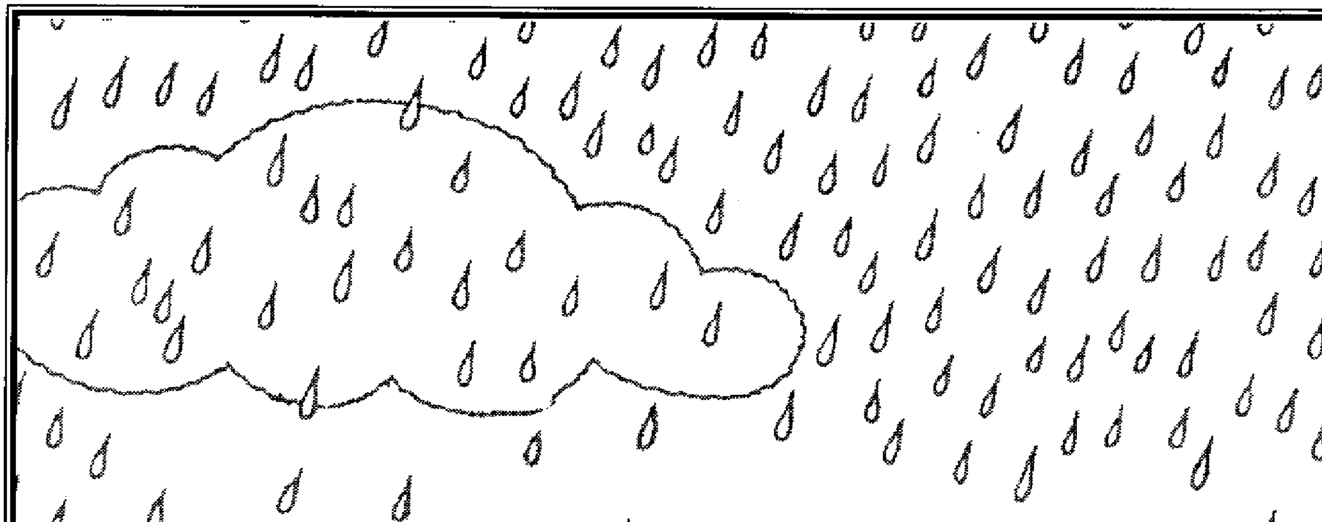


TECHNICAL MEMORANDUM

1994 Extended Wet Season Hydrologic Conditions

DRE 324

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Department of Water Resources Evaluation ■ Ecosystems Research and Implementation Department ■ Operations and Maintenance Department ■ Planning Department ■ Regulation Department ■ Office of Government and Public Affairs

Technical Memorandum

1994 EXTENDED WET SEASON HYDROLOGIC CONDITIONS

DRE 324

South Florida Water Management District

May 1995

TABLE OF CONTENTS

List of Figures

List of Tables

EXECUTIVE SUMMARY

In a word, 1994 was *wet*. Meteorologists and hydrologists are declaring it one of the wettest years in recent history, with rainfall in some areas breaking all records.

It rained intermittently all year, filling lakes, streams and underground aquifers. Both people and the natural systems were impacted. By late 1994, water levels were so high that managers had no viable alternatives than to release large amounts of fresh water to sensitive coastal estuaries, along the Gulf and the Atlantic Ocean. High water accumulated in the Everglades, causing extensive animal mortality, although all efforts were made to minimize the situation. Water levels eventually receded and life returned to normal. However, memories will not soon be forgotten.

Rainfall. Precipitation in the District's 16-county region, stretching from south of Orlando to Key West was 65 inches -- 13 inches above average! The highest rainfall amount recorded at a District station in a single year was 95 inches, where the St. Lucie Canal intersects the Florida Turnpike. Several rainfall stations in Broward County recorded in excess of 90 inches. Readings at the lower end of the scale were found in Glades and Hendry counties, with Clewiston and Moore Haven each receiving about 47 inches. The only region considered "normal" was the southwest coast, mainly comprised of Lee and Collier counties.

Much of south Florida remained wet nearly all year. Districtwide rainfall from January through April was 140 percent of normal; May to August 97 percent; September and October 116 percent; and November and December wrapped up the year with a drenching 316 percent.

By October, ground and surface water storage were nearly full. Then during the normally dry months of November and December, the region received another 11.60 inches! Tropical Storm Gordon swept through the District twice in November dumping 7 inches, and 4 inches on each occasion. The unusually heavy rainfall caused widespread flooding of streets and yards, crop loss, and impacts to ecological systems and wildlife.

System Operations. South Florida's waters are managed by one of the world's largest water conveyance systems. The Central and Southern Florida (C&SF) Project was authorized by the federal government in 1949 following a series of deadly hurricanes and droughts. Its purpose: temper and tame nature's climactic extremes to make Florida a safer and more habitable place. The system consists of a complex network of 1,500 miles of canals and levees, 215 primary water control structures, numerous smaller facilities, and 25 major pump stations. It was built by the federal government and is operated by the District. The major canals are fed by literally thousands of smaller secondary and tertiary public and private drainage systems.

The C&SF Project was built to handle a percentage of Standard Project Flood (SPF) rainfall conditions, which represent a 100 year one-day rainfall event increased by 25 percent. Hurricanes and other extremely wet years can be expected to cause some flooding. Also, since the C&SF system was designed nearly 50 years ago it frequently strains to keep up with today's population and infrastructure. However, the system worked as well as expected last year -- even performing in excess of design capabilities. As a result, most urban and agricultural areas were served well and impacts to the natural environment were minimized.

Impacts to Urban and Agricultural Areas. Last year's rains were slow and steady generally, and the regional drainage system was able to convey *most* potential floodwaters out to sea or away from urban and agricultural areas. However, flooding was reported throughout the region from August to November for a number of reasons. Some common causes include:

♦ Standing water in streets, recreational areas, and residential yards. This is because local drainage systems are designed to store excess water in these areas, and it is considered "normal" to take several days or longer to fully drain.

♦ Local flooding resulting from poorly maintained secondary drainage systems. Serious flooding can occur when secondary and tertiary drainage systems -- which feed into the District's primary canal system -- are not properly maintained. These work adequately during normal weather conditions because they are not stressed. However, when ignored and not properly maintained, they become restrictive and inhibit water flow and drainage. Much of last year's local flooding was directly related to poorly maintained non-District drainage systems.

♦ Collected water in very low areas. Another common type of flooding occurs routinely in developments built in low, flat areas. Florida has little topographic relief and many rural developments are near, or in, swamps or marshes. People who choose to live in these areas normally experience flooding during an above normal rainfall year, and can count on it during an especially wet year such as 1994.

Fortunately, there were few reports of extensive property or home damage resulting from last year's rains, with several exceptions worth noting: a number of houses in an older area of Hobe Sound were damaged; standing water on agricultural fields caused crop damage; flooding occurred in the East Everglades and in an 8.5-square-mile area in Dade County; and Miccosukee lands were affected. (In March, a federal judge ruled the District was not at fault in the case of the Miccosukees, citing that the District operated the C&SF Project according to design objectives.)

Ecological Impacts. Humans were not the only creatures impacted by high water levels. The most noticeable effects were felt by coastal estuaries and Everglades wildlife. A discussion of how some components of the greater Everglades ecosystem fared follows:

Kissimmee River. The channelized river is designed to convey large quantities of water. As a result, much of its floodplain (rangeland) was inundated as expected, although this did not cause a long-term impact. The 1,000-foot test-fill was delayed for approximately 30 days and a related revegetation project was canceled. However, this measure will not impact the overall restoration project.

Heavy infestations of hydrilla restricted large releases of water from Lake Tohopekaliga in August. Eventually, enough vegetation was removed to reduce flow blockages. However, additional resources are needed to manage hydrilla to ensure that flood control is not compromised in the future.

Lake Okeechobee. An additional amount of 267 tons (1 ton = 2,000 pounds) of phosphorus washed into the Lake because of runoff from watersheds north of the Lake, with smaller amounts from agricultural back-pumping. The long-term impacts, if any, have not been determined. Lake Okeechobee can naturally assimilate a portion of this nutrient load and subsequently some of the load was flushed out during coastal discharges.

Coastal estuaries. Estuaries are nursery grounds for shellfish and other small marine organisms at the base of the food chain. These highly productive areas require a brackish water environment. The water management system benefits coastal estuaries when it sends fresh water to them during times of drought. It can be detrimental, however, when large quantities of fresh water are discharged to tide via estuaries in order to lower high water levels.

This occurred in late 1994 when the District was forced to make fresh water releases to the Lake Worth, St. Lucie and Caloosahatchee estuaries. In mid-September the agency initiated environmentally-friendly "pulse" releases. These pulse releases are intended to mimic freshwater inflows to the estuaries under normal conditions. Water is released in 10-day pulses in which discharges start out slow, increase to a maximum amount, then decline again. Four series of such pulses occurred through mid-November. At that time, the agency was forced to begin continuous releases due to heavy rains. These lasted until January 1995, at which time pulse releases were resumed and continued until late April, 1995.

