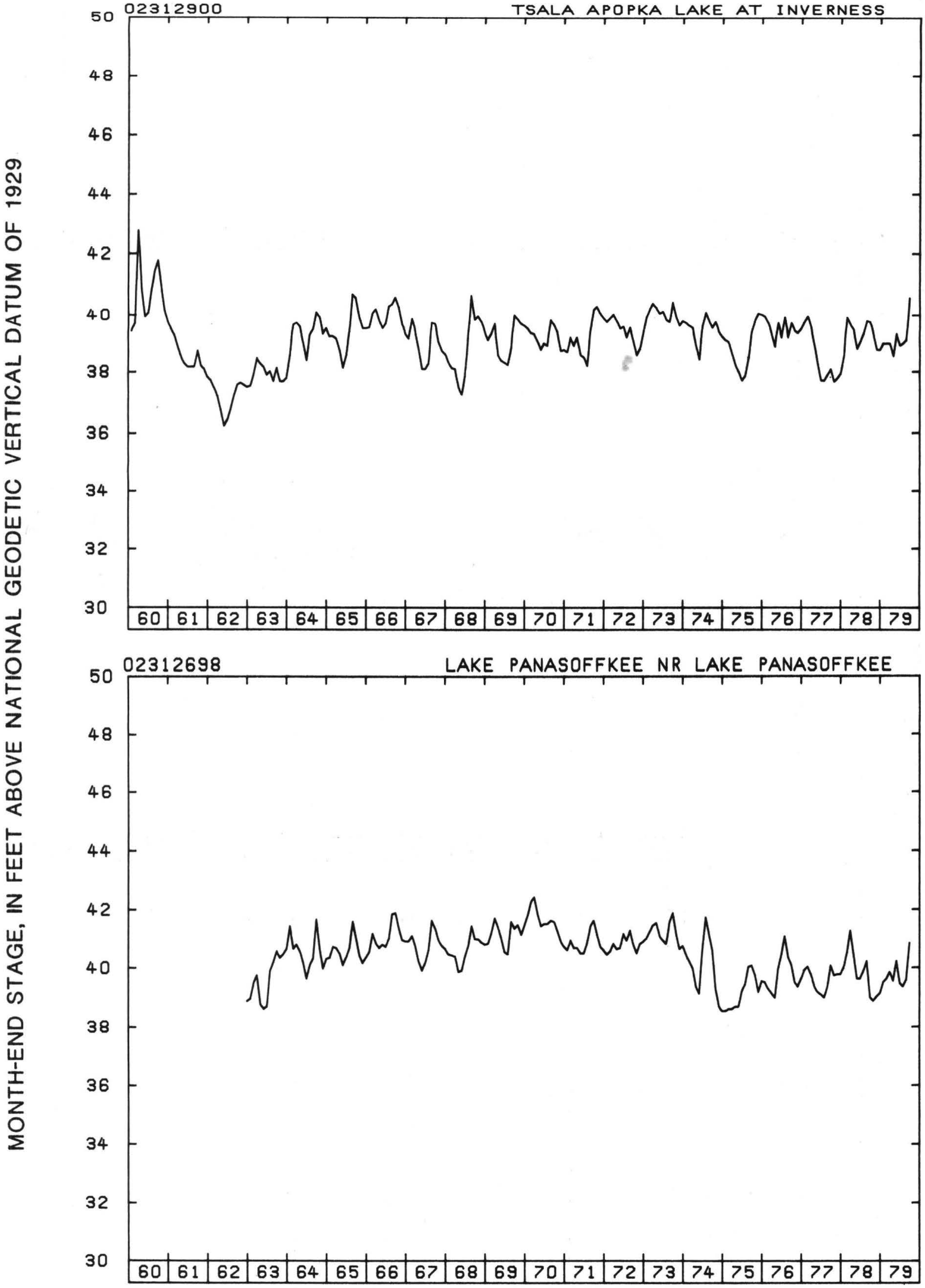


Figure 26.--Stage hydrographs for Tsala Apopka Lake at Inverness and Lake Panasoffkee near Lake Panasoffkee.

IDENTIFICATION

Hydrographs for sites listed below are shown in figures 29-33.

1. Mulberry deep well at Mulberry
2. Maddox well near Bowling Green
3. Hollingsworth deep well at Pine Level
4. Sarasota well 9 near Sarasota
5. Verna deep well 1A near Verna
6. Council deep well near Ruskin
7. Tampa deep well 15 near Dover
8. Hillsborough deep well 13 near Citrus Park
9. Pasco well 13 near Drexel
10. Cypress Creek deep well 3 near Ehren
11. Eldridge-Wilde deep well near Tarpon Springs
12. Pinellas well 665 near Clearwater
13. Weeki Wachee well near Weeki Wachee
14. North Lecanto deep well near Lecanto

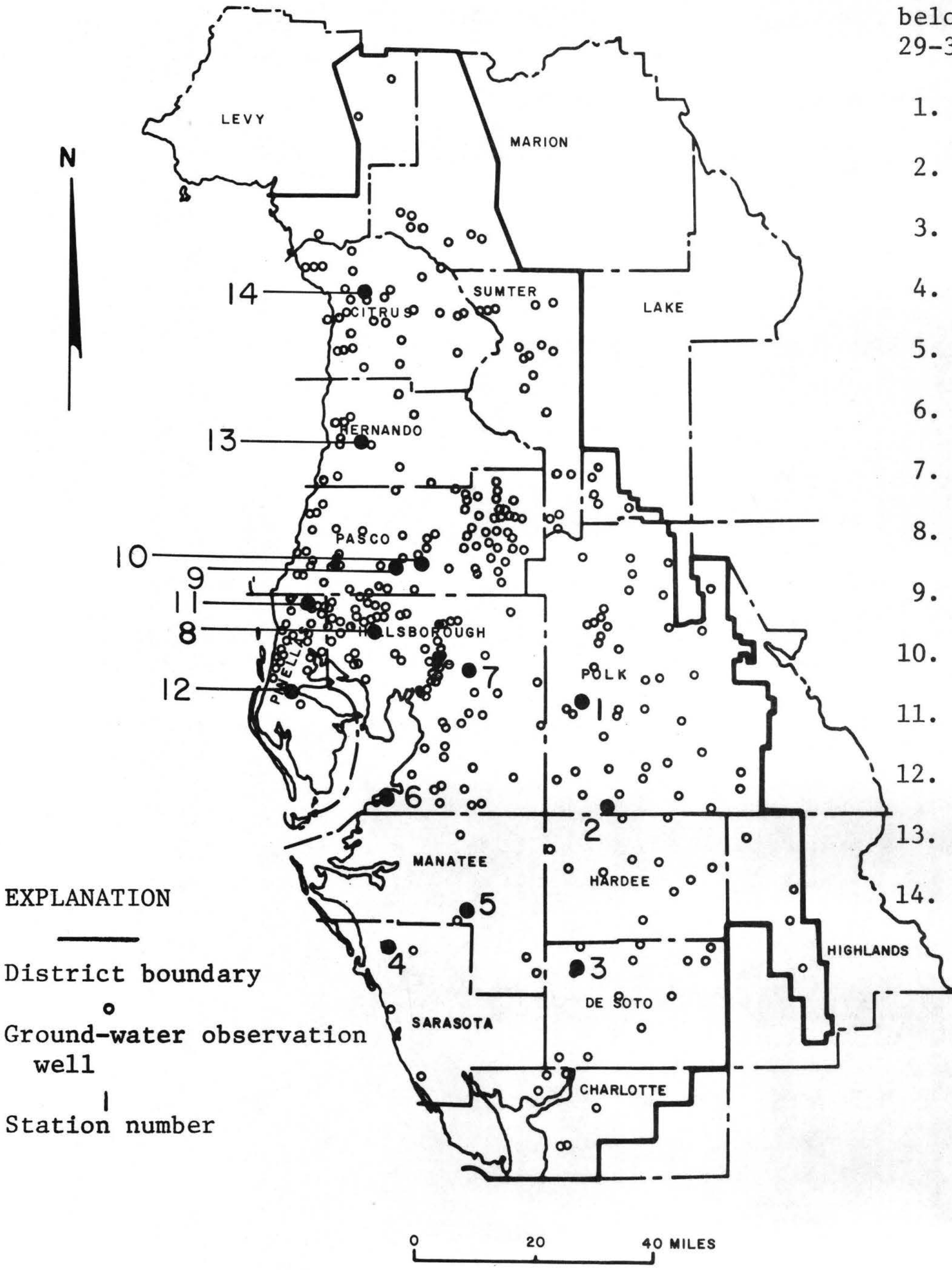


Figure 27.--Locations of observation wells.

Ground-water levels

Water levels in most observation wells open to the Floridan aquifer were below average throughout much of the water year (fig. 28). Levels recovered in May and were near average by month end. Levels in the central part of the District were steadily rising at the end of the year. Year-end levels for this part of the District were slightly above average. Levels in most observation wells in the northern portion of the District were slightly below average for the entire year.

Hydrographs illustrating annual and long-term fluctuations of ground-water levels (figs. 29-33) have been prepared for selected observation wells in the District (fig. 27). All wells selected are open to the Floridan aquifer. The selection was made primarily on the basis of areal coverage.

Mulberry, Maddox, and Hollingsworth Wells.--Changes in water levels of the Floridan aquifer in the Peace River basin are illustrated by hydrographs in figures 29 and 30 for the Mulberry deep well at Mulberry (site 1, fig. 27), Maddox well near Bowling Green (site 2, fig. 27), and Hollingsworth deep well at Pine Level (site 3, fig. 27). Water levels in the Mulberry and Maddox wells continued to rise from the low levels of 1975 and were slightly higher than those of 1978. Water levels at the end of the 1979 water year for these two wells were about 3.5 feet higher than those at the end of 1978. Water levels in both wells are affected by pumpage for industrial and irrigation supplies. Their levels may fluctuate from 15 to 25 feet annually, reflecting, in part, the effects of pumping. The well at Mulberry has experienced a long-term range in levels of about 61 feet; the Maddox well has a range of 52 feet. Water levels of the Hollingsworth deep well for 1979 were the highest since 1974. Water levels in the well probably reflect changes in rainfall. The land area in the vicinity of the Hollingsworth deep well is used primarily for agricultural purposes. Pumpage is reduced when sufficient rainfall occurs. The long-term range for this well is only about 19 feet and the annual range is about 12 feet.

Sarasota and Verna Wells.--Water levels in Sarasota well 9 near Sarasota (site 4, fig. 27) and Verna deep well 1A near Verna (site 5, fig. 27) showed continued recovery from the record low levels of 1975 (fig. 30). Water levels in both wells are affected by seasonal pumping of nearby irrigation wells. These effects are reflected in most years by the 15- to 20-foot seasonal range in levels. Seasonal ranges in water levels have increased in recent years, reflecting greater withdrawals for irrigation.

Council, Tampa 15, and Hillsborough 13 Wells.--Changes in ground-water levels in Hillsborough County are illustrated in figure 31 by water-level hydrographs for Council deep well near Ruskin, Tampa deep well 15 near Dover, and Hillsborough deep well 13 near Citrus Park (sites 6, 7, and 8, fig. 27). Year-end water levels for the 1979 water year in each well were higher than those of 1978 and continue to reflect recovery from the record low levels of previous years. Water levels in Council and Tampa 15 wells are affected by pumpage of nearby wells for irrigation. Levels in the Hillsborough 13 well are affected by pumpage of nearby wells for public supply.

Pasco 13 and Cypress Creek 3 Wells.--Changes in ground-water levels in Pasco County are illustrated by hydrographs (fig. 32) for Pasco well 13 near

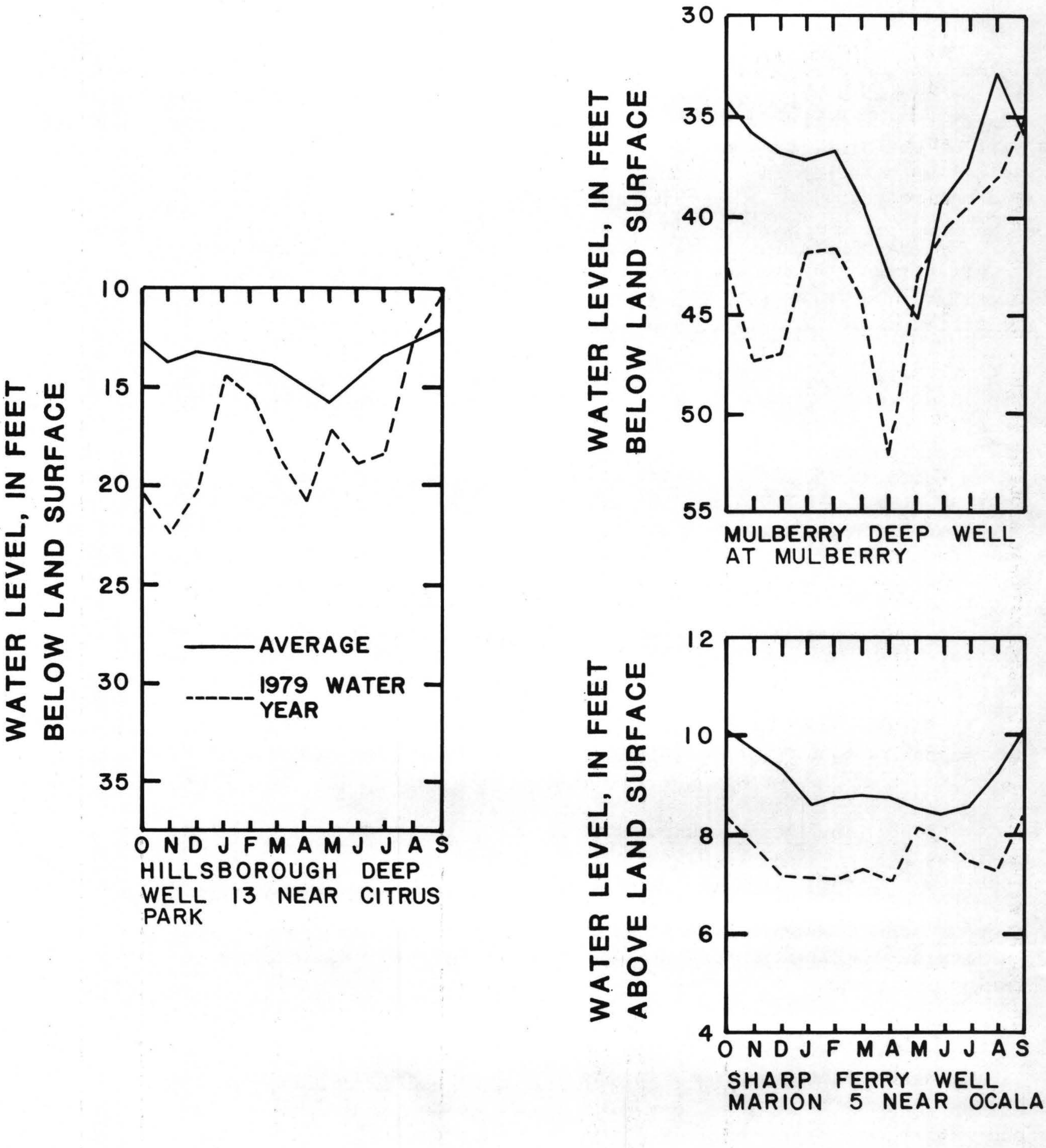


Figure 28.--Month-end average water levels and month-end levels for 1979 water year at selected wells.

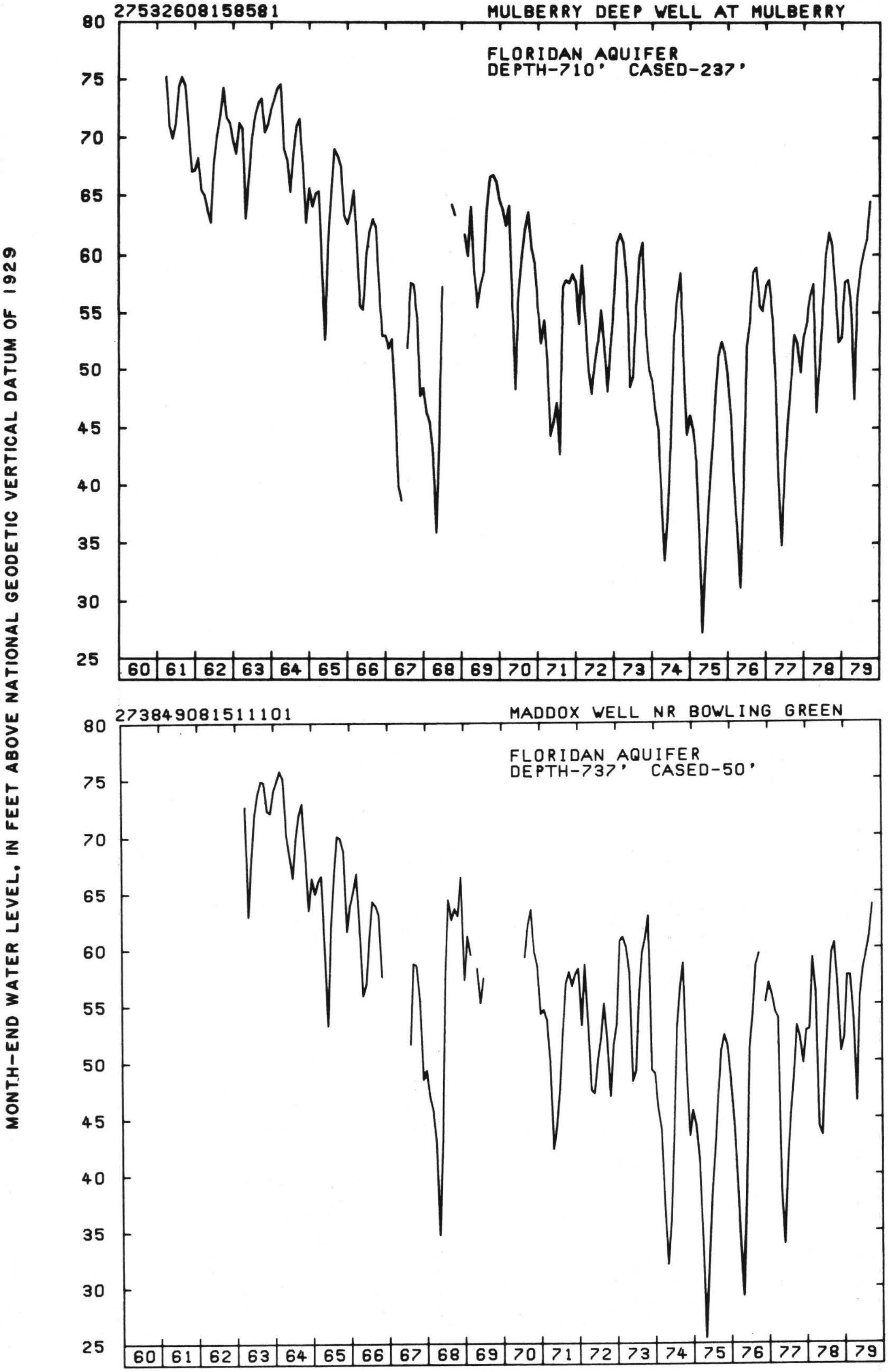


Figure 29.--Hydrographs of month-end water levels for Mulberry deep well at Mulberry and Maddox well near Bowling Green.