Fresh water impacts to the estuaries from these heavy releases were recorded as far away as the Indian River Lagoon and San Carlos Bay. It is expected that seagrasses and other productive features were damaged, although it will take a year to assess the degree of damage.

Water Conservation Areas. The Everglades developed over 5,000 years of climatic extremes, including drought, floods and fire. Last year's flooding devastated the deer population and killed many other terrestrial mammals such as mice, possums and raccoons in Water Conservation Area 3. Although this is extremely unfortunate, the mammal population should naturally recover in three to four years. On a positive note, the flooding has been beneficial to fish and other aquatic resources, and the Everglades could experience an excellent wading and migratory bird nesting season with abundant fish available for foraging.

Florida Bay. Florida Bay received a large infusion of fresh water in 1994 and experienced record-low salinity levels. While additional fresh water is sought for the Bay over a long period, scientists do not yet know the biological effects of drastically changing fresh water inputs and salinity during a single wet season. No negative effects of the fresh water inflows were observed in 1994.

While the above-normal rain created some havoc, it did provide beneficial effects as well. The generous rains raised regional ground and surface water levels, providing a valuable fresh water supply for urban, agricultural and environmental users and recharging peninsular Florida's ability to resist saltwater intrusion.

CHAPTER 1
INTRODUCTION

The Mission of the South Florida Water Management District (SFWMD) is to manage the natural resources (water resources) of the 16 county area for environmental and water quality enhancement, flood protection and water supplies. One of the primary functions of natural resources management is to operate the system of levees, canals and water control structures during normal as well as above normal (for flood control) and below normal (for water supply) conditions, in an optimal manner. The driving force for natural resources management in south Florida is the varying amount of rainfall the District receives.

Floods are common in south Florida due to the area's flat topography and low elevation in combination with high amounts of rainfall from thunderstorms, tropical depressions and hurricanes. Additionally, due to the shallow water table of the area, runoff is high. Therefore, south Florida is subject to damage from flooding.

In 1994 south Florida experienced one of the wettest years in history. The area experienced several storm events, the significant ones occurring during November and December. The heavy rains of 1994 caused flooding in several areas of the District at various times. In addition, higher than normal freshwater discharges from Lake Okeechobee had to be made through Caloosahatchee and St. Lucie River outlets to the estuaries. Florida Bay also received higher than normal amounts of freshwater discharge from the Water Conservation Areas.

The SFWMD has analyzed and documented reports on various storms as well as wet season and dry season conditions since the 1960s to inform the public, provide a systematic record of rainfall events, and analyze the impacts on the District's operations in terms of minimizing the impact on the ecosystem and protecting the area from floods.

The objective of this report is to compile and analyze all available provisional data on hydrometerology, water quality and the environment as well as descriptions of different areas that were impacted by the heavy rainfall of 1994 and the storm events of November and December.

This page intentionally left blank

CHAPTER 2
METEOROLOGICAL DESCRIPTION OF 1994

During 1994, 65.22 inches of rain fell over the District -- nearly 13 inches above the annual mean. The most substantial increases of rainfall occurred during what is historically considered the dry months as seen in Figures 1 and 2. If normal rains are defined as the climatological mean, then normal to above normal rains fell during 9 of the 12 months and all basins were well above the mean except for the Caloosahatchee River and the Southwest Coast.

During the dry months (November through March), high pressure typically dominates the weather pattern except for occasional disturbances such as cold fronts which bring rainfall episodes. During the wet months (June through September), warm tropical air resides over the region allowing a regular daily cycle of thunderstorms to develop. Superimposed over this daily cycle are enhanced rain days generated by disturbances such as upper level lows and tropical cyclones. May and October represent transitional months between the two seasons. For this report, the wet season is defined as May through October and the dry season as November through April. In a typical year, 52 inches of rain will fall with three-quarters falling in the six-month wet season. Due to seasonal variability in the length of day, the sun angle, and cloud cover, evapotranspiration is greatest in May and at a minimum in December and January. Therefore, if the wet season is slow to commence, conditions can be very dry and if it is late in ending, conditions can become very wet.

Table 1 breaks down the year into four periods of rainfall: the end of the 93-94 dry season, the first portion of the wet season, the second portion of the wet season, and the beginning of the 94-95 dry season. Each period is discussed below.

Table 1. 1994 Rainfall Distribution

	Jan-Apr	May-Aug	Sep-Oct	Nov-Dec
Measured	13.30"	26.18"	14.14"	11.60"
Climatological Mean	9.52"	27.11"	12.14"	3.67"
Percent of Normal	140%	97%	116%	316%

During 1994, the historically dry months of January through April were wet, producing an excess of nearly 4 inches of rain, particularly along the Upper East Coast (Martin and St. Lucie Counties). The normal daily thunderstorm cycle began in late May and continued into the wet season. Near normal rains then fell during the first four months of the wet season, though the Upper Kissimmee Valley received an excess of 5 inches of rain and the Upper East Coast received an excess of 4 inches between May and August. Rains were enhanced during this period by a number of upper level disturbances as well as the indirect effects of Tropical Storm Alberto in early July, Tropical Depression 2 in late July, and Tropical Storm Beryl in early August.

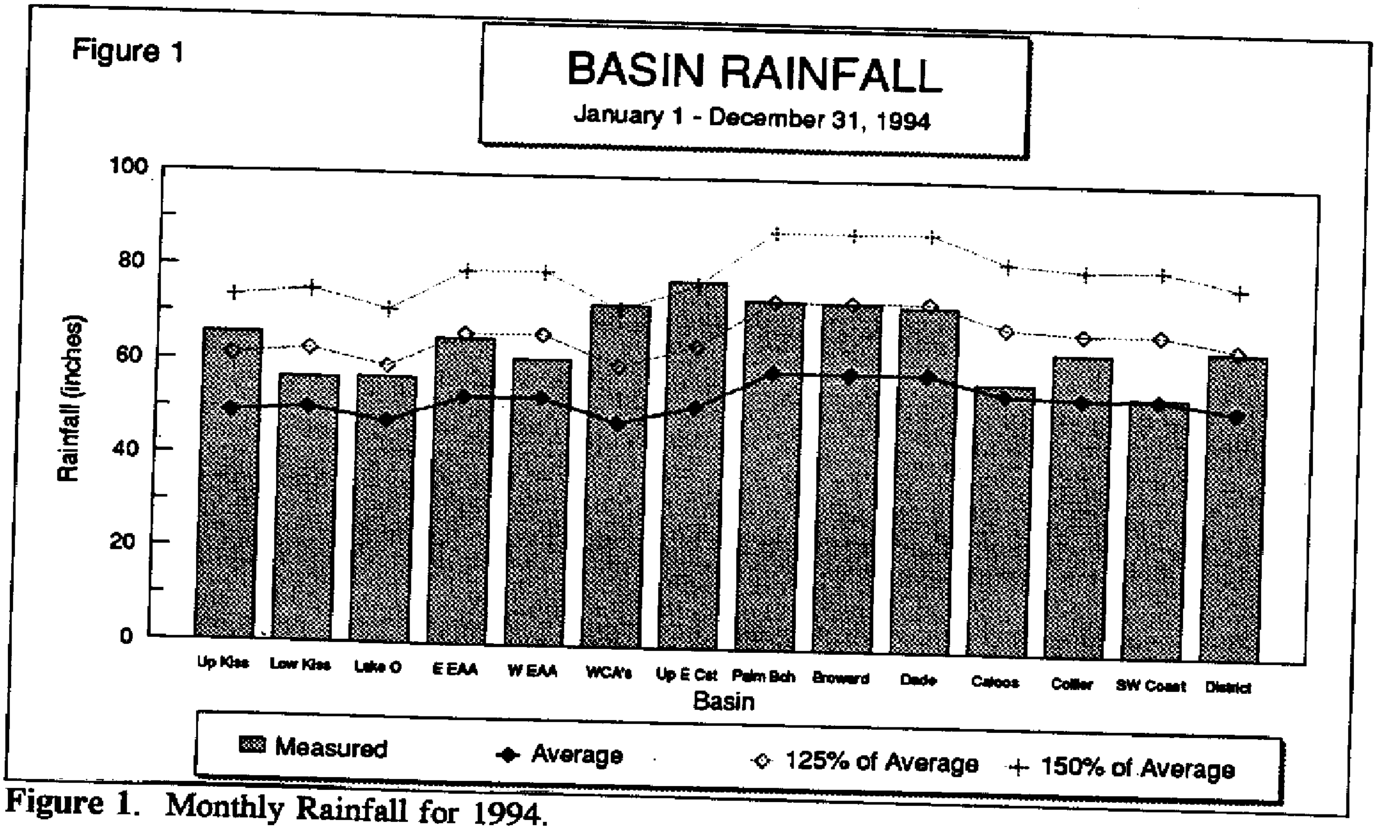


Figure 1. Monthly Rainfall for 1994.

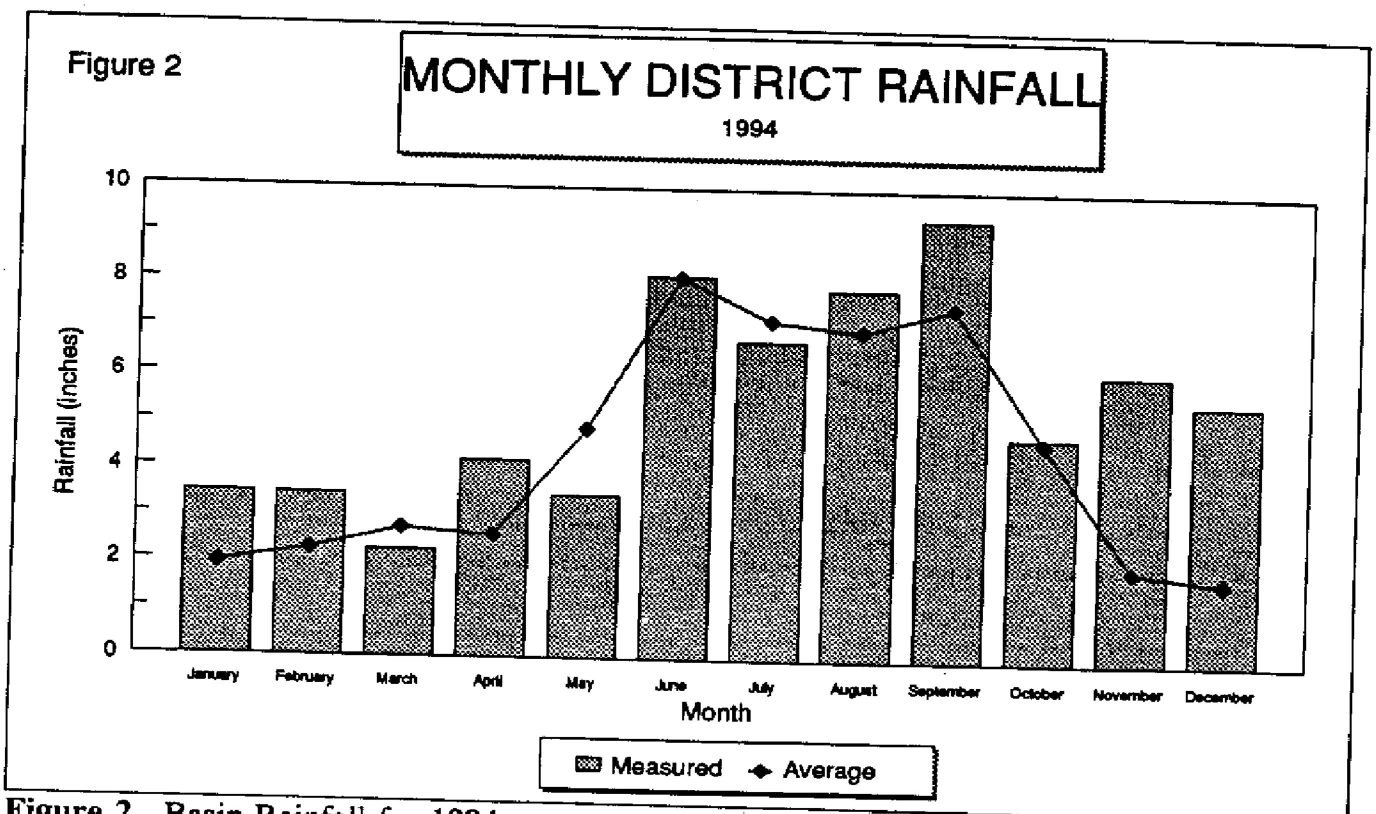


Figure 2. Basin Rainfall for 1994.

The typical thunderstorm pattern continued in early September, but rainfall increased significantly from September 12th through the 15th as the remains of Tropical Storm Debby interacted with a stalled front producing 2.43 inches. Another stalled front brought 2 inches of rain between the 18th and the 20th and moisture associated with Tropical Depression 8 brought 1.78 inches between the 24th and the 27th. Tropical Depression 10 then developed in late September bringing 0.86 inches between September 30 and October 1. By the end of September, which is normally one of the wettest months of the year, monthly rainfall was 125% of normal with a 2 inch excess in the Upper Kissimmee Valley and a 4 inch excess over the Upper East Coast. October was a fairly typical transitional month with the dry season apparently arriving as cold fronts began to regularly move through the area. Rain associated with Tropical Depression 10 in the beginning of the month and two upper level disturbances later in the month brought near normal rains for the month, but a 1 inch excess of rain did fall in the Upper Kissimmee Valley and Collier County.

Instead of beginning the dry season, November and December together produced 11.60 inches of rain, or over three times the average value, due mainly to three excessive rainfall events each separated by about two weeks. November rainfall was dominated by the 5.46 inches brought by Tropical Storm Gordon. This storm produced 90% of the month's rain over a 72-hour period between the 15th and the 17th as the storm moved westward through the Florida Straits and then turned northeastward through the heart of the District. December brought two more heavy rain events. An upper level disturbance moved across the area on the 4th and brought 1.48 inches of rain focused across the Everglades Agricultural Areas, the Water Conservation Areas, and coastal Palm Beach County. A 24-hour rain event between December 20th and 21st then produced 2.85 inches as a low developed along a stalled front south of the District with heaviest rains over the Lower East Coast and the Everglades Agricultural Areas.

Figure 3 depicts a running total of anomalous rainfall from June 1 through the end of the year where anomalous rainfall is defined as the difference between observed rainfall and the climatological mean. Peaks on this graph correspond to rainfall events which have been discussed in this summary. While the 1994 Atlantic Hurricane Season was officially below its climatological mean, the District was either directly or indirectly affected by 7 tropical depressions or storms between July and November. These systems, combined with periodic upper level disturbances and stalled fronts, produced one of the wettest years on record. These rains were most pronounced in the Upper Kissimmee Valley, the Water Conservation Areas, and the Upper East Coast. From a historical perspective, the year was the wettest year since at least the 1960s in every major basin in the District except two, and it was the wettest year since records began in the Upper East Coast and the Water Conservation Areas. This information is summarized in Table 2.

A more detailed description of the spatial distribution of precipitation, including quantification of the frequency of some of the events are provided in the Rainfall Analysis Section of this report.