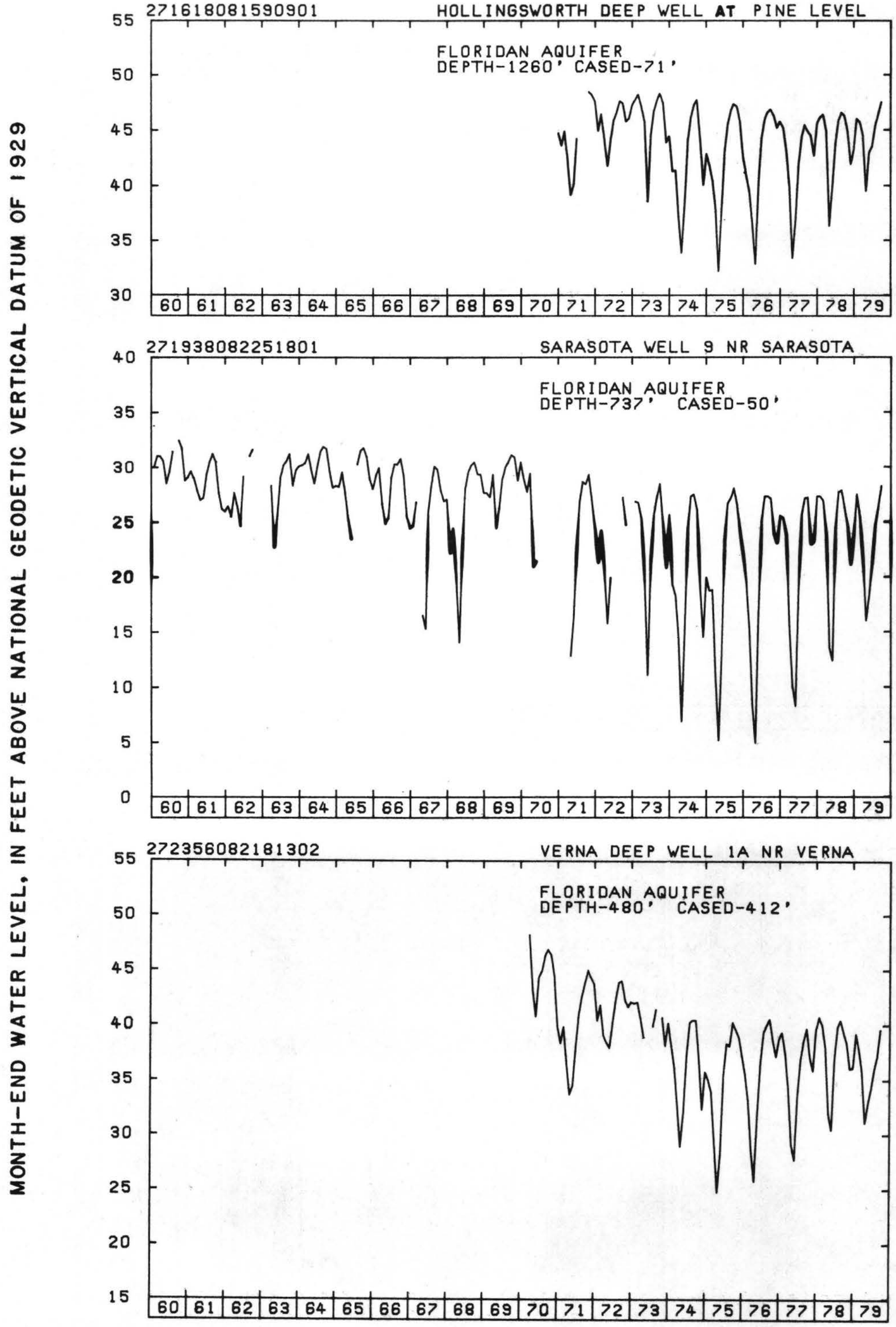


Figure 30.--Hydrographs of month-end water levels for Hollingsworth deep well at Pine Level, Sarasota well 9 near Sarasota, and Verna deep well 1A near Verna.

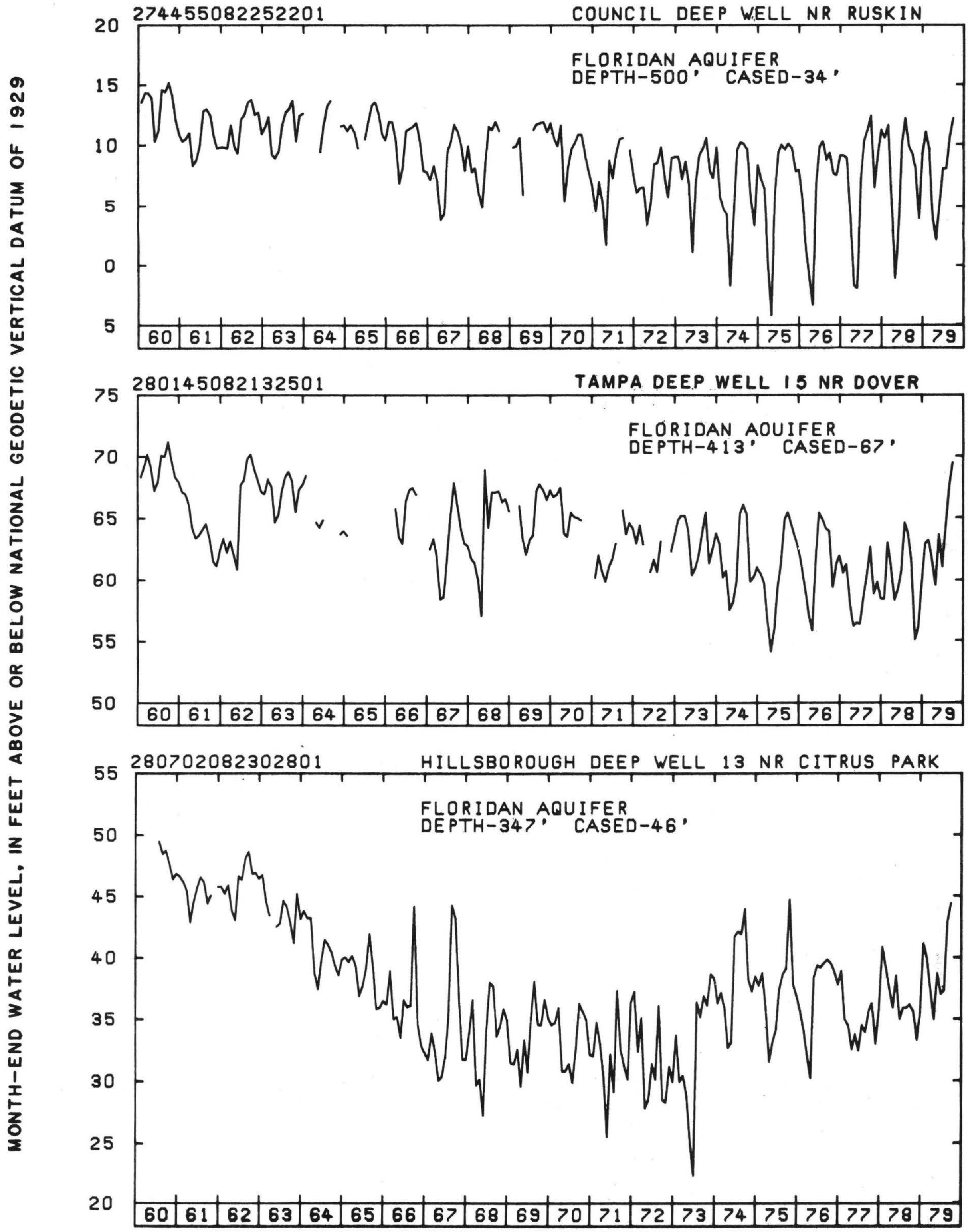


Figure 31.--Hydrographs of month-end water levels for Council deep well near Ruskin, Tampa deep well 15 near Dover, and Hillsborough deep well 13 near Citrus Park.

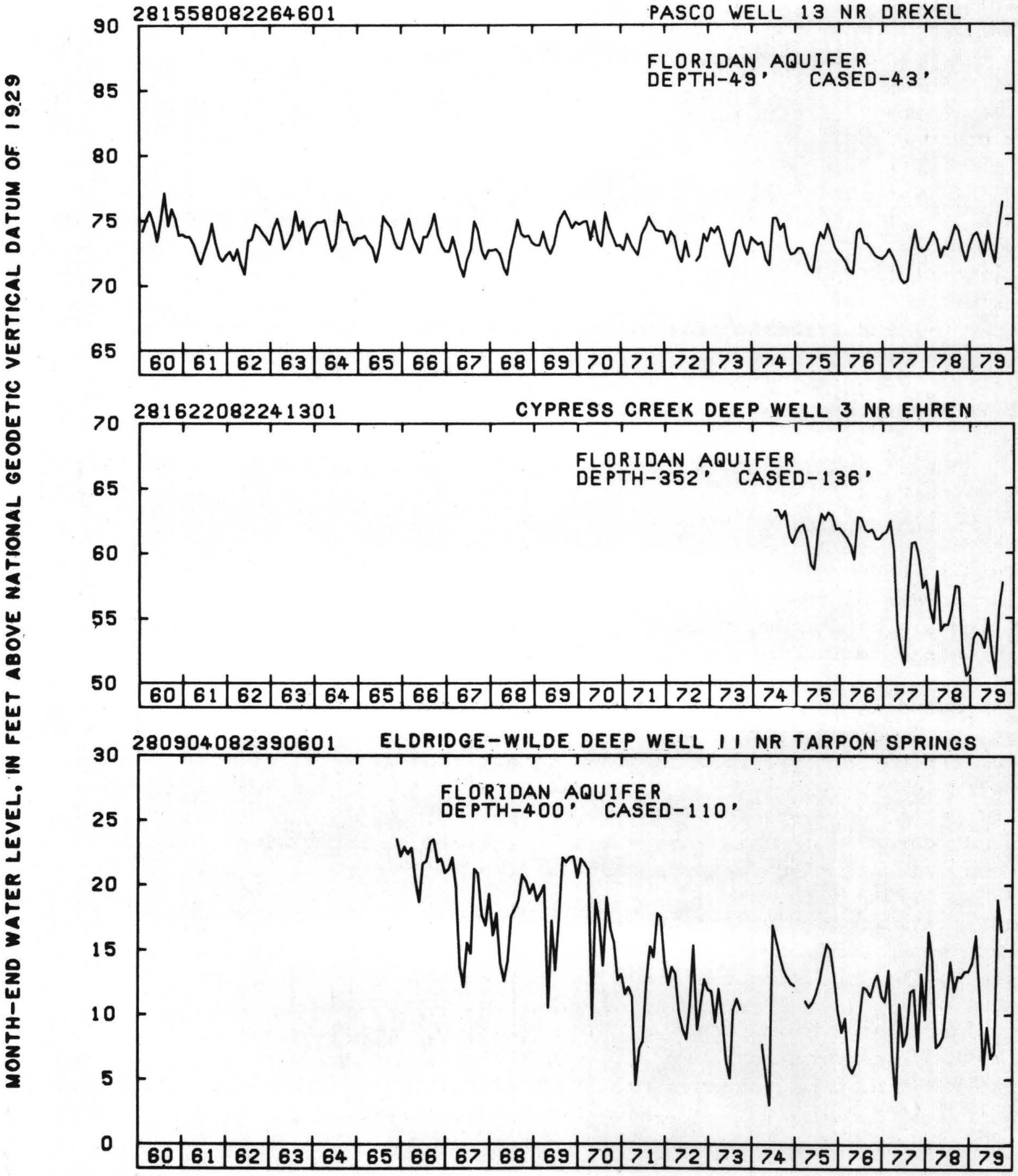


Figure 32.--Hydrographs of month-end water levels for Pasco well 13 near Drexel, Cypress Creek deep well 3 near Ehren, and Eldridge-Wilde deep well 11 near Tarpon Springs.

Drexel and Cypress Creek deep well 3 near Ehren (sites 9 and 10, fig. 27). Levels in Pasco well 13 during 1979 were slightly higher than those of 1978. Water levels in the well show little change over the years (about 7 feet) and relatively small seasonal changes in levels (about 3 feet). Water levels in the Cypress Creek well reflect seasonal fluctuations and an overall lowering trend that coincides with increased pumpage from the Cypress Creek well field for public supply. A new minimum water level, 1.3 feet below the previous record low of June 1977, was established in December 1978.

Eldridge-Wilde 11 and Pinellas 665 Wells.--Hydrographs of water levels in the Eldridge-Wilde deep well 11 near Tarpon Springs (site 11, fig. 27) and Pinellas well 665 near Clearwater (site 12, fig. 27), Pinellas County, are shown in figures 32 and 33, respectively. Levels in the Eldridge-Wilde well varied considerably during the year, as indicated by the 13-foot range in levels. Water levels of Pinellas well 665 were about the same as those for 1978. The well has exhibited a long-term gradual decline in water levels, but fluctuates little seasonally. Water levels in both wells are affected by pumping of nearby wells for public supply.

Weeki Wachee and North Lecanto Wells.--Water levels in the northern part of the District are illustrated by hydrographs of water levels for Weeki Wachee well near Weeki Wachee in Hernando County (site 13, fig. 27) and North Lecanto deep well near Lecanto in Citrus County (site 14, fig. 27) in figure 33. Water levels in both wells were approximately equal to the long-term average levels. Water levels of the Lecanto well remain uniform from year-to-year and during any year. The maximum range in water level for the Lecanto well has been less than 4 feet during the period of record.

Potentiometric Surface and Water Table.--The potentiometric surface of the Floridan aquifer and the water-table levels respond to rainfall, evapotranspiration, streamflow, ground-water withdrawal, lake levels, and tides. Maps of the potentiometric surface of the Floridan aquifer are prepared twice each year. Water levels are measured in about 900 wells each May and September. These data are contoured to produce maps that describe water-level conditions during the dry and wet seasons. Maps for 1979 are shown in figures 34 and 35. Water levels for May 1979 reflect seasonal declines from those of September 1978 (Wolansky and others, 1979). Heavy rains during the normally dry spring months, however, sustained the ground-water levels in most areas and lessened the amount of decline. Declines throughout most of the District were generally less than 5 feet. Declines of about 10 feet, however, occurred in parts of Manatee and Sarasota Counties. Water levels for May 1979 were about the same as those for May 1978 in most of the District. The exception was in the southern part of the Alafia River basin and the northern half of Manatee County where levels were approximately 5 feet higher. The higher levels in these areas are attributed to reduced pumpage for irrigation because of the heavy rains in early May.

Water-level data for May 1979 and September 1979, the period when ground-water recharge normally is greatest, showed that water level changed very little in the northern half and extreme southern portion of the District. In the central part of the District, however, water levels were 10 to 12 feet higher in September than in May. Generally, water levels for September 1979 were 2 to 3 feet higher than those for September 1978.

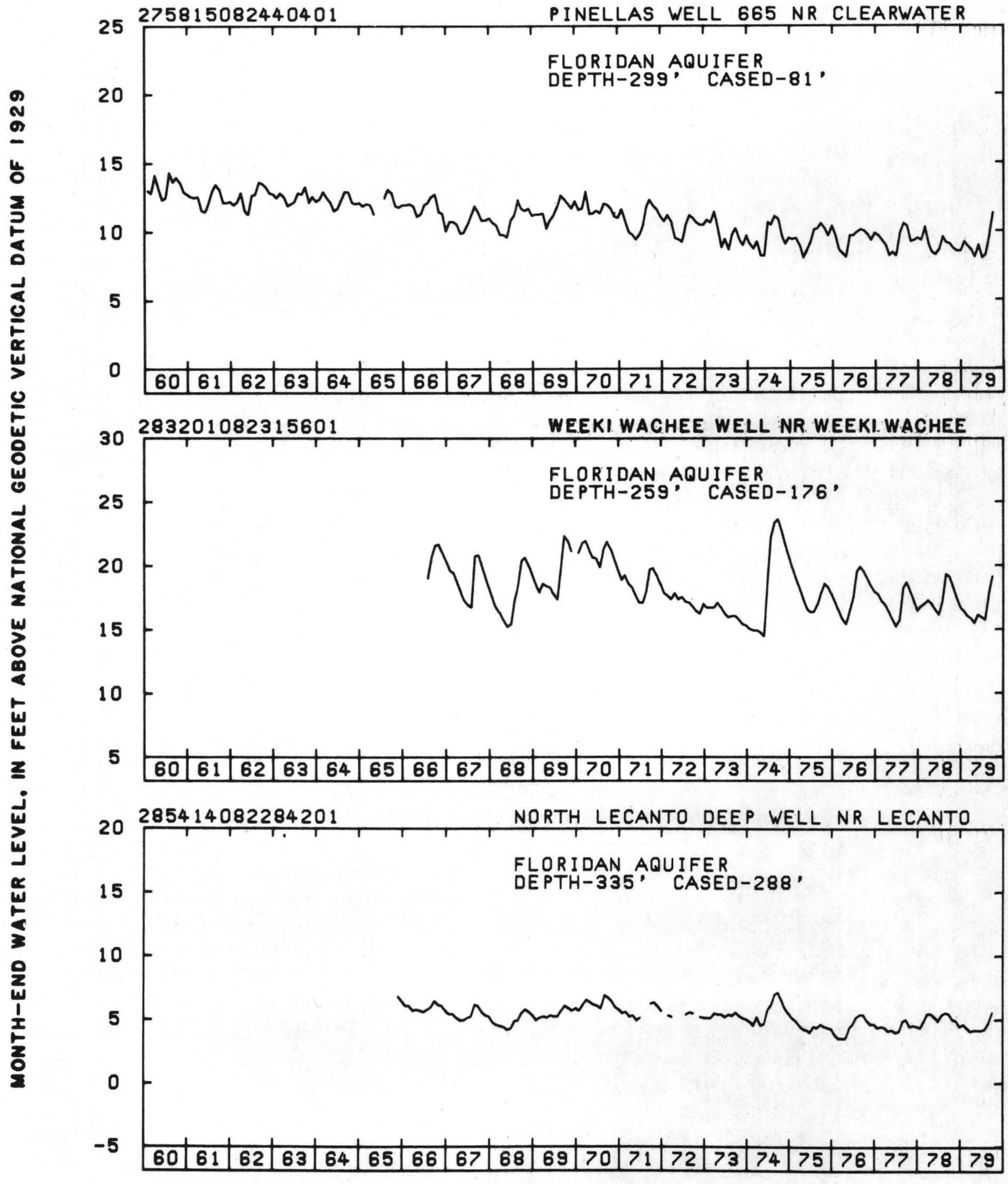


Figure 33.--Hydrographs of month-end water levels for Pinellas well 665 near Clearwater, Weeki Wachee well near Weeki Wachee, and North Lecanto deep well near Lecanto.

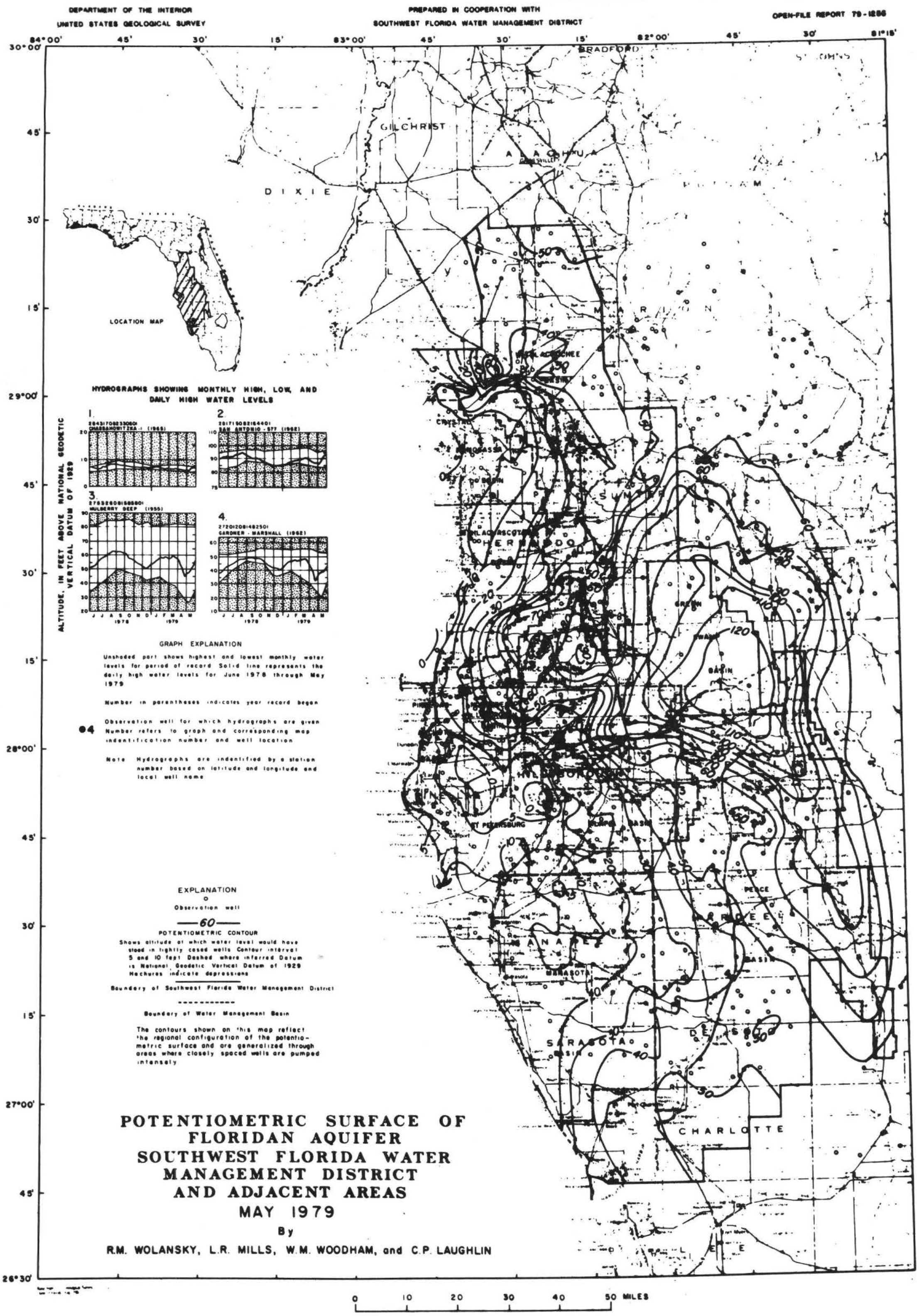


Figure 34.--Potentiometric surface of the Floridan aquifer, May 1979 (Wolansky, Mills, Woodham, and Laughlin, 1979).

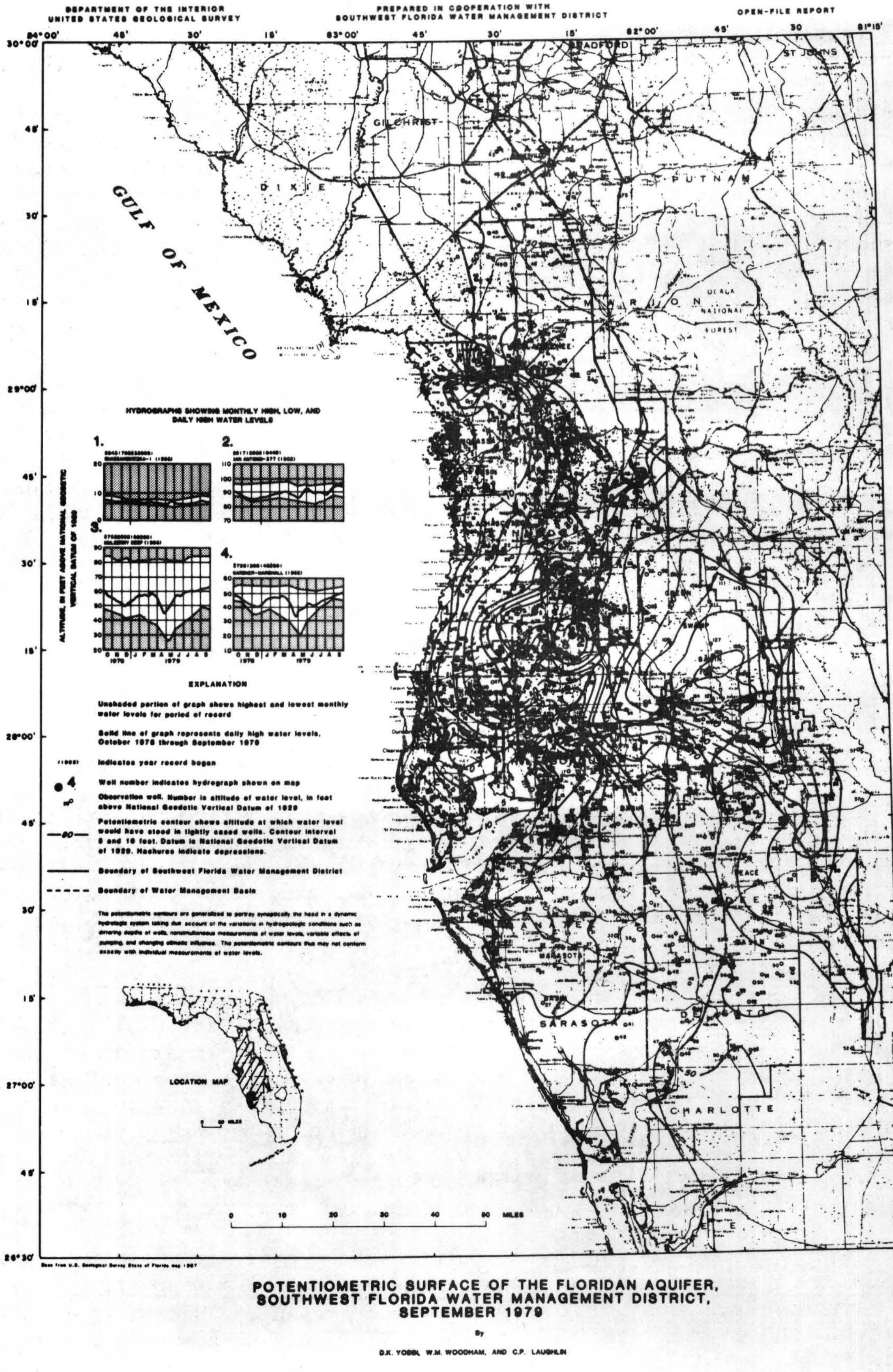


Figure 35.--Potentiometric surface of the Floridan aquifer, September 1979 (Yobbi, Woodham, and Laughlin, 1979).

Potentiometric-surface and water-table maps for May and September are also prepared for selected municipal well fields. These maps illustrate the effects of local hydrologic factors and ground-water withdrawals on water levels. Maps for 1979 are shown in figures 36 to 39--figure 36 for the Floridan aquifer, May 1979; figure 37 for the surficial aquifer, May 1979; figure 38 for the Floridan aquifer, September 1979; and figure 39 for the surficial aquifer, September 1979. The potentiometric surface in all well fields was generally much higher in May 1979 than in May 1978 (Wolansky and others, 1979). Increases averaged about 4 feet and ranged from zero at Sun City well field (fig. 36c) to about 8 feet at Eldridge-Wilde well field (fig. 36a). Levels were higher because of the large rainfall that occurred in May 1979. Similarly, the water table was generally higher in May 1979 than in May 1978. Levels ranged from zero at Sun City and Verna well fields to a maximum of about 12 feet at the Riverview well field (fig. 37c). The potentiometric surface in most well fields in September 1979 was generally higher than that of September 1978. Water-level changes ranged from a decrease of 9 feet at Verna well field (fig. 38c) to an increase of 15 feet at Cosme well field (fig. 38a). Water-level changes in the surficial aquifer ranged from a decrease of 4 feet at Cypress Creek well field to an increase of 6 feet at Morris Bridge well field (fig. 39b). The higher water levels of September reflect seasonal trends of the late summer rains.

Quality of Water

Quality-of-Water Monitoring Network

The ground- and surface-water quality monitoring network was established to provide data necessary for local agencies to: (1) define location and movement of the saltwater-freshwater interface; (2) locate areas where ground-water quality is deteriorating from sources other than seawater; (3) monitor movement of leachates from landfills and spray-effluent irrigation sites; (4) predict long-term changes in the quality of ground water, streamflow, and lakes; and (5) make water-quality management decisions.

Water samples are analyzed for major inorganic constituents, trace elements, radiochemical constituents, organics, and biological characteristics. Samples of water are collected by the U.S. Geological Survey from about 220 surface-water sites (fig. 40) and from approximately 700 wells (fig. 41). A portion of the chemical analyses is included in the annual report "Water Resources Data for Florida, Water Year 1979, Volume 3: Southwest Florida." Some selected data collected for interpretive investigations and chloride monitoring are not published but are in files of the U.S. Geological Survey.

A major component of the ground-water quality monitoring network is the chloride-monitoring network (fig. 42). Samples of water are collected at least once a year from numerous wells to monitor changes in the saltwater-freshwater interface in the coastal parts of southwest Florida. Graphs of chloride concentrations for selected wells in the monitoring network are presented in figures 43 and 44.

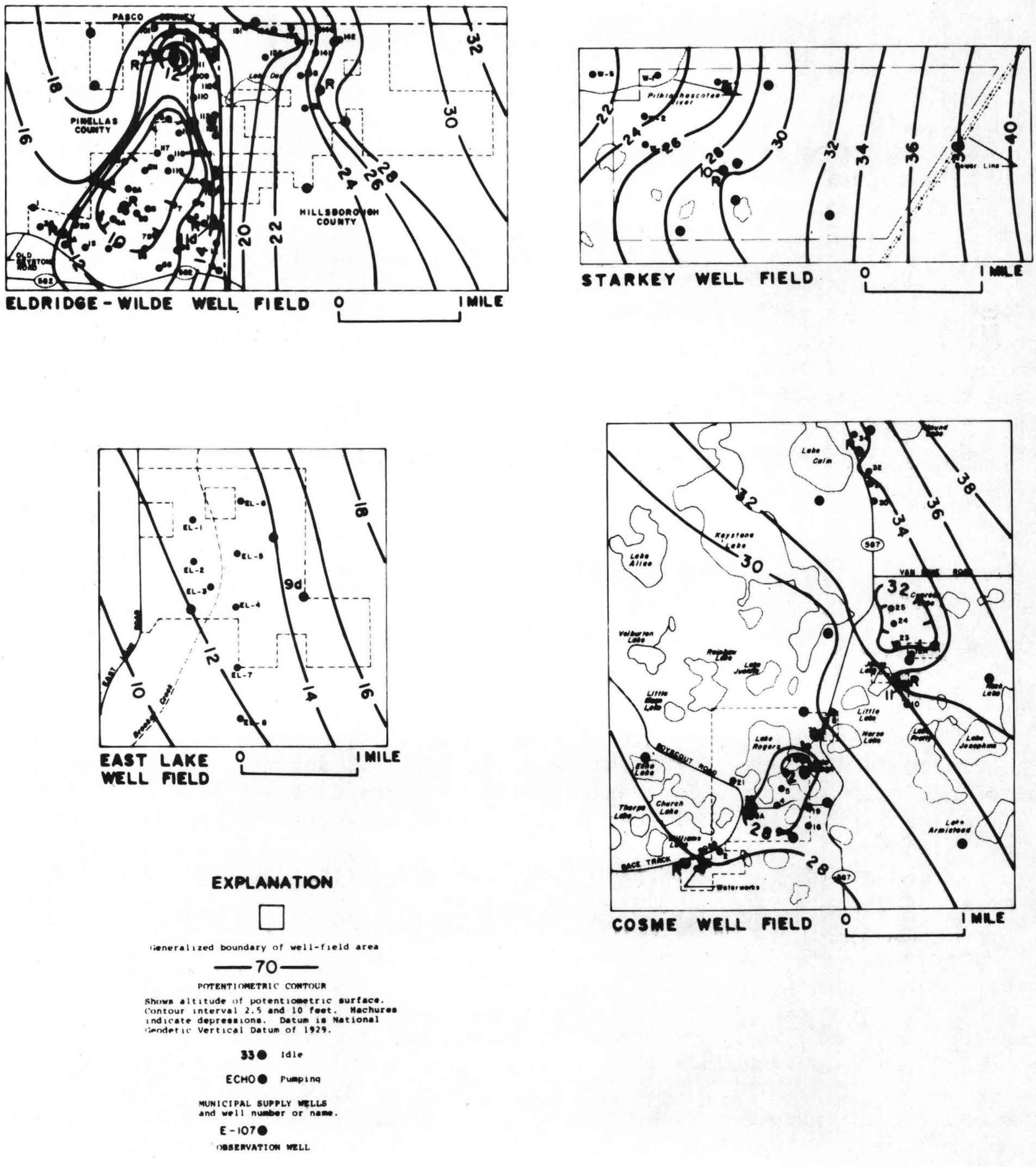


Figure 36a.--Potentiometric surface of the Floridan aquifer in selected well fields, May 1979 (from Wolansky, Mills, Yobbi, and Woodham, 1979).

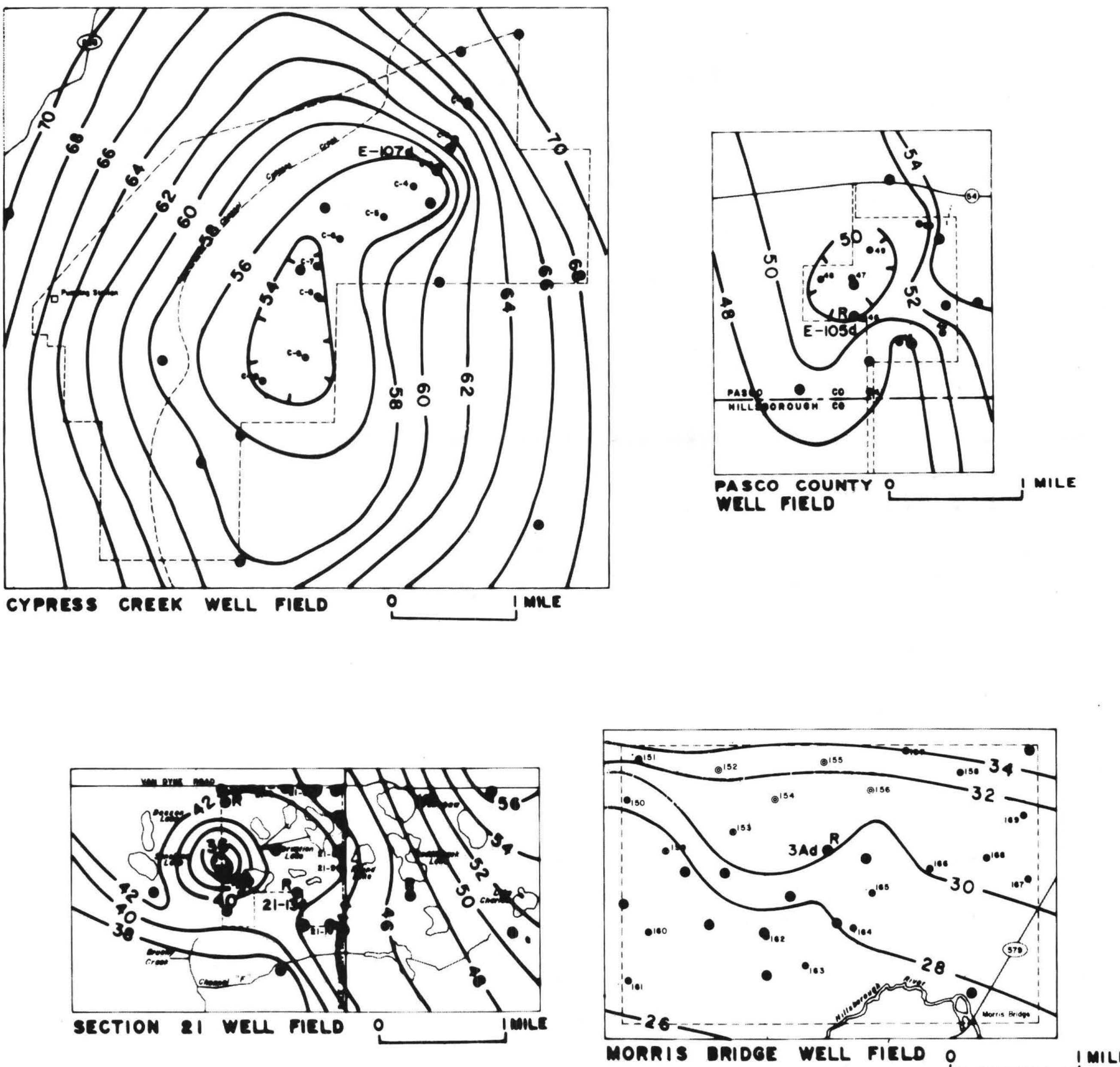


Figure 36b.--Potentiometric surface of the Floridan aquifer in selected well fields, May 1979 (from Wolansky, Mills, Yobbi, and Woodham, 1979).