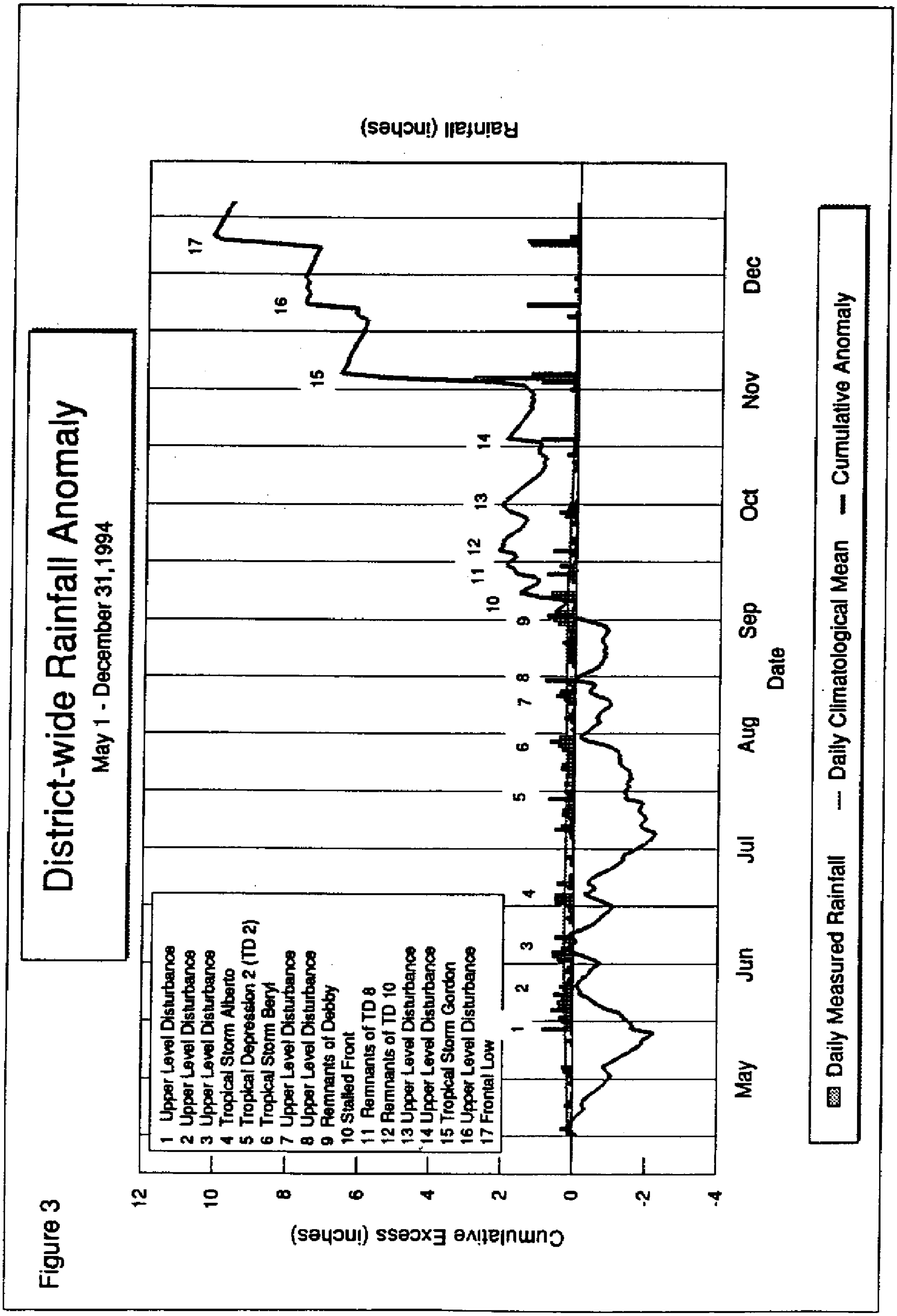


Figure 3. District-wide Rainfall Anomaly from June 1-December 31, 1994.

Table 2. Historical Perspective of 1994 Rainfall

BASIN	1994 RAINFALL	HEAVIEST SINCE[1]	RANK SINCE 1962[2]	RANK SINCE 1949[3]
Upper Kissimmee	66"	1960	1st	4th
Lower Kissimmee	56"	1969	2nd	6th
Lake Okeechobee	57"	1969	1st	3rd
Everglades Agricultural Areas	64"	1960	1st	3rd
Water Conservation Areas	73"	<1915[4]	1st	1st
Upper East Coast	78"	<1915	1st	1st
Lower East Coast	74"	1983	2nd	2nd
Lower West Coast[5]	61"	1983	5th	8th

NOTES:

1. Using data from SFWMD Technical Publication 86-6, Frequency Analysis of SFWMD Rainfall.
2. Flood Act of 1962 was when the Central & South Florida (CS&F) Flood Control Project facilities began to take meaningful shape.
3. The year of the District's creation.
4. Data in the Water Conservation Areas estimated prior to 1963.
5. Not a part of the CS&F Project, except for C-43.

This page intentionally left blank

CHAPTER 3

RAINFALL ANALYSIS

SPATIAL DISTRIBUTION AND FREQUENCY ANALYSIS

In terms of rainfall, weather in south Florida is divided into two distinct seasons; wet and dry. The wet season begins in May and lasts till the end of October. The dry season begins in November and ends in April of the next year. During the wet season south Florida usually receives almost 70 percent of the total annual rainfall. The average annual rainfall for south Florida is approximately 52 inches (Tech. Pub. 86-6). During 1994 south Florida experienced one of the wettest years in history. In addition to receiving the wettest wet season rainfall, south Florida experienced several severe storm events having return periods of several years during the beginning of the 1994-1995 dry season (November and December). The most significant ones were tropical storm Gordon (November 15-17), and the storm events on December 5 and December 21-22.

This section of the report is a preliminary rainfall analysis of sub-basins within the District for the 1994 wet season as well as for the storm events during the months of November and December of the same year. This analysis quantifies the total amount of rainfall received within different subbasins of the District, as well as the average for the District during the wet season. If the 1994 wet season monthly rainfall amount exceeded the average for a certain subbasin, then this amount has a return period of several years. It should be noted that the average basin rainfall has a return period of close to two years. The total wet season rainfall amount is also compared against the average wet season totals, and if any subbasin total exceeds the basin average, the monthly rainfall amount will also be subjected to a frequency analysis to determine the expected return period.

Using the Rainfall Frequency Analysis Procedure (RFAP) currently under utilization by the Hydrologic Projection Model, return periods for basin average monthly rainfall totals for some basins were determined. Historical rainfall data up to 1991 was used to select the best frequency distribution. From the fitted distribution, the return period for the selected 1994 event was determined. Only 1994 months exceeding the long term average were analyzed and only basins for which the current operations and maintenance (OMD) definition agrees with the RFAP basin definition were the subject of frequency analyses.

In addition, magnitudes for different durations for the November and December storm events will be evaluated (such as the 1-day maximum, 2-day maximum, etc.) and will be subjected to frequency analyses. However, these analyses will be based on the results of a study prepared by MacVicar (Tech. Pub. 81-3, Frequency Analysis of Rainfall Maximums for Central Florida).

RAINFALL MEASURING STATIONS WITHIN SUBBASINS OF THE DISTRICT

There are 121 rainfall measuring stations in the District (Figure 4). Rainfall data is collected daily by OMD and grouped by subbasins. The OMD divides the District area into 13 subbasins: (1) Upper Kissimmee, (2) Lower Kissimmee, (3) Lake Okeechobee, (4) EAA East, (5) EAA West, (6) Conservation Areas, (7) Martin-St. Lucie, (8) Palm Beach County, (9) Broward County, (10) Dade County, 11) Caloosahatchee, (12) Collier County, and (13) Southwest (Figure 5). In order to compute the subbasin rainfall, OMD uses 9 rainfall stations within the Upper Kissimmee, 23 within the Lower Kissimmee with one repetitive station (Coley) for both the Upper and Lower Kissimmee basins.

RAINFALL DATA ANALYSIS

Daily Rainfall data were retrieved for the period May 1, 1994 to December 31, 1994 from the OMD data base. These amounts were then summed to monthly values for the wet season period (May through October) to get the wet season total. Rainfall amounts for the months of November and December were also totalled.

Tables 4A through 16A list the monthly rainfall values for each of the 13 subbasins within the District for the months of May through December 1994. In addition, these tables show the total wet season rainfall (May-October) as well as the total for the months of May through December. The tables also show the 1994 monthly basin average rainfall derived by averaging the rainfall values from the stations within the subbasins. The monthly basin average rainfall values are compared against the long-term monthly values (Table 3). Average monthly values for 1994, as a percentage of the long-term average, are also derived. The return frequency, where it was appropriate, was derived from the RFAP.

Tables 4B through 16B show the rainfall statistics for the November and December storm events. For example, Table 4B depicts the rainfall statistics for the storm events in the Southwest coast. It can be seen from the table that during Gordon, the Southwest coast received only 2.97 inches of rainfall. The 1-day maximum rainfall during the storm was 1.76 inches. The basin rainfall for the Southwest coast during the storm events were less than 5 inches.

Table 4C through 16C depict the storm frequencies associated with the storm events. Tables 4C and 6C are blank as there were no storms with return periods greater than three years. The return frequency of average daily rainfall is 2.2 years.