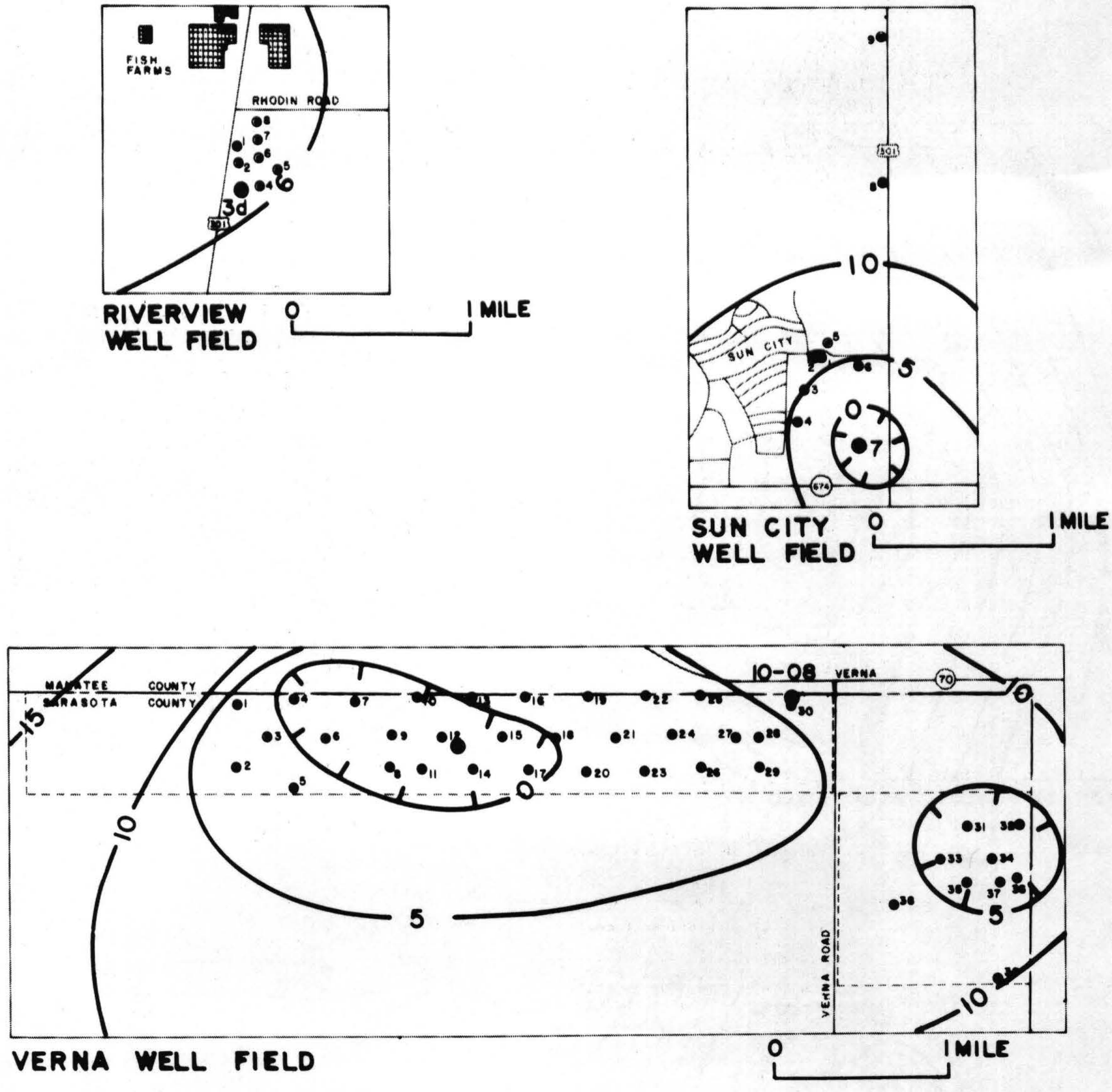


Figure 36c.--Potentiometric surface of the Floridan aquifer in selected well fields, May 1979 (from Wolansky, Mills, Yobbi, and Woodham, 1979).

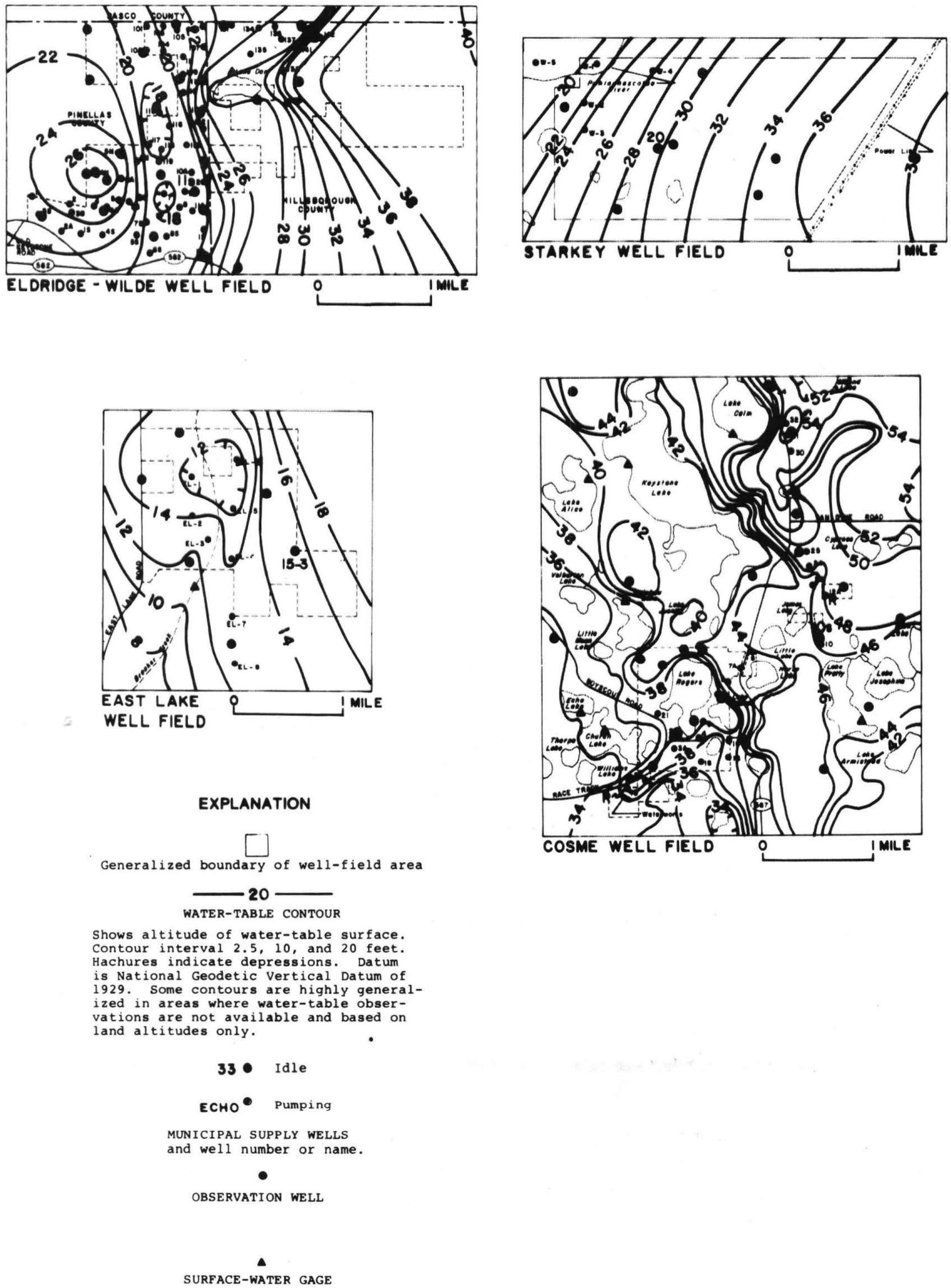


Figure 37a.--Water table of the surficial aquifer in selected well fields, May 1979 (from Wolansky, Mills, Yobbi, and Woodham, 1979).

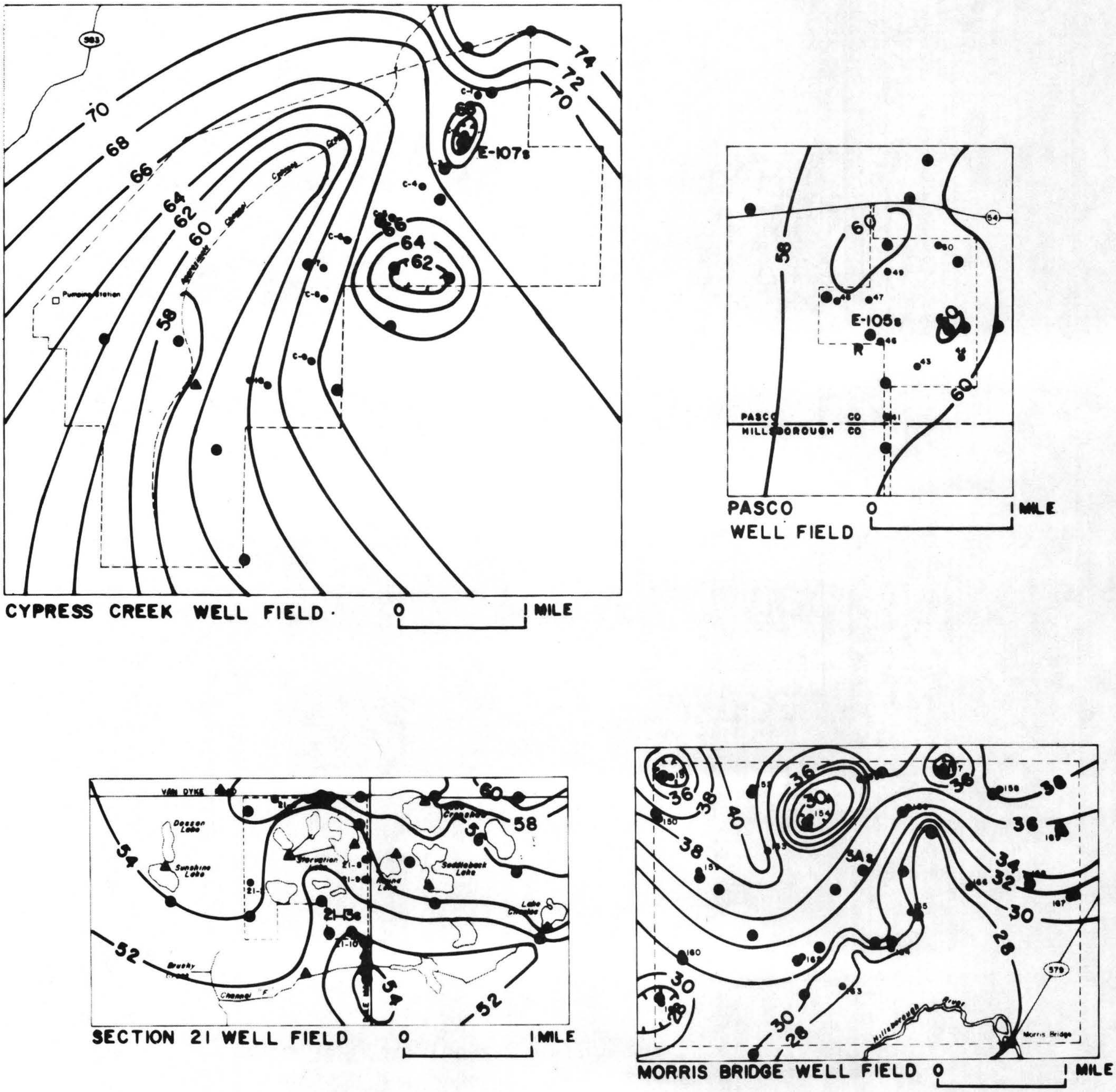


Figure 37b.--Water table of the surficial aquifer in selected well fields, May 1979 (from Wolansky, Mills, Yobbi, and Woodham, 1979).

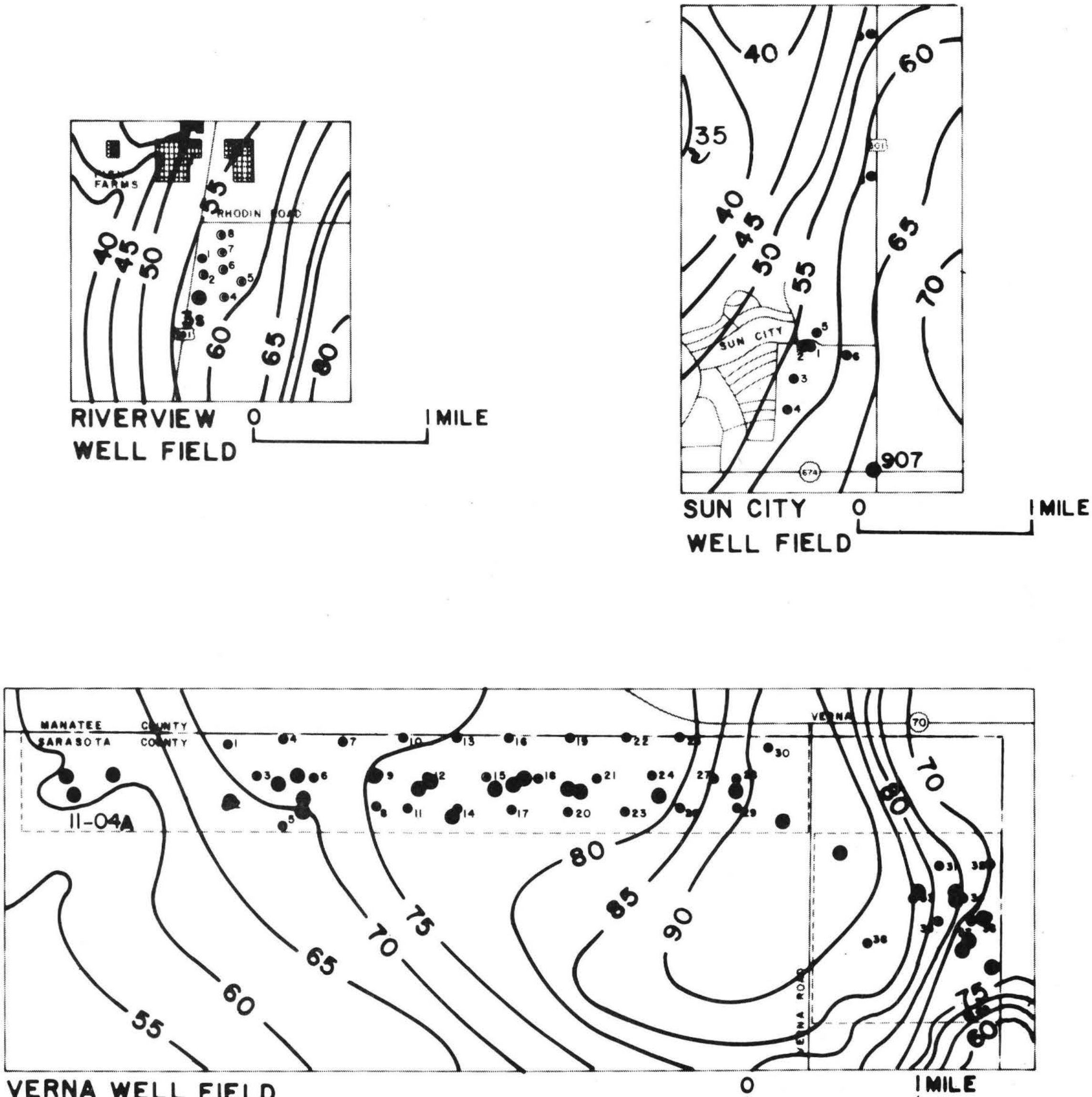


Figure 37c.--Water table of the surficial aquifer in selected well fields, May 1979 (from Wolansky, Mills, Yobbi, and Woodham, 1979).

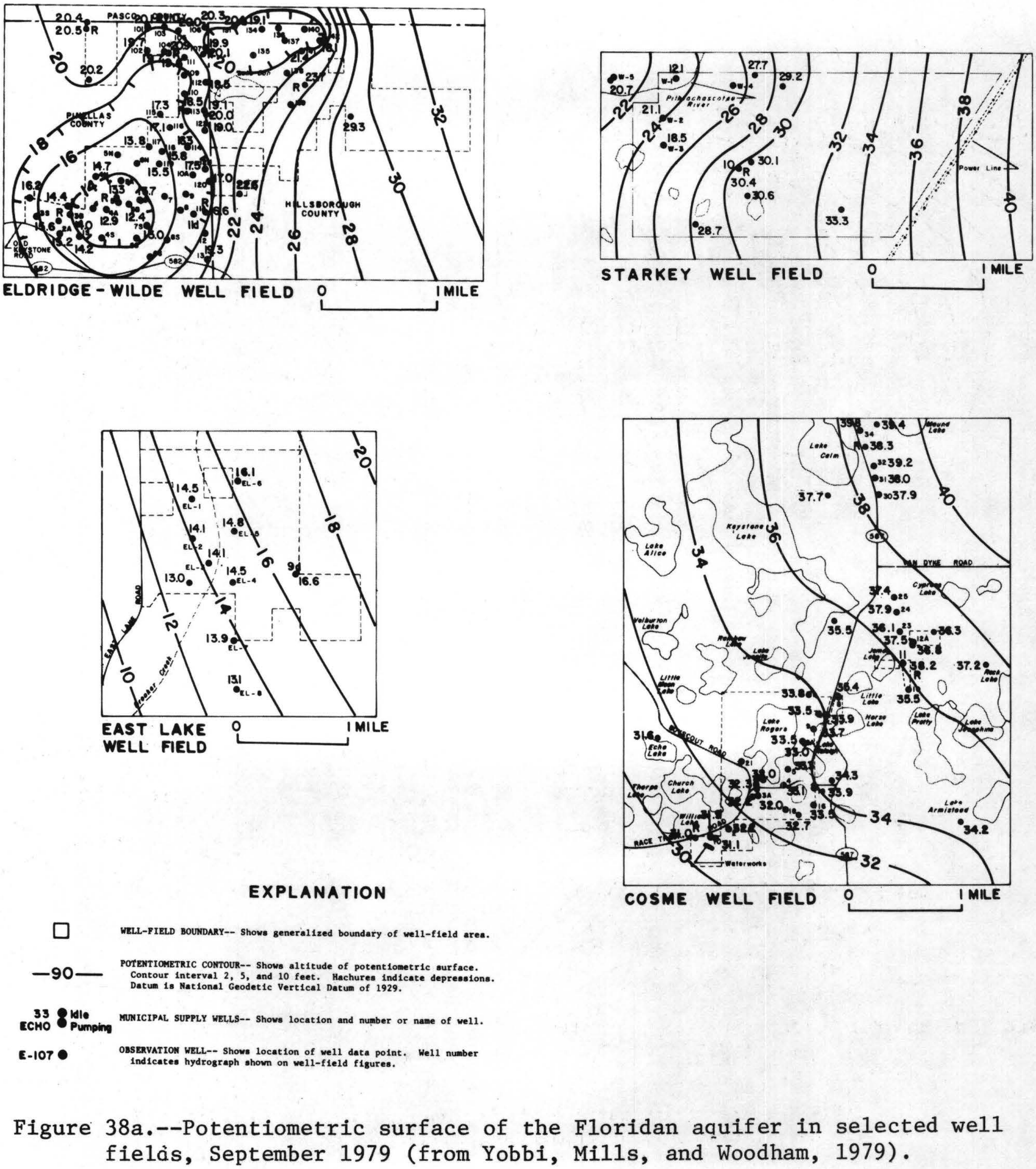


Figure 38a.--Potentiometric surface of the Floridan aquifer in selected well fields, September 1979 (from Yobbi, Mills, and Woodham, 1979).

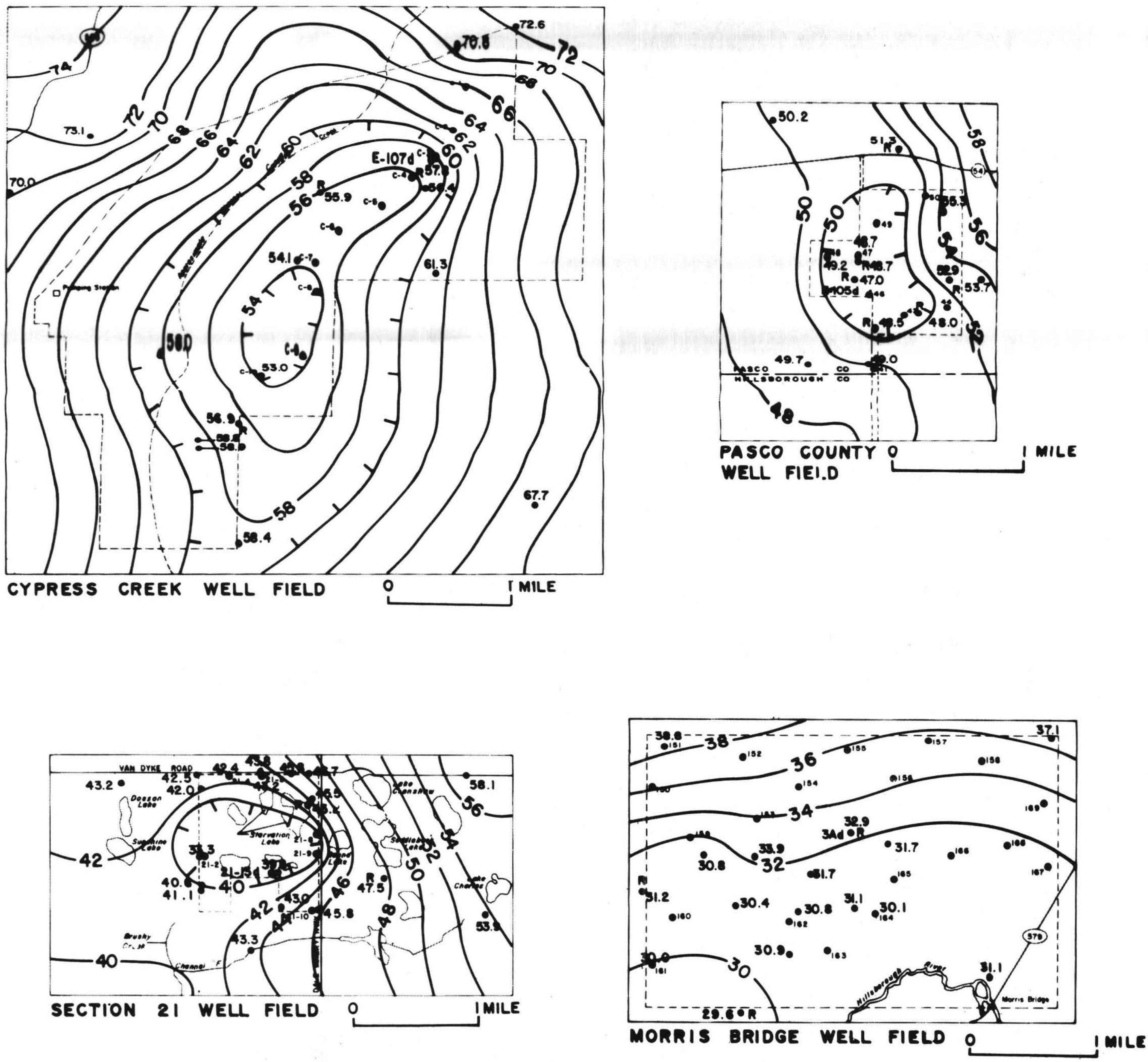


Figure 38b.--Potentiometric surface of the Floridan aquifer in selected well fields, September 1979 (from Yobbi, Mills, and Woodham, 1979).

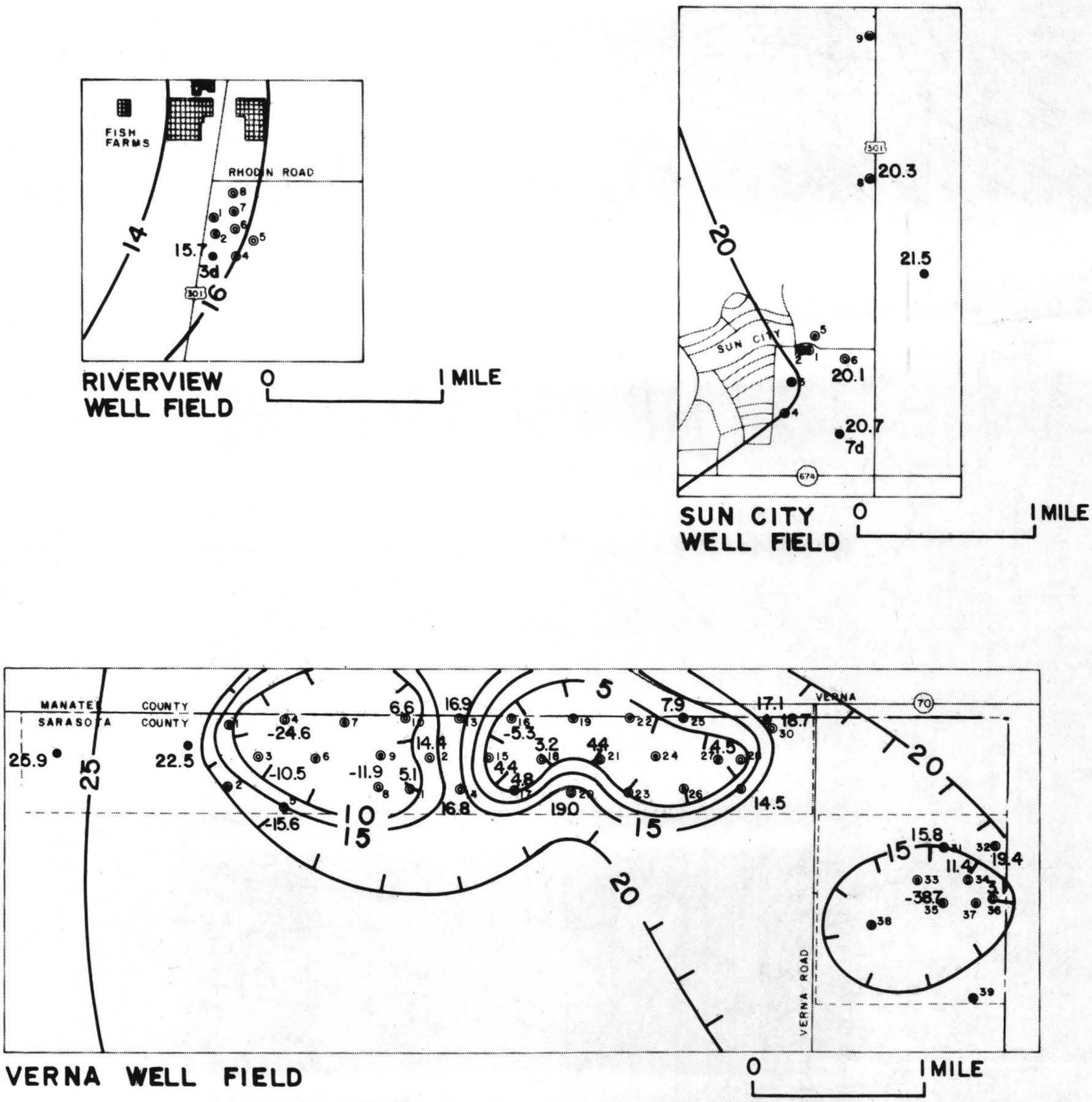


Figure 38c.--Potentiometric surface of the Floridan aquifer in selected well fields, September 1979 (from Yobbi, Mills, and Woodham, 1979).

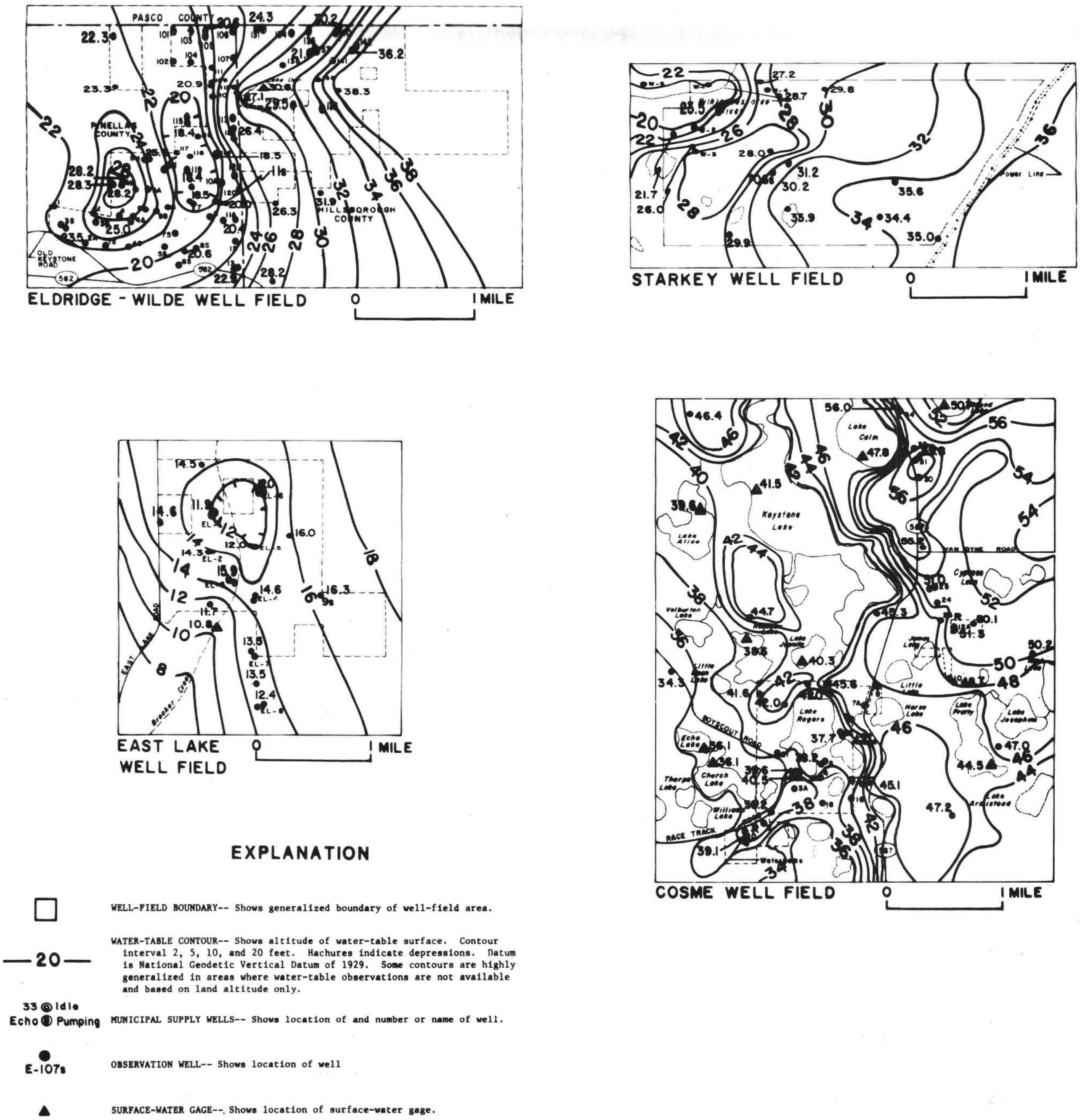


Figure 39a.--Water table of the surficial aquifer in selected well fields, September 1979 (from Yobbi, Mills, and Woodham, 1979).

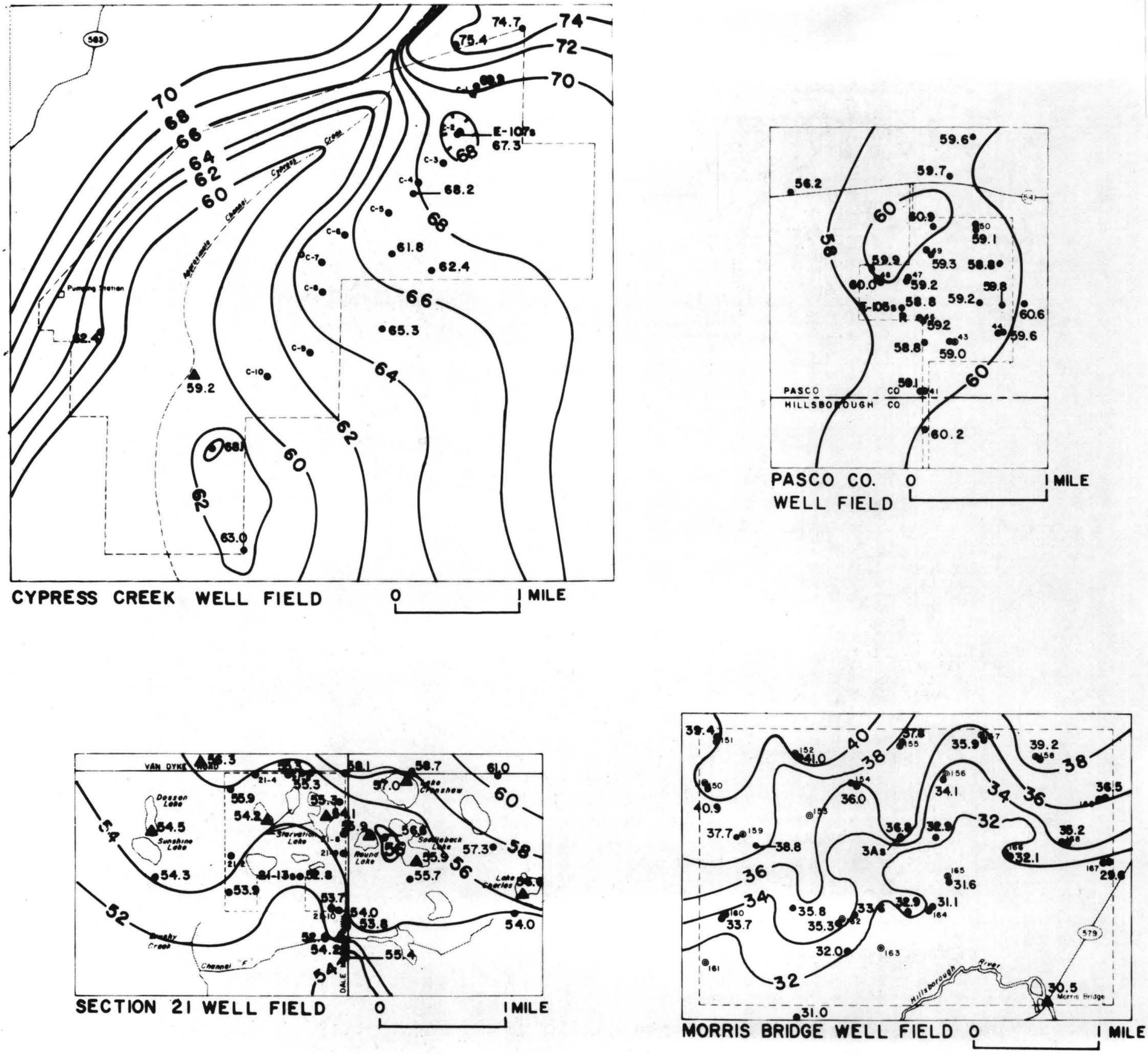


Figure 39b.--Water table of the surficial aquifer in selected well fields, September 1979 (from Yobbi, Mills, and Woodham, 1979).

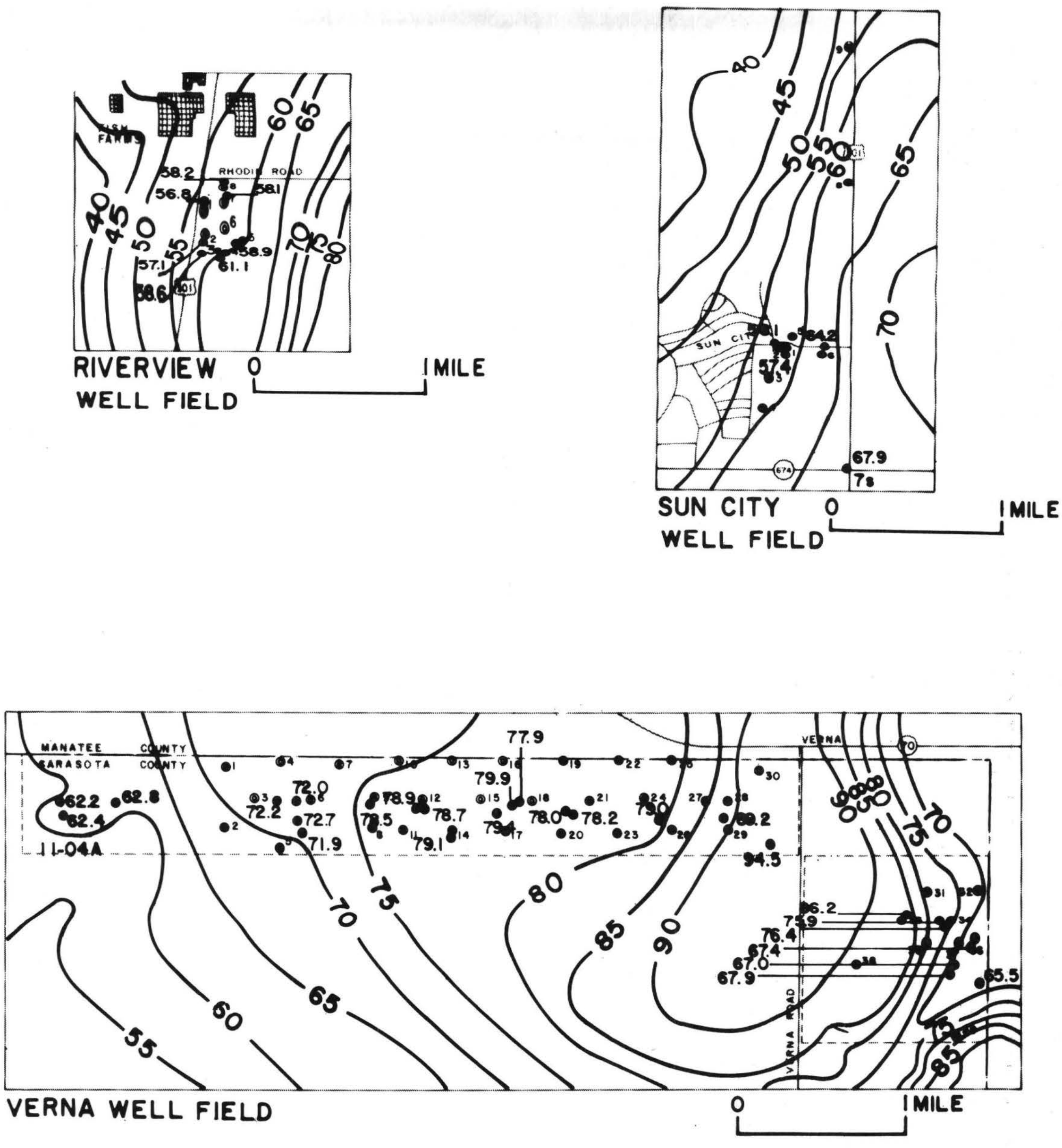


Figure 39c.--Water table of the surficial aquifer in selected well fields, September 1979 (from Yobbi, Mills, and Woodham, 1979).