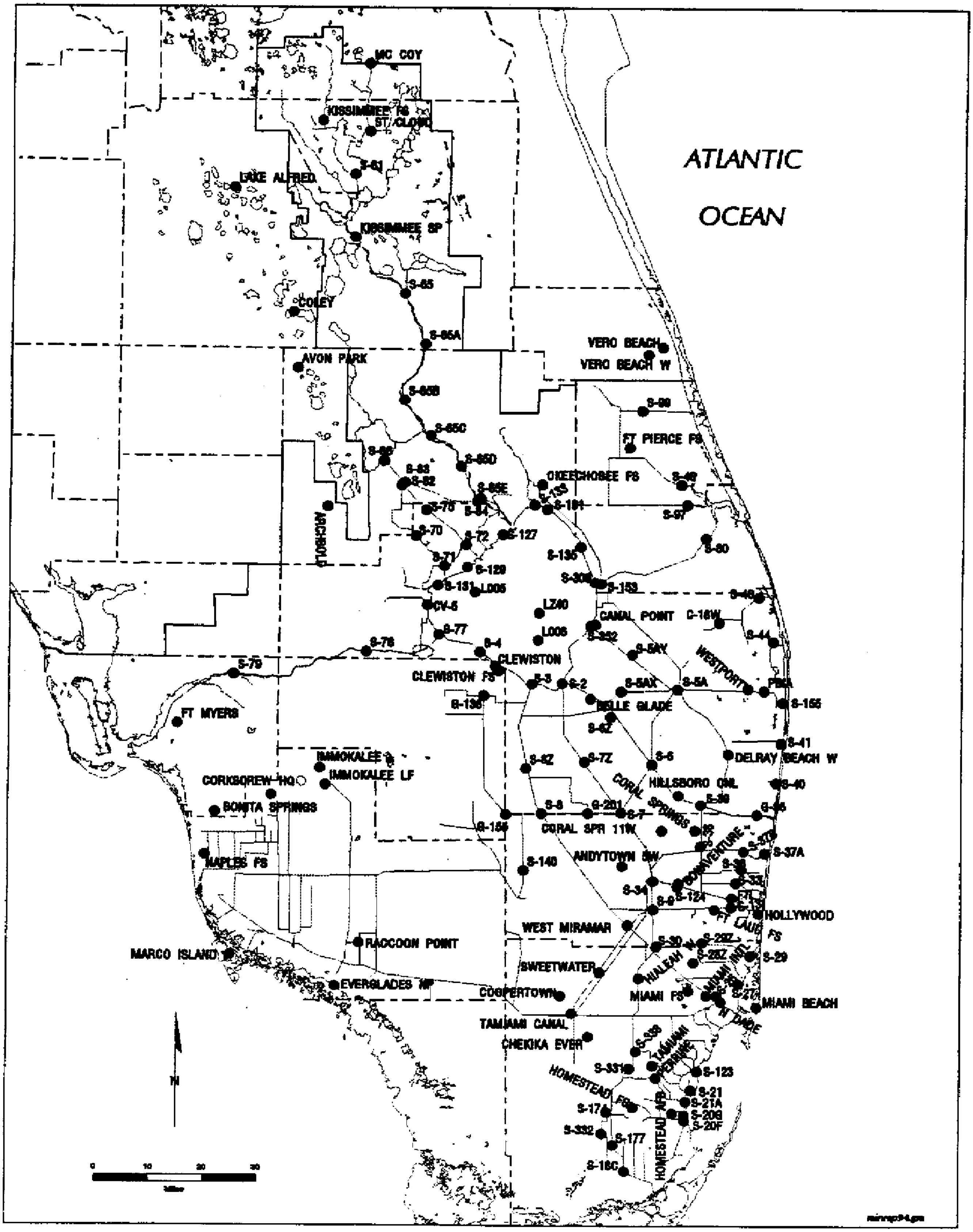


Figure 4. Rainfall Measuring Stations within Subbasins of the District.

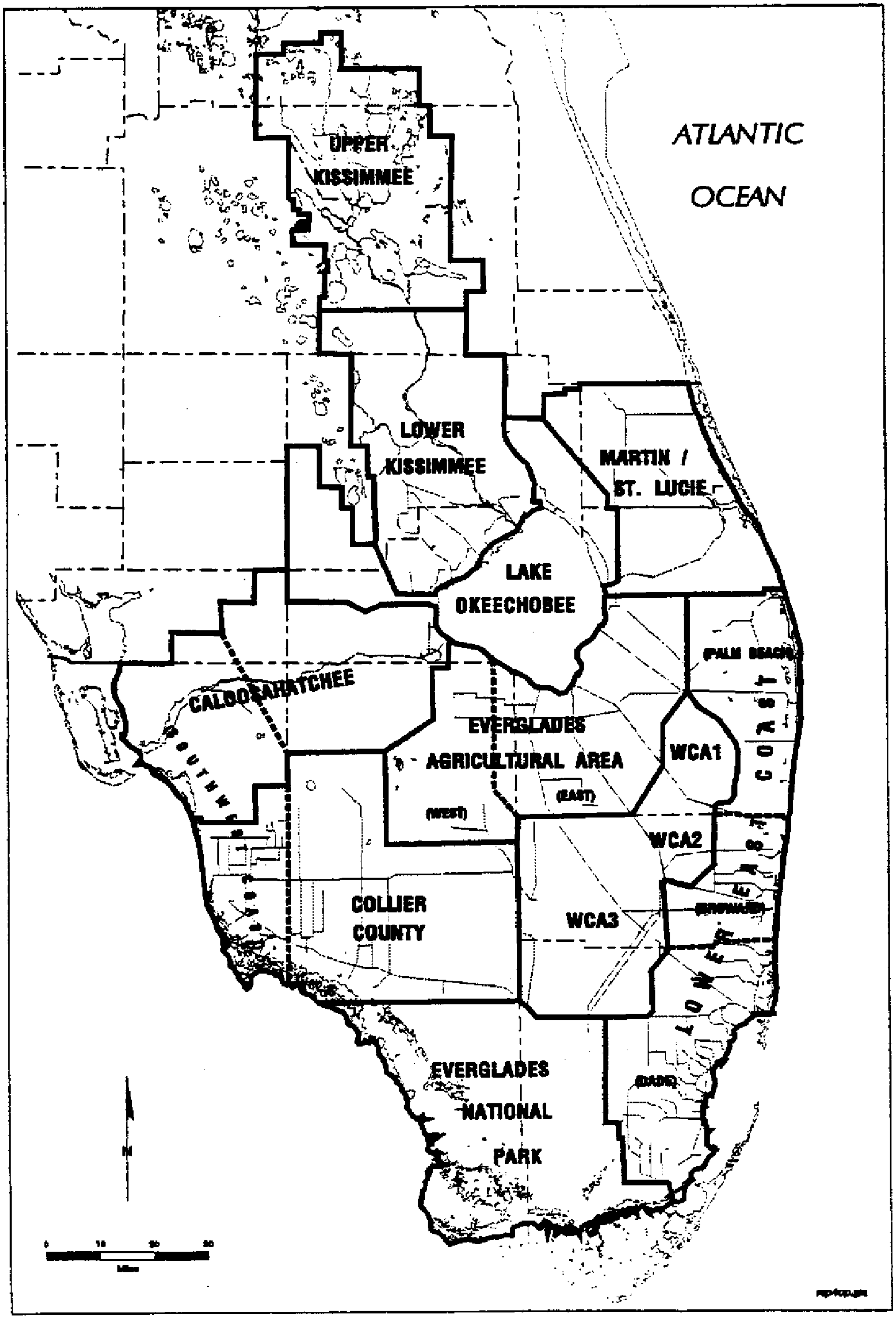


Figure 5. Daily and Monthly Rainfall Reporting Areas.

Table 3. SFWMD NORMAL RAINFALL
(REF. TECHNICAL PUBLICATION 86-6 DECEMBER 1986
FREQUENCY ANALYSIS OF SFWMD RAINFALL)

Normal	Upper Kiss	Lower Kiss	Lake Okee	East EAA	West EAA	WCA's	Martin/ St. Lucie	Palm Beach	Broward	Dade	LEC	Caloosa	Collier	SW coast	District
JAN	2.07	1.99	1.86	1.73	1.73	1.73	2.24	2.41	2.41	2.41	2.41	1.80	1.67	2.08	1.94
FEB	2.72	2.43	2.25	1.91	1.91	2.26	2.39	2.19	2.19	2.19	2.19	2.45	1.96	2.34	2.26
MAR	3.21	2.67	2.82	2.79	2.79	2.32	2.90	2.70	2.70	2.70	2.70	3.18	2.18	2.73	2.73
APR	2.71	2.68	2.15	2.66	2.66	1.83	3.03	3.43	3.43	3.43	3.43	2.27	2.41	1.82	2.59
MAY	4.29	4.28	4.82	5.05	5.05	5.02	4.46	5.87	5.87	5.87	5.87	4.50	4.95	4.48	4.86
JUN	7.37	7.48	7.26	8.64	8.64	8.45	6.31	8.10	8.10	8.10	8.10	9.17	9.10	9.38	8.10
JUL	6.29	7.70	6.59	7.35	7.35	6.23	6.22	6.41	6.41	6.41	6.41	8.38	8.66	8.54	7.18
AUG	6.90	6.98	6.22	7.26	7.26	6.38	5.73	6.83	6.83	6.83	6.83	8.07	7.59	8.60	6.97
SEP	6.38	6.91	6.25	7.74	7.74	6.13	7.50	8.52	8.52	8.52	8.52	8.23	8.64	8.20	7.49
OCT	3.20	3.65	3.96	4.24	4.24	3.81	6.37	7.84	7.84	7.84	7.84	3.98	4.15	3.20	4.65
NOV	1.80	1.64	1.43	1.85	1.85	2.00	2.48	2.94	2.94	2.94	2.94	1.54	1.65	1.76	1.94
DEC	2.04	1.55	1.66	1.72	1.72	1.60	1.87	2.02	2.02	2.02	2.02	1.66	1.50	1.58	1.73
YEAR	48.98	49.96	47.27	52.94	52.94	47.76	51.50	59.26	59.26	59.26	59.26	55.23	54.46	54.71	52.44

Table 4A. Monthly Rainfall (Inches) for the Southwest Coast

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
BONITA SPRINGS	2.32	6.28	7.44	7.07	10.06	2.45	35.62	3.55	4.35	43.52
CORKSCREW HQ	-	-	-	-	-	2.00	-	3.32	4.91	-
FT MYERS	0.34	4.38	9.79	9.34	7.67	2.96	34.48	2.50	3.82	40.80
IMMOKALEE	-	-	-	-	-	3.18	-	2.00	0.36	-
MARCO ISLAND	1.20	7.99	11.76	5.94	7.28	1.92	36.09	5.04	4.67	45.80
NAPLES FS	1.81	7.73	12.21	11.55	9.56	3.72	46.58	4.27	3.61	54.46
S-79	2.96	9.45	6.11	8.18	9.72	3.56	39.98	1.48	4.35	45.81
1994 Basin Average.	1.73	7.17	9.46	8.42	8.86	2.83	38.46	3.17	3.72	45.35
LONG TERM AVG.	4.48	9.38	8.54	8.60	8.20	3.20	42.40	1.76	1.58	45.74
% of Normal	39%	76%	111%	98%	108%	88%	91%	180%	236%	99%
Approx. Return Frequency (yrs)										