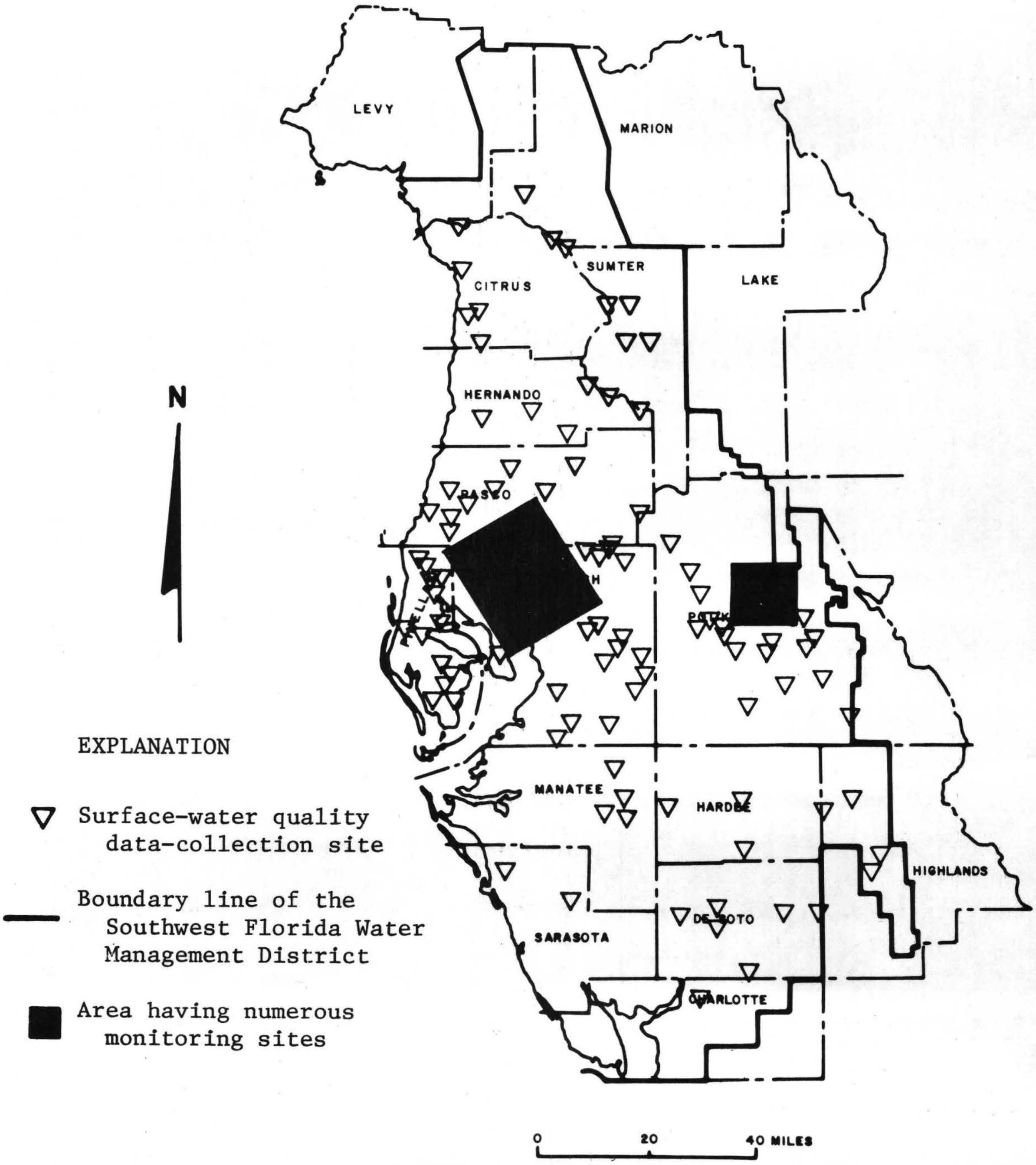


Figure 40.--Locations of surface-water quality monitoring sites.

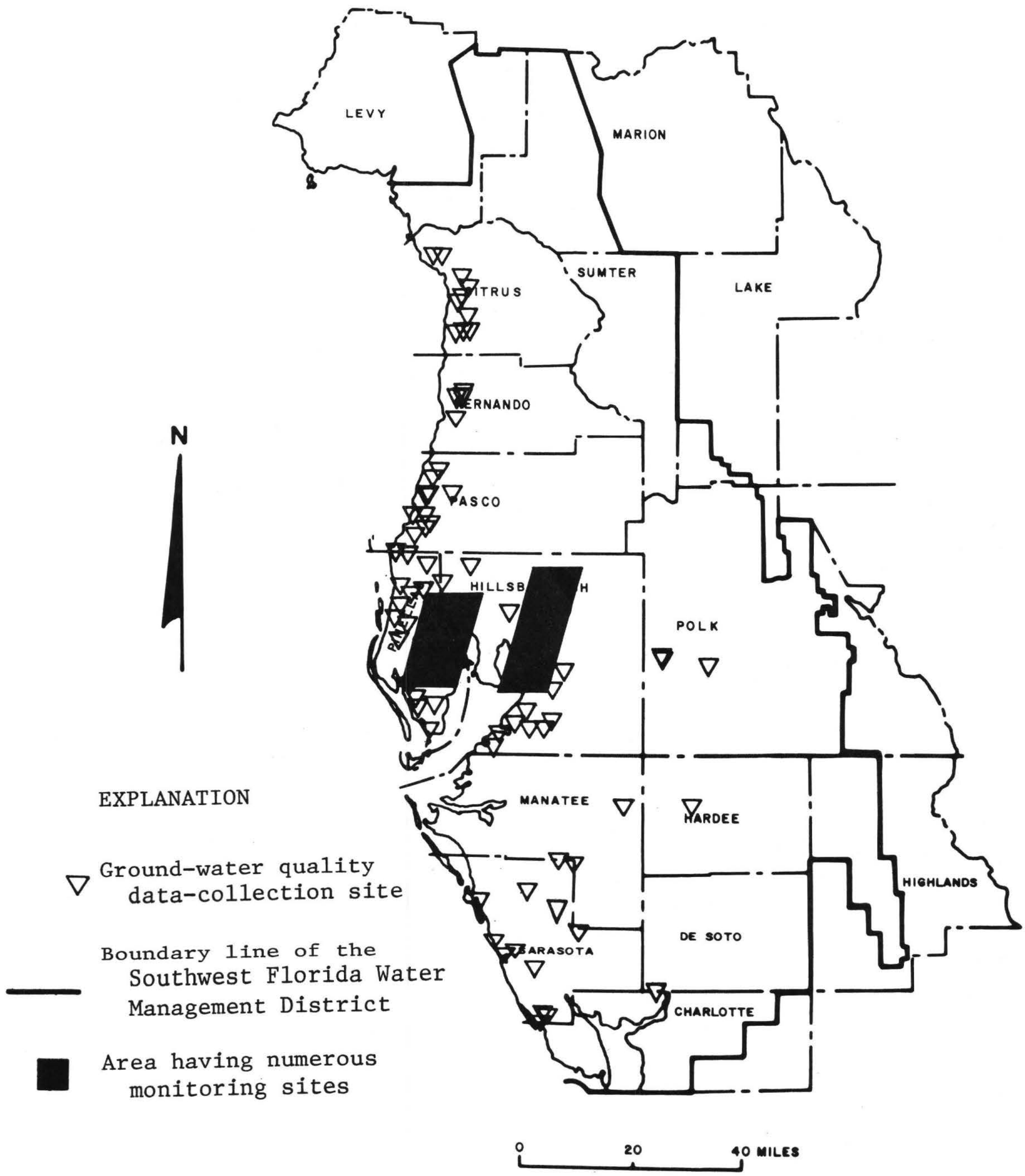


Figure 41.--Locations of ground-water quality monitoring sites.

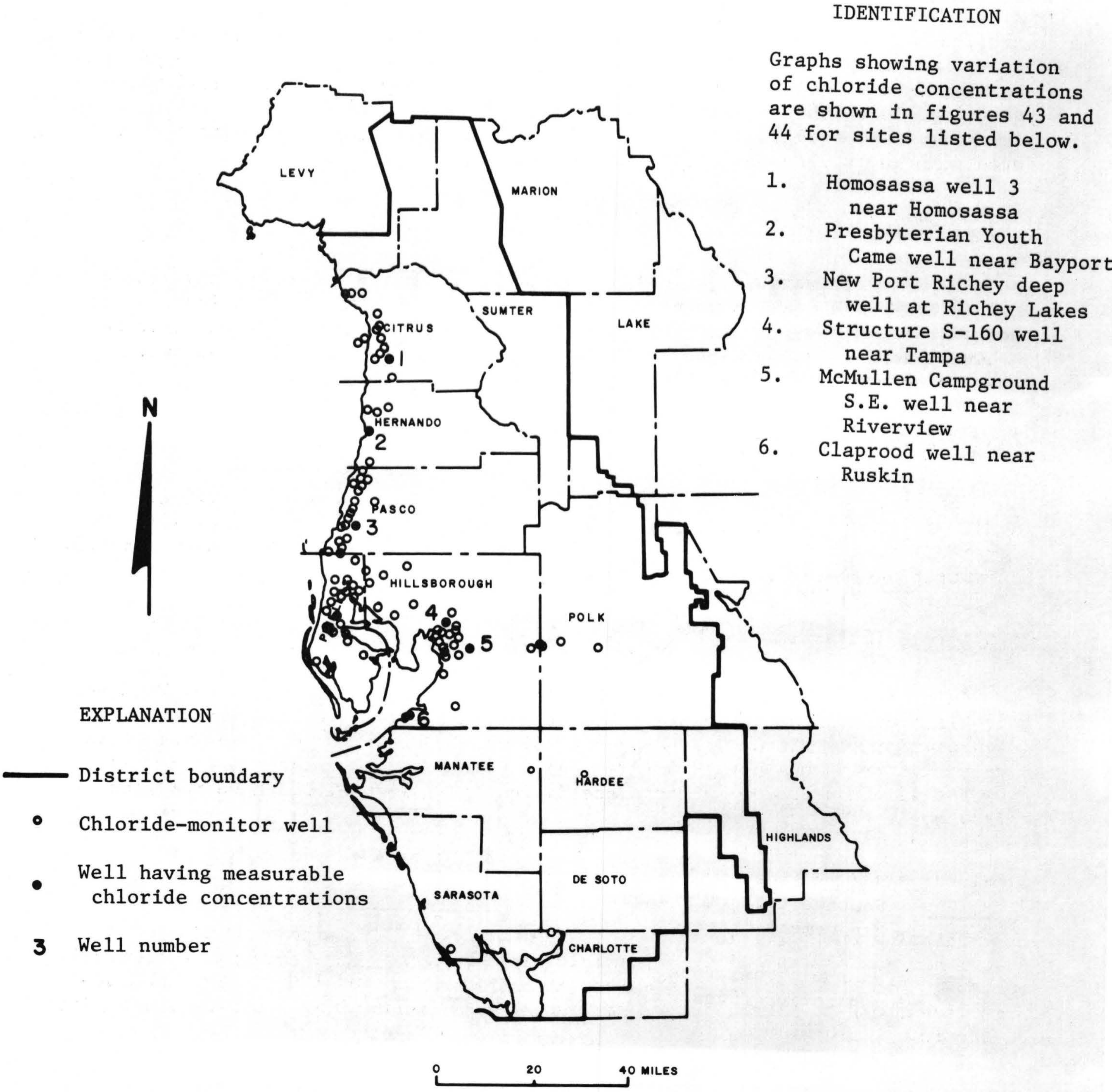


Figure 42.--Locations of chloride-monitoring wells.

New Port Richey deep well at Richey Lakes

The chloride concentrations of samples from the New Port Richey well (site 3, fig. 42) in Pasco County, about 2 miles from the Gulf of Mexico, ranged from about 6,200 mg/L (milligrams per liter) to about 8,600 mg/L in the 1979 water year (fig. 43). The artesian well is affected by pumping of nearby public supply wells. The reduction in chloride levels this year coincides with the reduced pumpage of these public supply wells.

Presbyterian Youth Camp well near Bayport

Chloride concentrations in water from the Presbyterian Youth Camp artesian well (site 2, fig. 42) in Hernando County during 1979 showed a continuation of the long-term trend of increased chloride levels (fig. 43). Average chloride concentrations have increased about 20 mg/L per year since 1974. The average chloride concentration for 1979 was about 680 mg/L.

Homosassa well 3 near Homosassa

Chloride concentrations in water from Homosassa well 3 (site 1, fig. 42) in Citrus County was lower in 1979 than in the previous 3 years (fig. 43). The average concentration since 1974 is about twice that of previous years, 1969-73. Concentrations were highest in 1974 and 1976.

Structure S-160 well near Tampa

Chloride concentrations in water from the Southwest Florida Water Management District well at structure S-160 of the Tampa Bypass Canal (site 4, fig. 42), about 3 miles from Hillsborough Bay in Hillsborough County, remained relatively uniform throughout 1979 (fig. 44). Chloride concentrations of samples from the well had gradually increased in the early 1970's, but have remained fairly constant since 1976.

McMullen Campground S.E. well near Riverview

Chloride concentrations in water from the McMullen Campground S.E. well near Riverview (site 5, fig. 42), Hillsborough County, have remained essentially constant throughout the 10 years that it has been sampled (fig. 44). The samples have shown a range in concentration of only about 10 mg/L during the period of record.

Claprood well near Ruskin

Chloride concentrations in water from the Claprood well near Ruskin (site 6, fig. 42), Hillsborough County, remained relatively unchanged during 1979 (fig. 44). Records, which began in 1960, have shown little change in chloride concentrations. Variations in chloride concentrations of about 20 to 30 mg/L have occurred, but they have been of short duration. The maximum concentration of about 75 mg/L occurred in 1977.

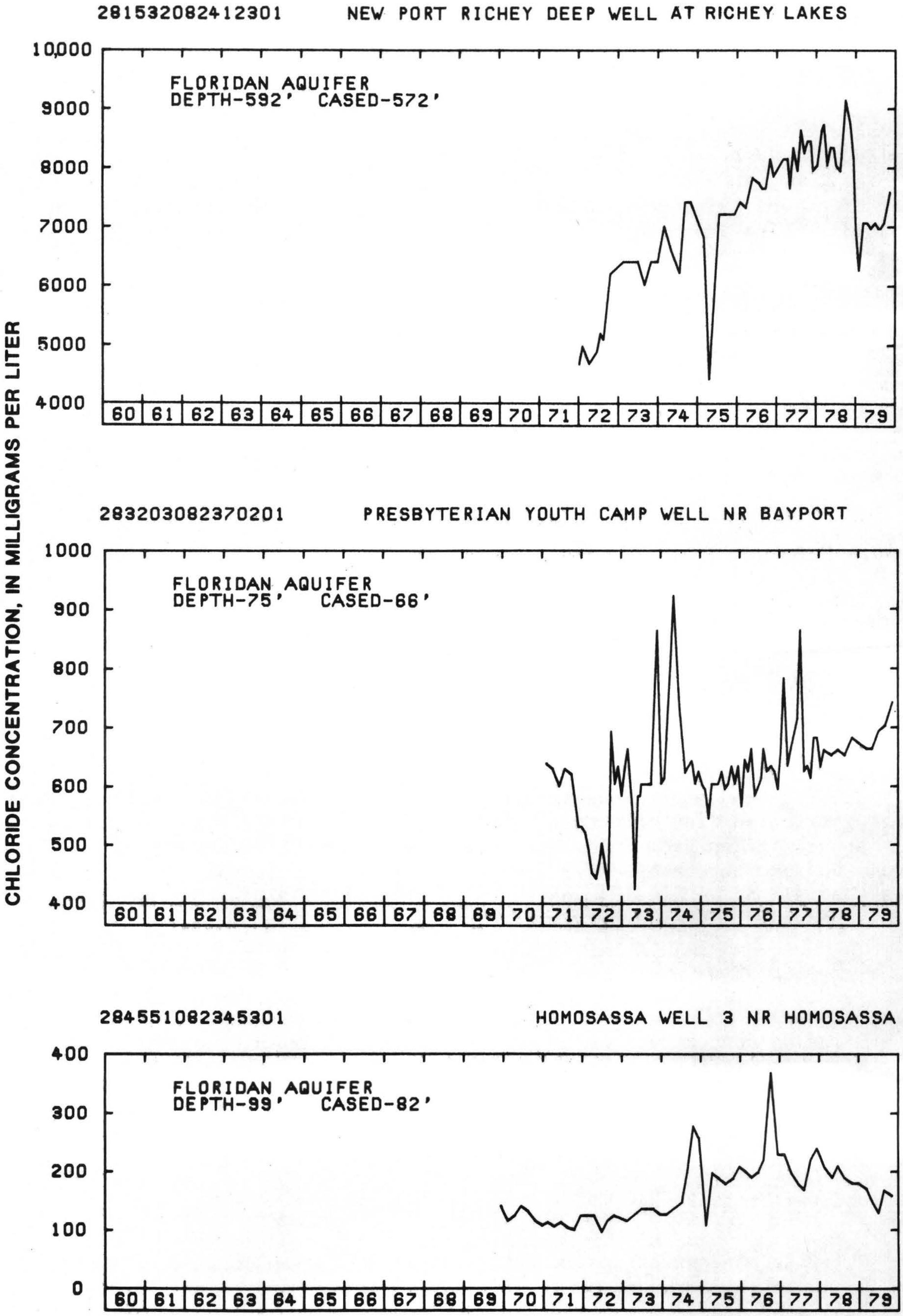


Figure 43.--Variation of chloride concentrations in New Port Richey deep well at Richey Lakes, Presbyterian Youth Camp well near Bayport, and Homosassa well 3 near Homosassa.

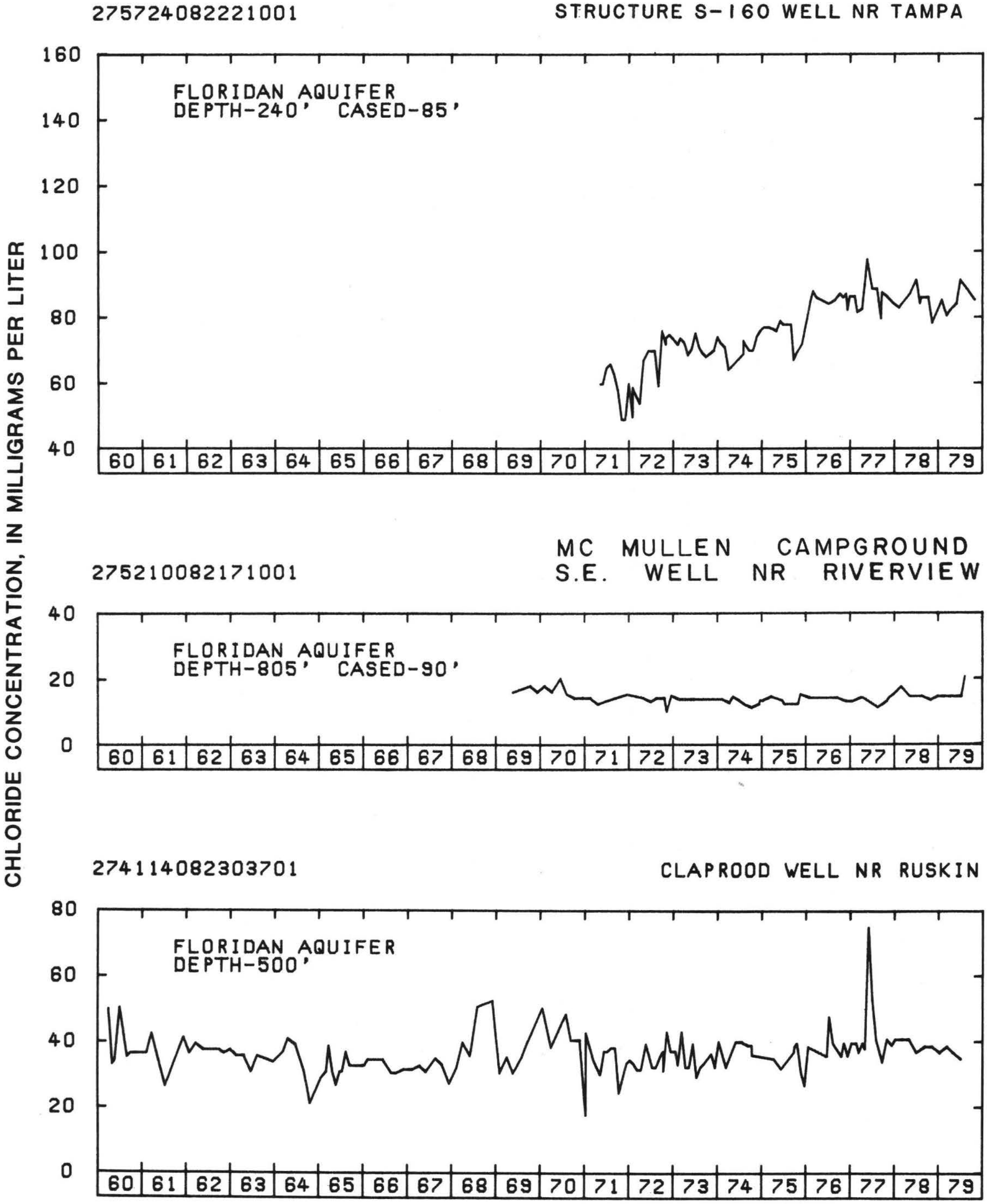


Figure 44.--Variation of chloride concentrations in Structure S-160 well near Tampa, McMullen Campground S.E. well near Riverview, and Claprood well near Ruskin.