Table 4B. Rainfall Statistics for Storm Events in the Southwest Coast

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
BONITA SPRINGS	3.42	2.48	3.37	2.64	1.49	1.48
CORKSCREW HQ	-	-	-	1.85	2.50	1.90
FT MYERS	2.77	1.01	1.48	1.22	2.38	1.72
IMMOKALEE	1.44	1.12	1.44	-	-	-
MARCO ISLAND	5.03	2.08	4.03	1.71	2.48	1.53
NAPLES FS	3.76	3.25	3.75	1.53	1.76	1.41
S-79	1.37	0.61	1.08	2.15	2.08	1.06
1994 Basin Average	2.97	1.76	2.53	1.85	2.12	1.52

Table 4C. Storm Frequency and Return Period for Southwest Coast

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
-	-	-	-	-

Note: No Return periods > 3 Years

Table 5A. Monthly Rainfall (Inches) for Collier County

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
BONITA SPRINGS	2.32	6.28	7.44	7.07	10.06	2.45	35.62	3.55	4.35	43.52
COOPERTOWN	-	-	-	-	-	9.95	-	8.61	3.69	-
CORKSCREW HQ						2.00	-	3.32	4.91	-
EVERGLADES NP	3.24	9.85	5.50	5.59	11.21	3.03	38.42	6.35	4.49	49.26
G-155	-	-	-	-	-	4.28	-	6.22	7.09	-
IMMOKALEE	-	-	-	-	-	3.18	-	2.00	0.36	-
IMMOKALEE LF	1.89	7.36	6.38	6.63	12.02	2.71	36.99	3.37	6.30	46.66
MARCO ISLAND	1.20	7.99	11.76	5.94	7.28	1.92	36.09	5.04	4.67	45.80
NAPLES FS	1.81	7.73	12.21	11.55	9.56	3.72	46.58	4.27	3.61	54.46
RACCOON POINT	-	-	-	-	-	8.50	-	8.49	4.99	-
S-140	1.68	11.23	4.58	8.45	12.64	10.23	48.81	10.57	6.37	65.75
1994 Basin Average	2.02	8.41	7.98	7.54	10.46	4.72	41.13	5.62	4.62	51.37
LONG TERM AVG.	4.95	6.10	8.66	7.59	8.64	4.15	40.09	1.65	1.50	43.24
% of Normal	41%	138%	92%	99%	121%	114%	103%	340%	308%	119%
Approx. Return Frequency (yrs)										

Table 5B. Rainfall Statistics for Storm Events in Collier County

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
BONITA SPRINGS	3.42	2.48	3.37	2.64	1.49	1.48
COOPERTOWN	7.72	2.73	5.27	0.74	2.48	2.29
CORKSCREW HQ	-	-	-	1.85	2.50	1.90
EVERGLADES NP	6.14	5.40	5.90	2.20	1.35	0.75
G-155	6.08	3.70	5.36	4.06	2.56	1.56
IMMOKALEE	1.44	1.12	1.44	-	-	-
IMMOKALEE LF	3.30	2.00	3.00	2.65	3.05	1.90
MARCO ISLAND	5.03	2.08	4.03	1.71	2.48	1.53
NAPLES FS	3.76	3.25	3.75	1.53	1.76	1.41
RACCOON POINT	8.29	3.33	6.57	1.79	2.25	1.33
S-140	10.52	5.30	8.72	2.30	3.11	1.68
1994 Basin Average.	5.57	3.14	4.74	2.15	2.30	1.58

Table 5C. Storm Frequency and Return Period for Collier County

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
Coopertown	-	> 3 Years	-	-
Everglades Np	> 5 Years	> 3 Years	-	-
G-155	> 3 Years	> 3 Years	> 3 Years	-
Raccoon Point	-	> 3 Years	-	-
S-140	> 5 Years	> 10 Years	-	-

Table 6A. Monthly Rainfall (Inches) for the Caloosahatchee Basin Area

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
ARCHBOLD	4.30	11.80	4.41	9.03	8.31	2.53	40.38	4.16	3.40	47.94
BONITA SPRINGS	2.32	6.28	7.44	7.07	10.06	2.45	35.62	3.55	4.35	43.52
CORKSCREW HQ	-	-	-	-	-	2.00	-	3.32	4.91	-
CV-5	-	-	-	-	-	5.03	-	4.76	8.09	-
FT MYERS	0.34	4.38	9.79	9.34	7.67	2.96	34.48	2.50	3.82	40.80
G-136	-	-	-	-	-	5.67	-	3.39	4.25	-
IMMOKALEE	-	-	-	-	-	3.18	-	2.00	0.36	-
S-77	5.25	6.99	5.84	4.00	12.31	3.70	38.09	3.78	5.01	46.88
S-78	3.92	7.85	11.07	4.91	8.47	4.62	40.84	2.93	3.79	47.56
S-79	2.96	9.45	6.11	8.18	9.72	3.56	39.98	1.48	4.35	45.81
1994 Basin Average	3.18	7.79	7.44	7.09	9.42	3.57	38.50	3.19	4.23	45.92
LONG TERM AVG.	4.50	9.17	8.38	8.07	8.23	3.98	42.33	1.54	1.66	45.53
% of Normal	71%	85%	89%	88%	114%	90%	91%	207%	255%	101%
Approx. Return Frequency (yrs)										

Table 6B. Raintall Statistics for the Storm Events in the Caloosahatchee Basin Area

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
ARCHBOLD	2.06	1.86	1.89	0.46	2.32	1.81
BONITA SPRINGS	3.42	2.48	3.37	2.64	1.49	1.48
CORKSCREW HQ	-	-	-	1.85	2.50	1.90
CV-5	3.98	3.23	3.63	0.85	6.01	3.04
FT MYERS	2.77	1.01	1.48	1.22	2.38	1.72
G-136	2.71	2.14	2.43	0.83	1.90	1.20
IMMOKALEE	1.44	1.12	1.44	-	-	-
S-77	3.12	2.32	2.74	0.39	3.56	2.47
S-78	2.55	2.02	2.46	0.24	3.11	1.64
S-79	1.37	0.61	1.08	2.15	2.08	1.06
1994 Basin Average.	2.60	1.84	2.28	1.18	2.82	1.81

Table 6C. Storm Frequency and Return Period for Caloosahatchee

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec. 5	Dec. 21- 22
	1 Day Max	2 Day Max		1 Day Max.

Note: No return Periods > 3 Years

Table 7A. Monthly Rainfall (Inches) for Dade County

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
CHEKIKA EVER	-	-	-	-	-	6.12	-	2.13	0.08	-
HIALEAH W	-	-	-	-	-	8.95	-	14.87	5.50	-
HOMESTEAD AFB	4.36	3.03	5.32	13.37	12.04	5.26	43.38	13.85	4.46	61.69
HOMESTEAD FS	5.88	7.05	6.00	8.38	9.84	6.35	43.50	6.33	5.24	55.07
MIAMI BEACH	-	-	-	-	-	6.03	-	6.60	3.70	-
MIAMI FS	4.29	6.40	4.80	18.39	12.07	5.96	52.01	10.93	6.76	69.70
MIAMI INTL	4.42	4.28	3.36	16.55	12.54	9.73	50.88	8.93	4.95	64.76
N DADE	7.90	4.73	4.62	13.14	10.56	5.56	46.51	13.06	5.08	64.65
PERRINE	-	-	-	-	-	2.25	-	9.78	4.40	-
S-123	5.21	4.39	3.15	8.07	4.85	4.49	30.16	8.21	2.11	40.48
S-174	5.35	4.98	3.03	7.84	9.85	4.96	36.01	5.25	2.41	43.67
S-177	4.57	5.75	4.16	7.03	11.50	7.02	40.03	7.68	2.78	50.49
S-18C	4.05	2.85	4.16	5.73	12.12	10.30	39.21	6.13	3.33	48.67
S-20F	8.50	3.12	6.31	8.59	10.33	7.15	44.00	11.43	3.65	59.08
S-20G	8.15	2.28	5.80	6.93	2.52	5.63	31.31	10.03	3.48	44.82
S-21	8.20	2.95	3.21	5.39	4.97	3.73	28.45	9.45	3.78	41.68
S-21A	6.89	3.93	3.78	6.87	6.20	4.48	32.15	11.07	2.94	46.16
S-26	4.34	4.57	2.78	13.21	11.99	8.49	45.38	11.04	4.75	61.17
S-27	5.48	5.35	2.49	9.27	11.70	11.46	45.75	11.63	7.21	64.59
S-28Z	5.06	5.40	3.39	13.80	12.83	4.16	44.64	6.38	5.73	56.75
S-29	5.84	2.89	2.15	7.86	7.23	2.24	28.21	8.83	5.83	42.87
S-29Z	5.06	5.40	3.39	13.80	12.83	4.16	44.64	6.38	5.73	56.75
S-30	3.08	6.93	5.63	8.92	7.74	8.00	40.30	8.67	5.23	54.20
S-331	5.63	8.51	7.83	13.62	11.39	10.11	57.09	6.86	4.15	68.10
S-332	-	-	-	-	-	6.27	-	6.50	1.81	-
S-338	-	-	-	-	-	9.10	-	3.70	3.12	-
TAMIAMI	3.57	8.66	6.55	15.64	9.99	10.17	54.58	6.75	5.63	66.96
TAMIAMI CANAL	-	-	-	-	-	4.80	-	4.50	4.80	-
1994 Basin Average	5.58	4.90	4.31	9.63	9.55	6.79	40.77	7.90	4.24	52.92
LONG TERM AVG.	5.87	8.10	6.41	6.83	8.52	7.84	43.57	2.94	2.02	48.53
% of Normal	95%	61%	67%	141%	112%	87%	94%	269%	210%	109%
Approx. Return Frequency (yrs) (1)				8	4			100	20	

(1) Return Periods derived for a basin aggregate of Dade, Broward and Palm Beach Counties.

Table 7B. Rainfall Statistics for the Storm Events in Dade County

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
CHEKIKA EVER	1.60	0.59	1.17	0.00	-	-
HIALEAH W	12.85	5.25	9.94	0.25	3.87	3.79
HOMESTEAD AFB	10.59	2.63	4.51	0.00	1.54	1.54
HOMESTEAD FS	5.10	3.08	4.45	0.02	2.29	1.95
MIAMI BEACH	2.97	1.02	2.97	0.22	-	-
MIAMI FS	7.21	3.48	4.91	0.25	5.10	4.93
MIAMI INIT	5.57	2.25	4.42	0.00	3.25	2.64
N DADE	8.93	3.79	6.62	0.46	3.15	2.34
PERRINE	6.72	4.47	5.77	0.03	2.59	1.85
S-123	5.46	2.53	4.70	0.01	0.62	0.60
S-174	-	-	-	0.02	1.50	1.19
S-177	6.91	3.62	6.14	0.03	0.93	0.65
S-18C	4.71	2.48	4.16	0.03	1.13	0.84
S-20F	7.63	2.77	5.50	0.03	0.63	0.48
S-20G	6.91	3.12	5.35	0.01	0.88	0.60
S-21	6.18	2.45	4.29	0.01	0.82	0.73
S-21A	6.72	2.63	4.88	0.00	0.72	0.63
S-26	7.86	3.33	6.07	0.11	2.92	2.49
S-27	9.35	5.49	7.77	0.11	3.87	3.21
S-28Z	5.04	2.62	4.06	0.39	3.87	3.21
S-29	6.58	3.14	4.99	0.54	3.87	3.21
S-29Z	9.94	5.79	8.38	0.35	3.88	3.28
S-30	7.73	3.21	5.95	0.53	3.64	3.00
S-331	6.28	2.55	4.83	0.27	2.42	2.18
S-332	5.86	2.69	4.76	0.04	0.99	0.83
S-338	2.77	1.28	2.34	0.03	2.35	2.17
TAMIAMI	4.94	2.45	3.97	0.14	2.86	2.60
TAMIAMI CANAL	4.21	1.78	3.07	-	4.33	4.18
1994 Basin Average	6.54	2.98	5.04	0.14	2.46	2.12

Table 7C. Storm Frequency and Return Period for Dade County

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
Hialeah W		> 25 Years	-	-
N Dade	-	> 3 Years	-	-
S-177	-	> 3 Years	-	-
S-27	> 3 Years	> 3 Years	-	-
S-29Z	> 3 Years	> 5 Years	-	-
S-30	-	> 3 Years	-	-

Table 8A. Monthly Rainfall (Inches) in Broward County

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
B0NAVENTURE	-	-	-	-	-	0.39	-	5.11	3.06	-
CORAL SPRINGS	-	-	-	-	-	2.24	-	9.08	7.96	-
FT LAUD FS	4.20	13.02	11.02	13.52	12.47	4.55	58.78	10.53	4.92	74.23
FTL	4.40	8.20	7.99	11.23	15.19	3.30	50.31	16.02	6.74	73.07
G-56	3.04	1.58	3.63	11.69	3.53	3.30	26.77	10.18	7.47	44.42
HOLLYWOOD	7.32	6.42	1.56	10.54	13.24	3.26	42.34	12.80	9.19	64.33
S-124	4.48	10.13	5.45	8.73	7.10	4.51	40.40	10.37	7.14	57.91
S-13	6.07	7.38	5.94	11.45	16.09	3.10	50.03	12.25	6.62	68.90
S-28Z	5.06	5.04	3.39	13.80	12.83	4.16	44.28	6.38	5.73	56.39
S-29	5.84	2.89	2.15	7.86	7.23	2.24	28.21	8.83	5.83	42.87
S-29Z	5.23	6.57	7.76	11.94	12.46	4.17	48.13	13.78	5.77	67.68
S-30	3.08	6.93	5.63	8.92	7.74	8.00	40.30	8.67	5.23	54.20
S-33	5.15	6.77	17.88	6.74	10.34	0.07	46.95	12.38	5.95	65.28
S-34	-	-	-	-	-	3.65	-	8.80	8.96	-
S-36	3.84	4.46	2.87	6.12	14.54	2.63	34.46	9.97	5.72	50.15
S-37A	2.48	5.89	2.70	8.70	13.13	2.06	34.96	11.28	7.36	53.60
S-37B	6.25	4.79	5.33	14.77	10.27	3.02	44.43	12.96	7.32	64.71
S-38	2.34	3.18	3.20	7.63	10.81	7.96	35.12	10.10	8.14	53.36
S-39	1.81	5.76	6.34	8.74	7.48	3.49	33.62	9.73	5.09	48.44
S-9	3.53	7.12	6.90	9.78	9.48	4.86	41.67	11.42	6.21	59.30
1994 Basin Average	4.36	6.24	5.87	10.13	10.82	3.55	40.96	10.53	6.52	58.02
LONG TERM AVG.	5.87	8.10	6.41	6.83	8.52	7.84	43.57	2.94	2.02	48.53
% of Normal	74%	77%	92%	148%	127%	45%	94%	358%	323%	120%
Approx. Return Frequency (yrs) (1)				8	4			100	20	

(1) Return Periods derived for a basin aggregate of Dade, Broward and Palm Beach Counties.

Table 8B. Rainfall Statistics for the Storm Events in Broward County

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
BONAVENTURE	4.84	2.48	3.82	0.95	1.68	1.48
CORAL SPRINGS	8.33	3.32	6.66	1.98	4.62	4.30
FT LAUD FS	7.75	3.20	5.50	0.70	2.85	1.55
FTL	10.20	4.38	8.44	0.63	5.50	3.64
G-56	7.49	3.37	5.81	2.20	3.81	2.56
HOLLYWOOD	10.20	4.86	7.61	0.70	6.32	4.20
S-124	9.21	4.18	7.25	1.99	4.05	2.69
S-13	9.05	4.65	6.95	0.64	4.42	2.77
S-28Z	5.04	2.62	4.08	0.40	3.87	3.35
S-29	6.58	3.14	4.99	0.54	3.88	3.28
S-29Z	9.64	5.79	8.36	0.35	4.07	3.42
S-30	7.63	3.21	5.95	0.53	3.64	3.00
S-33	8.57	3.51	6.70	0.81	4.68	2.85
S-34	8.73	3.27	5.58	3.58	3.88	2.34
S-36	5.34	2.94	4.95	0.93	3.81	2.48
S-37A	8.12	3.45	6.64	0.96	4.97	3.54
S-37B	8.04	3.53	6.07	1.30	4.15	2.46
S-38	8.89	3.61	8.89	1.74	4.54	2.28
S-39	8.16	3.23	5.84	-	3.91	2.04
S-9	10.35	4.28	8.03	1.73	3.59	2.77
1994 Basin Average	8.11	3.65	6.41	1.19	4.11	2.85

Table 8C. Storm Frequency and Return Period for Broward County

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
Coral Springs	-	> 3 Years	-	-
FTL	-	> 3 Years	-	-
Hollywood	-	> 3 Years	-	-
S-124	-	> 3 Years	-	-
S-29z	> 5 Years	> 5 Years	-	-
S-30	-	> 3 Years	-	-
S-34	-	> 3 Years	-	-
S-38	-	> 5 Years	-	-
S-9	> 3 Years	> 10 Years	-	-