WATER USE

An average of 7.1 billion gallons of water was used each day in southwest Florida during 1978 (the latest year for which data have been compiled). About 1.4 billion gallons were freshwater, of which 72 percent was from ground-water sources. The amounts of water used for public, rural, industrial, irrigation, and thermoelectric supplies are given by county in table 1. Data are provided for all counties and parts of counties within the Southwest Florida Water Management District. Data are not provided for parts of counties lying outside the District.

A comparison of the amounts of water used in each county for each type of use, except cooling for thermoelectric power generation, is shown in figure 45. As shown, the major water use in the southern part of the District is for irrigation. In highly developed areas along the coast, the major water use is for domestic supply. In Polk, Hillsborough, and Hernando Counties, the major use is for industry, principally mining operations.

The amounts of water obtained from ground-water and surface-water sources for each county are shown in figure 46. Ground-water sources are predominant throughout the District. The only large users of surface water are Hillsborough and Manatee Counties. Hillsborough County obtains some water from the Hillsborough River and Manatee County uses water from the Manatee River.

The amounts of water used in cooling for thermoelectric power generation are shown in figure 47. As shown, only small amounts of freshwater are used.

REGIONAL OBSERVATION AND MONITOR-WELL PROGRAM

In 1974, the Southwest Florida Water Management District initiated a regional observation and monitor-well program (ROMP), a network of ground-water observation wells, to obtain hydrologic data. The program was designed to provide an integrated District-wide network of observation wells that, upon completion, will consist of observation wells at about 89 inland sites and 20 coastal sites. At each site, one to four wells will be drilled to define hydrogeologic conditions and to monitor water levels in the shallow and artesian aquifers

Data collected from the drilling and monitoring program will provide a basis to: (1) accurately describe the geologic structure; (2) define aquifer and confining layer characteristics; (3) prepare potentiometric surface maps of the artesian aquifer; (4) locate the freshwater-saltwater interface and monitor its movement; (5) obtain quality-of-water data; and (6) define the relation between ground-water levels and hydrologic factors. The ROMP network also will provide a basis for effective ground-water management. Regulatory and management decisions can be based on up-to-date information to assure protection of the water resources and yet use the resources in reasonable and beneficial ways.

Table 1.--Water use by counties in 1978

[GW - ground water used in Mgal/d; SW - surface water used in Mgal/d; s - saline water, all other is freshwater except for 39.8 Mgal/d of saline ground water used by industry in Hillsborough County; p - county is partially in Southwest Florida Water Management District (1978 boundaries) and water-use data are for that part of the county only.]

County	Amount of water used for indicated purpose												Total
	Public supply		Rural		Industrial		Irrigation		Thermoelectric		Subtotal		
	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	GW	SW	
Charlotte[p]	0	4.1	.4	0	0	0	24.0	.7	0	0	24.4	4.8	29.2
Citrus	.5	0	4.6	0	2.5	0	1.8	.6	.6	1,897[s]	10.0	1,897.6	1,907.6
DeSoto	.7	0	2.2	0	.5	0	38.5	1.2	0	0	41.9	1.2	43.1
Hardee	.8	0	2.6	0	11.0	0	48.0	0	0	0	62.4	0	62.4
Hernando	1.0	0	3.8	.1	33.8	0	4.1	.7	0	0	42.7	.8	43.5
Highlands[p]	4.3	0	2.3	0	.7	0	33.6	6.6	0	0	40.9	6.6	47.5
Hillsborough	21.0	45.0	14.7	0	75.3	9.3	56.5	3.0	1.0	2,292.1[s]	168.5	2,349.4	2,517.9
Lake[p]	0	0	.1	0	0	0	2.6	.8	0	0	2.7	.8	3.5
Levy[p]	.5	0	.5	.2	0	0	.4	0	0	0	1.4	.2	1.6
Manatee	0	17.0	6.5	.2	5.2	0	45.6	5.1	0	2.6	57.3	24.9	82.2
Marion[p]	.2	0	.9	0	.9	0	5.1	.3	0	0	7.1	.3	7.4
Pasco	4.4	0	13.1	0	14.5	0	26.0	0	.2	670.0[s]	58.2	670.0	728.2
Pinellas	97.8	0	1.1	0	1.0	0	19.4	0	.1	796.0[s]	119.4	796.0	915.4
Polk[p]	31.6	0	9.3	0	223.6	4.1	78.3	4.1	.1	168.6	342.9	176.8	519.7
Sarasota	9.1	7.7	5.8	.1	.3	0	30.5	3.4	0	0	45.7	11.2	56.9
Sumter	.9	0	2.3	0	.1	0	3.2	.2	0	0	6.5	.2	6.7
Subtotal	172.8	73.8	70.2	.6	369.4	13.4	417.6	26.7	2.0	5,826.3	1,032.0	5,940.8	6,972.8
TOTAL	246.6		70.8		382.8		444.3		5,828.3		6,972.8		

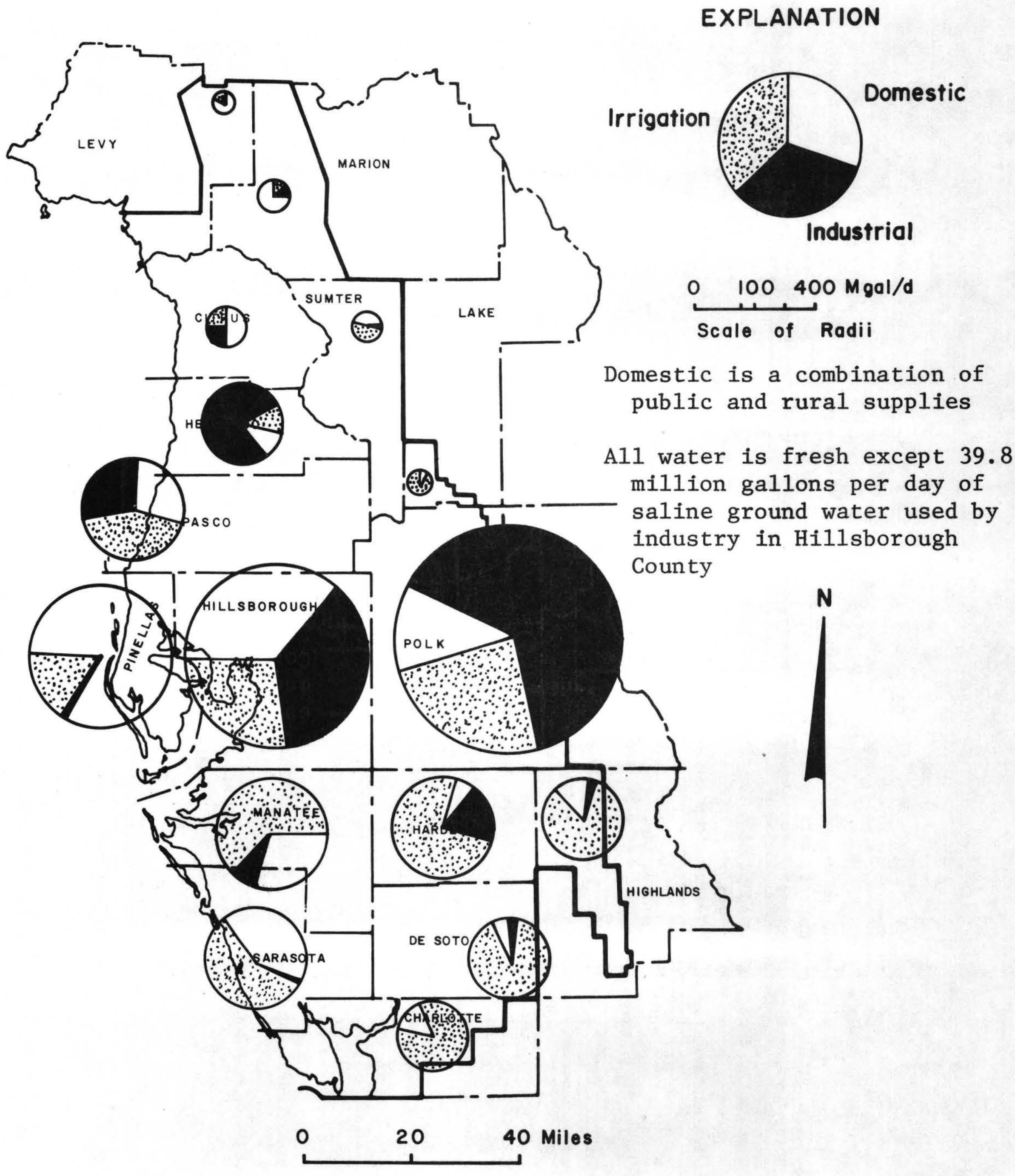


Figure 45.--Water use, by county, for domestic supply, industry, and irrigation in 1978.

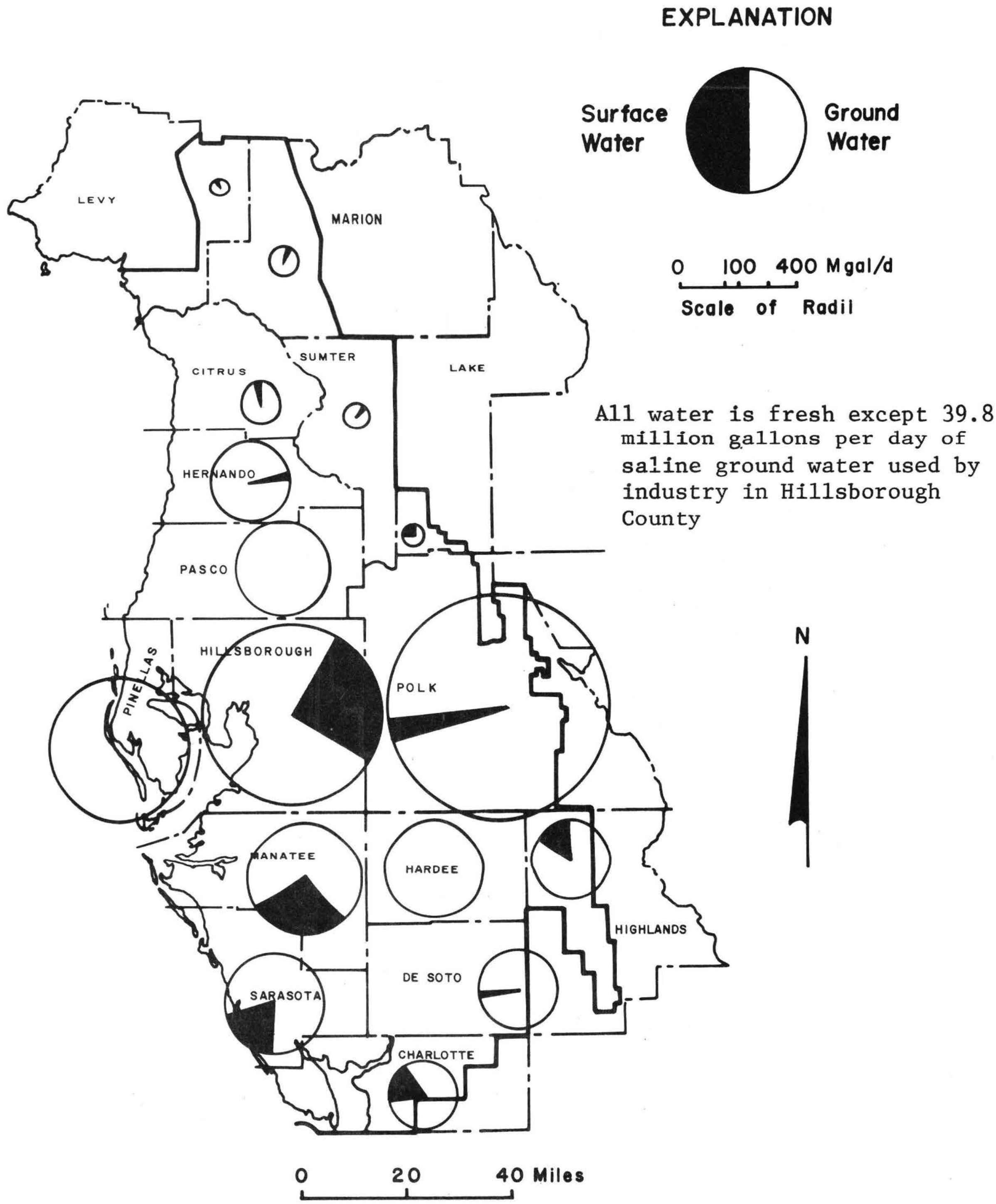


Figure 46.--Amounts of water obtained, by county, from ground and surface sources in 1978 for domestic supply, industry, and irrigation use.

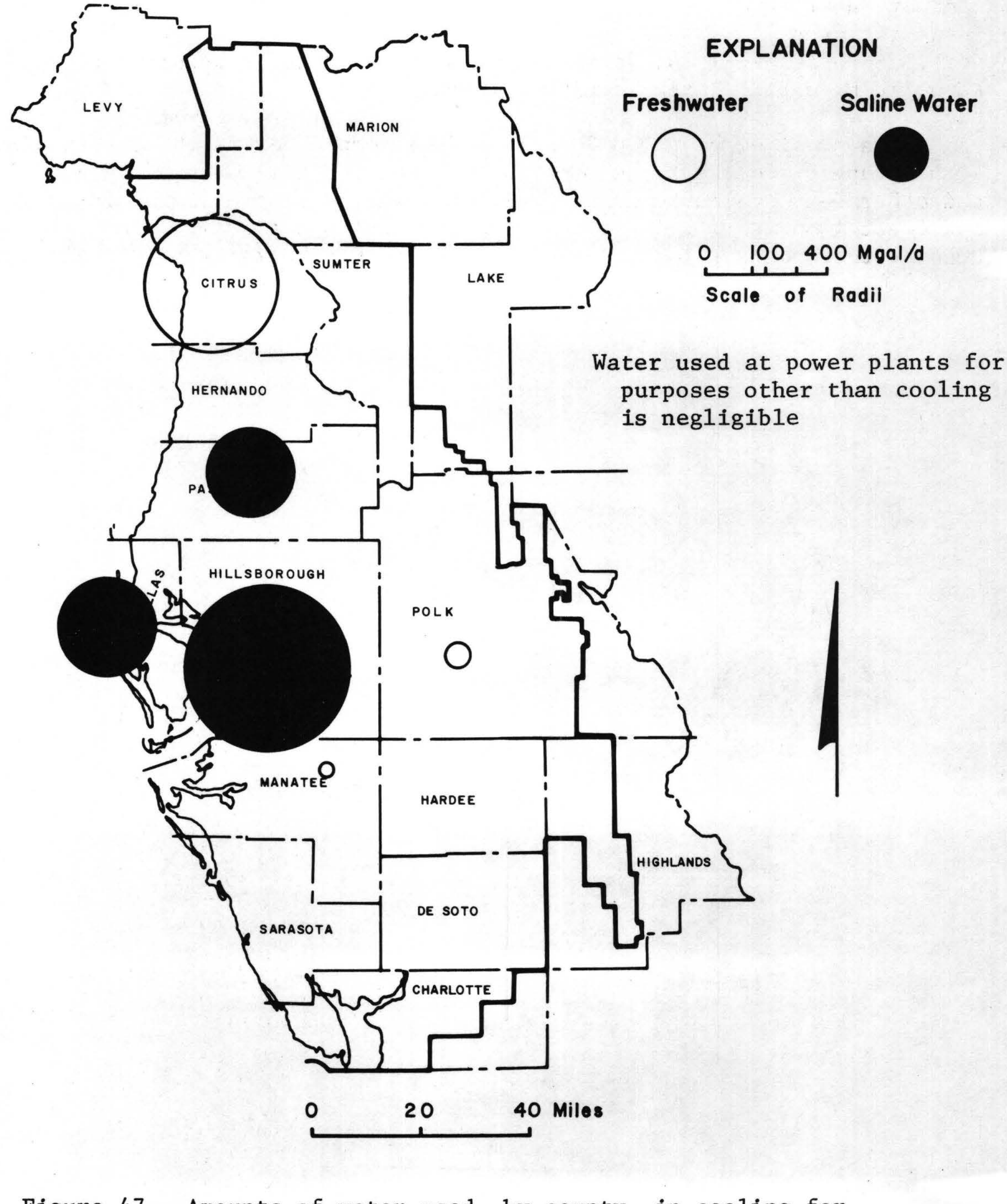


Figure 47.--Amounts of water used, by county, in cooling for thermoelectric power in 1978.

To date, a total of 69 wells have been constructed at 47 ROMP sites (fig. 48). Of these wells, 50 monitor water levels in the artesian aquifer and 10 monitor water levels in the water-table aquifer. Water levels will be monitored in the other nine wells when field testing is completed. Table 2 lists data for the present wells at 47 sites and selected data at proposed sites. Completed wells have been assigned site numbers.

Data provided on table 2 include date completed, depth, casing diameter, stratigraphic zone that the well is finished in, frequency of data collection, and other data available on the well. Similar data are listed in table 3 for the coastal monitor transect wells. These wells are drilled in a line perpendicular to the coast for purposes of monitoring the saltwater-freshwater interface.

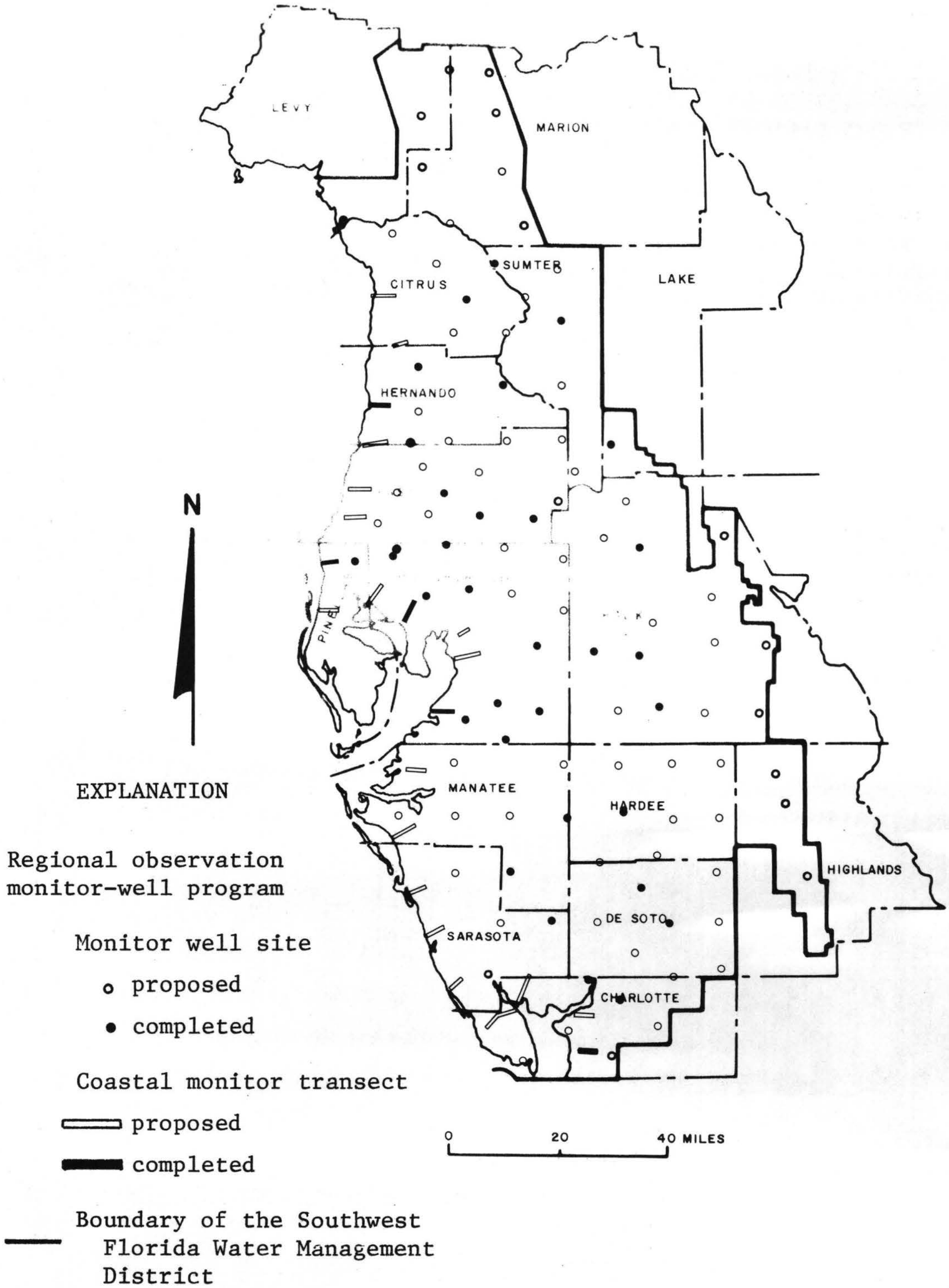


Figure 48.--Locations of wells in the regional observation monitor-well program network.

Table 2.--Data available for ROMP wells

[Data codes: A - time; B - collar; C - caliper; Cl - chloride; Con - continuous record; D - driller's; E1 - electric, single point; E2 - electric, 16 and 64; FC - fluid conductivity; FR - fluid resistivity; G - lithologic; H - magnetic; I - induction; J - gamma ray; K - dipmeter; k - specific conductance (umho/cm at 25°C); L - laterlog; M - microlog; N - neutron porosity; P - photograph; PT - penetration; Q - radioactive; SC - specific capacity; SG - sonograph; SP - self potential; SV - acoustic velocity; T - temperature; TV - television; U - gamma-gamma density; V - fluid velocity; Wl - water level; Z - other.]

Site number	Site name	SWFWMD number	Basin	Quadrangle	Date completed	Depth open to aquifer (ft below NGVD of 1929)	Casing diameter (in)	Stratigraphic zone	Data collected		Data available
									Type	Frequency per year	
	Placida	2	Peace River	Punta Gorda, El Jobean							
		4	Peace River	Bermont							
		7	Peace River	Englewood, Placida							
	Well 3 of transect 2	9	Manasota	Murdock							
2701520820028.04	Deep Creek	10	Peace River		4-25-75	0-10	4	Pleistocene sand	Wl	12	Cuttings
2701520820028.02		10			4-12-75	283-555	8	Tampa and Hawthorn Limestone	Wl T,Cl,k	12 6	G to 575', C, El, J
2701520820028.01		10			5-09-75	575-897	8	Suwannee and Ocala Limestones	Wl T,Cl,k	12 6	G to 917', C, El, J, V
2701520820028.03		10			4-20-75	90-250	4	Hawthorn Limestone	Wl T,Cl,k	12 6	G to 270', C, El, J
2658370815611.01	Shell Creek	11	Peace River		7-09-75	210-324.5	4	Hawthorn Limestone	Wl	12	G to 334.6, J, T, C, FR, core
		12	Peace River	Arcadia SE							
		13	Peace River	Long Island Marsh							
		15	Peace River	Long Island, Marsh NW and NE							
		16	Peace River	Arcadia							
	Horse Creek	17	Peace River								
		18	Manasota	Murdock NW							
		19	Manasota	Lower Myakka Lake							
		22	Manasota	Old Myakka, Bee Ridge							
		23	Manasota	Myakka City							
		25	Peace River	Limestone							
2717570814930.01	Brownsville	26	Peace River	Gardner		+62 - +57	6	Surficial	Wl	Con	G
2717570814930.02		26				740-1,245	8	Avon Park	Wl	Con	G to 1,320'; cuttings; El, C, J, FR, T
2717570814930.03		26				65-105	8	Hawthorn	Wl	Con	G to 1,320'; cuttings; El, C, J, FR, T
		28	Peace River	Crewsville SW							
		29	Peace River	Crewsville, Sweetwater							
		30	Peace River	Zolfo Springs							
2727140825459.01	Ona, Avon Park	31	Peace River	Ona	7-30-76	380-1,072	8	Suwannee, Ocala, Avon Park	Wl K,T,Cl	Con 6	G to 1,152'; El, J, T, FR
2727140815459.02	Ona, Hawthorn	31			5-10-77	50.14-270.14	8	Hawthorn, Tampa	Wl K,T,Cl	Con 6	C, El, J, T
2727140815459.03	Ona, Shallow	31			1-14-76	+74.86-+64.86	6	Surficial	Wl	Con	G to 15'
2728130820349.01	Myakka Head	32	Manasota	Myakka Head	12-21-77	460-500	6	Suwannee Limestone	Wl	Con	
2728130820349.02	Myakka Head	32			12-21-77	800-1,115	6	Avon Park	Wl	Con	G, J, U, N, E2, SP, FR, C, SV, TV
	Kibler Tower	33	Manasota	Myakka City NW							
		34	Manasota	Lorraine							
		38	Manasota	Parrish							
		40	Manasota	Duette							

Table 2.--Data available for ROMP wells - continued

Site number	Site name	SWFWMD number	Basin	Quadrangle	Date completed	Depth open to aquifer (ft below NGVD of 1929)	Casing diameter (in)	Stratigraphic zone	Data collected		Data available
									Type	Frequency per year	
		41	Peace River	Ft. Green							
		42	Peace River	Wauchula							
		43	Peace River	Griffins Cor., Avon Park							
		44	Peace River	Berea							
2745470814709.01	Ft. Meade	45	Peace River	Homeland	10-07-74	+11.5-70.5	4	Hawthorn	Wl	Con	C, El, J, T, core
2745470814709	Ft. Meade	45	Peace River	Homeland	2- 78	190.5-318.5	8	Suwannee			G to 440', cuttings; El, C, J, T
2745470814705	Ft. Meade	46	Peace River	Baird	2-28-78	559-636	8	Avon Park			G to 757', El, C, J, T
2744270820837.01	Thatcher	48	Alafia	Ft. Lonesome	2-11-76	110-436	16	Tampa, Suwannee, Ocala	Wl	Con	G to 535', J, El, T, C
2744270820837.02		48			2-17-76	+59.5-+44	8	Bone Valley	Wl	Con	G to 75'
2744270820837.03		48			6- 78	678-713	8	Avon Park	Wl	Con	
2745460821514.01	Balm	49	Alafia		1-21-76	49-474	8	Tampa, Suwannee	Wl	Con	G to 620', El, C, J, FC, T
		49									
2742400822127.01	Sun City Center	50	Alafia	Wimauma	1-02-76	156-518	8	Tampa, Suwannee	Wl	Con	G to 562', El, C, J, cuttings
2742400822127.02	Sun City Center	50	Alafia	Wimauma	1-03-76	+8-+3	6	Surficial	Wl	Con	
2742400822127.03	Sun City Center	50	Alafia	Wimauma	2- 77	596-1,208	8	Avon Park	Wl k,T,Cl	Con 6	J, U, N, E2, T, C, SV, SC, V
2744210822754.01	Well 1 of transect 9	51	Alafia						k,T,Cl	6	
		55	Peace River	Bradley Jct., Homeland							
		56	Peace River	Alturas							
		57	Peace River	Eloise							
2753140815142.01	Bartow Ball Park	59	Peace River	Bartow	5-01-74	5-930	12	Tampa, Avon Park	Wl k,T,Cl	Con 6	D to 1,400', El, C, J, FC, SC
2753140815142.02	Bartow Ball Park	59	Peace River	Bartow	5-07-74	+68-+58		Hawthorn	Wl	Con	
2753140815142.03	Bartow Ball Park	59	Peace River	Bartow	5-10-74	4-24		Hawthorn	Wl	Con	
2753260815858.01	Mulberry deep well	60	Alafia			136-609	10	Avon Park	Wl	Con	
2754290820941.0	Pleasant Grove	61	Alafia		11-22-77	226-230	12				J, T, C, FC, El
	78th St.	63	Hillsborough								
2758170823250.01	Sweetwater deep	64	NW Hillsborough			117-122	6	Tampa, Suwannee	Wl k,Cl,T	Con 12	
2758170823250.02	Sweetwater shallow	64				0.7-2.7	6	Surficial	Wl	Con	
	Florida Downs well 2 of transect 13	65	NW Hillsborough								
2802090822803.01	Chamberlain	66	Hillsborough	Sulphur Springs	4-18-76	2-210	8	Tampa	Wl	Con	G to 245', El, C, J, T
2803310822036.01	Golden Gate	67	Hillsborough	Thonotossassa	4-16-79	400-450	8	Avon Park	Wl	Con	G to 430'; El, J, FR, T
2803310822036.02		67	Hillsborough	Thonotossassa	4-16-79	30-101	6	Tampa, Suwannee	Wl	Con	
		68	Hillsborough	Thonotossassa, Antioch							
		69	Hillsborough	Plant City							
		73	Peace River	Winter Haven							
		75	Green Swamp	Auburndale							
2810570814950.01		76	Green Swamp	Polk City	4-29-74 revisit 79	+84-+61	6	Hawthorn	Wl	Con	Core and split spoon

Table 2.--Data available for ROMP wells - continued

Site number	Site name	SWFWMD number	Basin	Quadrangle	Date completed	Depth open to aquifer (ft below NGVD of 1929)	Casing diameter (in)	Stratigraphic zone	Data collected		Data available
									Type	Frequency per year	
2808010823104.01	Dundee Ranch	--	Hills-borough	Odessa	2- 74	+5- -633	8	Suwannee, Ocala	Wl	Con	D to 675'
2811150822500.01	Livingston	80	Hills-borough	Lutz	5- 76	+72.7- +62.7	6	Surficial sand	Wl	Con	G to 26.5'
		80			6- 76	7-61.8	-	Suwannee			G to 143'
2809460823104.03	St. Pete-Pasco So.		Hills-borough	Odessa	5-09-74	-34- -638	6	Suwannee, Ocala	Wl	Con	D to 700'
			NW Hills-borough	Odessa							
	Tarpon Sink, well 3 of trans-sect 15	82	Pinellas-Anclote								
2814250821925		85	Hills-borough	Wesley Chapel	7-17-78	340-395	8	Avon Park			G to 450', El, C, J, FC, T
2815050821048.01	Zephyrhills	86	Hills-borough	Dade City		338-348	8				D to 480', C, J
		87	Green Swamp	Branch-borough							
		88	Green Swamp	Rock Ridge							
		90	Withlacoo-chee	Lacoochee							
		94	Pithlachas-cotee	Fivay							
		95	Pithlachas-cotee	Port Richey							
2826050823458.01	Well 2 of transect 18	97	Pithlachas-cotee			278-313	6	Avon Park	Wl k,T,Cl	Con 6	
		98	Pithlachas-cotee								
		99	Withlacoo-chee	Lacoochee							
		100	Withlacoo-chee	Clay Sink							
2827170815531.01	Bay Lake	101	Green Swamp		-77	+59-273	8	Avon Park	Wl	Con	G to 374', El, C, J, FC, FR, T
2827170815537.01	Bay Lake	101	Green Swamp		4-25-77	17-309	8	Avon Park			G to 404', El, C, J, FC, T
		102	Withlacoo-chee	Webster							
2835370821515.01	103 deep nr Brooks-ville	103	Withlacoo-chee	Brooksville SE, St. Catherine	1- 77	57-144	8	Suwannee	Wl	Con	G to 198', C, J, T, FC, El
		105	Pithlachas-cotee	Brooksville							
	Palm 23	106	Pithlachas-cotee								
2839050822725.01	Ringgold	107	Pithlachas-cotee	Brooksville	12-01-76	24-124	8	Ocala, Avon Park	Wl	Con	Core, G to 344.5', El, C, J, FC, T
		107			9-16-76	?-228	-	-			
		109	Crystal-Homosassa	Brooksville							
		110	Withlacoo-chee	Nobleton							
2846190820351.01	G. C. Tompkins	111	Withlacoo-chee		9-06-74	17-179	8		Wl	Con	El, C, J, T
		112	Withlacoo-chee	Rutland							
2851240822456.01	Inverness west	113	Withlacoo-chee	Lecanto	6-07-74	+83-15	6		Wl	Con	
2857200822013.01	Tsala Apopka	116	Withlacoo-chee	Tsala Apopka	6-13-74	4-20	6	Ocala?, Avon?	Wl	Con	D to 55'
		117	Withlacoo-chee	Oxford							
		118	Withlacoo-chee	Shady, Belleview							
		119	Withlacoo-chee	Dunellon SE							

Table 2.--Data available for ROMP wells - continued

Site number	Site name	SWFWMD number	Basin	Quadrangle	Date completed	Depth open to aquifer (ft below NGVD of 1929)	Casing diameter (in)	Stratigraphic zone	Data collected		Data available
									Type	Frequency per year	
		120	Withlacoo-chee	Cotton Plant, Ocala W							
		122	Withlacoo-chee	Yankeetown SE							
2740310821504.01	Starling	123	Alafia		2-09-77	65-568	8	Tampa, Su-wannee, Ocala	Wl	Con	G to 620', El, C, J, FC, T
2902000824315.01	Yankeetown	124	Withlacoo-chee	Yankeetown SE	6-21-77	194-244	8	Avon Park			G to 254', El, C, J, FC, T, V, core
2902000824315.02	Yankeetown	124	Withlacoo-chee	Yankeetown			6				
2809010823104.04	Dundee BM		NW Hills-borough			6-687	8		Wl	Con	El, C, J, FC, T, V
	Channel A										
	Channel B										
2808520824143.01	East Lake		Pinellas Anclote		4- 67	710-732	8		Wl K,T,Cl	12 12	

Table 3.--Data available for ROMP coastal transect wells

[Data codes: A - time; B - collar; C - caliper; Cl - chloride; Con - continuous record; D - driller's; El - electric, single point; E2 - electric, 16 and 64; FC - fluid conductivity; FR - fluid resistivity; G - lithologic; H - magnetic; I - induction; J - gamma ray; K - dipmeter; k - specific conductance (umho/cm at 25°C); L - laterlog; M - microlog; N - neutron porosity; P - photograph; PT - penetration; Q - radioactive; SC - specific capacity; SG - sonograph; SP - self potential; SV - acoustic velocity; T - temperature; TV - television; U - gamma-gamma density; V - fluid velocity; Wl - water level; Z - other.]

Site number	Site name	SWFWMD number	Basin	Quadrangle	Date completed	Depth open to aquifer (ft below NGVD of 1929)	Casing diameter (in)	Stratigraphic zone	Data collected		Data available
									Type	Frequency per year	
		2-1	Peace River	El Jobean, Murdock							
		2-3 (site 9)									
		3-1	Peace River	Englewood, El Jobean							
		3-2									
		3-3 (site 7)									
		4-1	Manasota	Venice, Myakka River							
		4-2									
		5-1	Manasota								
		5-2									
		6-1	Manasota	Sarasota, Bee Ridge							
		6-2									
		7-1	Manasota	Bradenton							
		7-2									
		8-1	Manasota	Palmetto							
		8-2									
2744210822754.01		9-1 (site 51)	Alafia	Ruskin		120-284	8		Wl k,T,Cl	12 6	G to 470', core, J, El, T, C
2744280822515.01		9-3	Alafia	Ruskin	3- 76	12-17	6	Surficial	Wl	12	G
		9-4 (site 50)									
2754020822227.02		10-2	Alafia		5-16-78		6	Surficial	Wl	Con	
2754250822227.01		10-Sh				+1.5		Surficial			G to 470', FR, El, T, J, C
		10-3									
	Maydell	11-1									
		11-2	Hills-borough	Tampa							
2758170823250.01		12-1 (site 64)	NW Hills-borough	Citrus Park		117-122	8		Wl k,T,Cl	Con 12	G to 260;, core, J, El, T, C, FR
2758170823250.02		12-1				1-3	6	Surficial	Wl k,T,Cl	Con 12	
		12-2									
		12-3									
2803540823819.01	St. Pete 101 (purchased)	13-3			7-27-62	695-792	6	Avon Park Limestone	Wl k,T,Cl	Con 12	G
		14-2									
		14-3									
2807530824652.01		15-1	Pinellas-Anclote	Tarpon Springs, Elfers	7- 77	60-79	8	Tampa Lime-stone	Wl k,T,Cl	Con 6	G to 140', El, C, FR, T, core
2807470824520.01		15-2			7-16-76	37-41	8	Tampa Lime-stone	Wl k,T,Cl	Con 6	G to 201', core, El, C, J, FR, T
2807340824421.01		15-3 (site 82)	Pinellas-Anclote		3-08-74	122-125	8	Tampa Lime-stone	Wl k,T,Cl	Con 6	G to 266', core
		16-1	Pithlachas-cotee	Elfers, Port Richey							
		16-2									

Table 3.--Data available for ROMP coastal transect wells - continued

Site number	Site name	SWFWMD number	Basin	Quadrangle	Date completed	Depth open to aquifer (ft below NGVD of 1929)	Casing diameter (in)	Stratigraphic zone	Data collected		Data available
									Type	Frequency per year	
2819170824209.01		17-1	Pithlachas- cotee	Port Richey	9-25-78	122-130		Suwannee Limestone	Wl k, T, Cl	Con 6	G to 130', El, C, J, FR, T
		17-2									
2819220824039.01		17-3 (site 95)	Pithlachas- cotee	Port Richey	8-09-78	155-170		Suwannee Limestone	Wl k, T, Cl	Con 6	G to 170', C, J, T
2827420823759.01		18-1	Pithlachas- cotee	Aripeka	8-26-77	430-565	6	Avon Park	Wl k, T, Cl	Con 6	G to 565', El, C, J, FR
		18-2									
		19-1	Pithlachas- cotee	Bayport, Weeki Wachee							
2832430823657.01	Whitehurst (BM)	19-2			8-08-74	270-295	6		Wl k, T, Cl	Con 6	G, cuttings, C, J, T
		20-1	Crystal- Homosassa	Chassahowitz- ka							
		20-2									
2851120823544.01		21-2	Crystal- Homosassa			102-108	6	Avon Park	Wl k, T, Cl	Con 6	
2852340823419.01		21-3	Crystal- Homosassa				6	Avon Park	Wl k, T, Cl	Con 6	
		21-4									

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