Table 9A. Monthly Rainfall (Inches) in Palm Beach County

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
C-18W	4.50	6.15	7.69	9.34	10.61	5.48	43.77	7.81	7.88	59.46
DELRAY BEACH W	-	-	-	-	-	3.35	-	3.36	10.83	-
G-56	3.04	1.58	3.63	11.69	3.53	3.30	26.77	10.18	7.47	44.42
PBIA	4.50	10.76	5.32	10.33	8.79	3.82	43.52	8.24	11.45	63.21
S-155	5.94	10.61	5.11	7.45	9.00	2.73	40.84	8.66	11.02	60.52
S-39	1.81	5.76	6.34	8.74	7.48	3.49	33.62	9.37	5.09	48.08
S-40	5.19	6.97	2.30	9.49	6.79	6.65	37.39	8.39	12.23	58.01
S-41	1.84	12.85	2.24	6.42	8.09	2.41	33.85	7.64	6.70	48.19
S-44	2.47	11.07	4.77	9.73	9.00	4.95	41.99	7.78	3.61	53.38
S-46	4.20	8.29	6.18	8.86	7.44	6.19	41.16	9.01	5.44	55.61
S-5A	3.48	10.53	7.60	6.96	17.29	8.20	54.06	9.40	9.05	72.51
S-5AY	0.78	9.27	5.27	11.61	7.58	5.73	40.24	5.58	4.50	50.32
WESTPORT	-	-	-	-	-	8.94	-	4.95	3.31	-
1994 Basin Average	3.43	8.53	5.13	9.15	8.69	5.02	39.95	7.72	7.58	55.26
LONG TERM AVG.	5.87	8.10	6.41	6.83	8.52	7.84	43.57	2.94	2.02	48.53
% of Normal	95%	61%	67%	141%	112%	87%	94%	269%	210%	109%
Approx. return Frequency (yrs)				8	4			100	20	

Table 9B. Rainfall Statistics for the Storm Events in Palm Beach County

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
C-18W	6.97	3.59	6.65	1.15	3.67	2.10
DELRAY BEACH W	-	-	-	3.73	3.78	3.30
G-56	7.49	3.37	5.81	2.20	3.81	2.56
PBIA	7.26	4.37	6.49	2.92	7.77	4.73
S-155	7.55	3.60	5.92	3.99	6.42	4.21
S-39	8.16	3.23	5.84	-	3.91	2.04
S-40	5.92	2.47	4.31	7.02	3.35	2.15
S-41	6.19	3.21	5.66	3.88	1.77	1.21
S-44	5.90	3.50	5.72	2.28	-	-
S-46	7.39	4.25	7.29	1.10	2.86	1.65
S-5A	8.94	4.49	8.03	2.85	4.82	3.55
S-5AY	5.32	4.17	4.95	-	3.65	2.16
WESTPORT	-	-	-	1.95	-	-
1994 Basin Average.	7.01	3.66	6.06	3.01	4.16	2.70

Table 9C. Storm Frequency and Return Period for Palm Beach County

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
C-18W	-	> 3 Years	-	-
S-40	-	-	> 3 Years	-
S-46	-	> 3 Years	-	-
S-5A	-	> 5 Years	-	-

Table 10A. Monthly Rainfall (Inches) in Martin - St. Lucie County

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
C-18W	4.50	6.15	7.69	9.34	10.61	5.48	43.77	7.81	7.88	59.46
FT PIERCE FS	0.34	4.38	9.79	9.34	7.67	2.96	34.48	5.49	8.88	48.85
OKEECHOBEE FS	3.18	4.85	4.87	10.93	5.33	2.71	31.87	4.55	5.04	41.46
S-135	2.29	5.98	3.64	8.14	5.00	2.55	27.60	4.18	4.75	36.53
S-153	5.94	10.61	5.11	7.45	9.00	2.37	40.48	3.03	4.96	48.47
S-191	-	-	-	-	-	2.75	-	4.25	3.49	-
S-308	3.82	4.76	4.60	6.62	8.42	4.25	32.47	6.69	6.67	45.83
S-46	4.20	8.29	6.18	8.86	7.44	6.19	41.16	9.01	5.44	55.61
S-49	3.49	6.79	4.77	8.89	15.59	5.39	44.92	6.34	8.27	59.53
S-80	3.73	6.64	10.57	12.25	13.00	7.38	53.57	11.69	8.93	74.19
S-97	3.20	6.57	6.58	7.69	13.70	6.11	43.85	3.95	4.65	52.45
S-99	5.61	6.22	8.45	8.02	14.51	6.18	48.99	7.23	8.29	64.51
VERO BEACH	3.05	5.35	4.14	7.45	10.68	3.34	34.01	6.74	5.94	46.69
VERO BEACH W	-	-	-	-	-	1.70	-	8.79	6.12	-
1994 Basin Average	3.61	6.38	6.37	8.75	10.08	4.24	39.43	6.41	6.38	52.22
LONG TERM AVG.	4.46	6.31	6.22	5.73	7.50	6.37	36.59	2.48	1.87	40.94
% of Normal	81%	101%	102%	153%	134%	67%	108%	258%	341%	128%
Approx. Frequency (yrs)				13	5			20	40	

Table 10B. Rainfall Statistics for the Storm Events in Martin - St. Lucie County

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
C-18W	6.97	3.59	6.65	1.15	3.67	2.10
FT PIERCE FS	4.20	2.68	3.88	0.50	3.18	1.19
OKEECHOBEE FS	4.39	3.22	4.01	0.45	3.05	1.56
S-135	3.86	2.45	3.67	0.68	3.05	1.91
S-153	2.81	1.79	2.74	0.69	2.30	1.20
S-191	3.92	3.15	3.89	0.51	2.09	1.20
S-308	6.30	3.54	5.45	0.94	2.89	1.64
S-46	7.39	4.25	7.29	1.10	2.86	1.67
S-49	4.83	2.35	4.45	0.88	3.65	1.90
S-80	10.35	5.99	8.95	1.16	3.33	2.44
S-97	5.05	2.45	4.75	0.64	3.60	2.10
S-99	4.93	3.65	4.43	0.01	4.60	2.85
VERO BEACH	6.17	5.50	5.93	0.14	3.43	2.09
VERO BEACH W	7.82	6.94	7.39	0.13	3.60	1.95
1994 Basin Average	5.64	3.68	5.25	0.64	3.24	1.84

Table 10C. Storm Frequency and Return Period for Martin - St. Lucie County

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
C-18 W	-	> 3 Years	-	-
S-308	-	> 3 Years	-	-
S-46	-	> 3 Years	-	-
S-80	> 10 Years	> 10 Years	-	-
Vero Beach	> 5 Years	> 3 Years	-	-
Vero Beach W	> 10 Years	> 5 Years	-	-

Table 11A. Monthly Rainfall (inches) in Conservation Areas

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
ANDYTOWN 5W	-	-	-	-	-	1.81	-	16.82	14.42	-
BONAVENTURE	-	-	-	-	-	0.39	-	5.11	3.06	-
CHEKIKA EVER	-	-	-	-	-	6.12	-	2.13	0.08	-
COOPERTOWN	-	-	-	-	-	6.95	-	8.61	3.69	-
CORAL SPR 11W	-	-	-	-	-	1.24	-	12.89	10.52	-
CORAL SPRING	-	-	-	-	-	2.24	-	9.08	7.96	-
DELRAY BEACH W	-	-	-	-	-	3.35	-	3.36	10.83	-
G-155	-	-	-	-	-	4.28	-	6.22	7.09	-
G-201	-	-	-	-	-	5.28	-	6.68	10.54	-
HIALEAH W	-	-	-	-	-	8.95	-	14.87	5.50	-
HILLSBORO CNL	-	-	-	-	-	5.80	-	10.82	11.64	-
S-124	4.48	10.13	5.45	8.73	7.10	4.51	40.40	10.37	7.14	57.91
S-140	1.68	11.23	4.58	8.45	12.64	10.23	48.81	10.57	6.37	65.75
S-30	3.08	6.93	5.63	8.92	7.74	8.00	40.30	8.67	5.23	54.20
S-338	-	-	-	-	-	9.10	-	3.70	3.12	-
S-34	-	-	-	-	-	3.65	-	8.80	8.96	-
S-38	2.34	3.18	3.20	7.63	10.81	7.96	35.12	10.10	8.14	53.36
S-39	1.81	5.76	6.34	8.74	7.48	3.49	33.62	9.73	5.09	48.44
S-5A	3.48	10.53	7.60	6.96	17.29	8.20	54.06	7.54	8.98	70.58
S-6	3.71	5.12	3.94	7.43	10.34	4.62	35.16	8.92	13.80	57.88
S-7	2.79	5.07	7.40	9.38	12.82	4.47	41.93	6.63	18.99	67.55
S-8	2.40	9.83	4.33	8.27	5.82	3.49	34.14	6.90	9.26	50.30
S-9	3.53	7.12	6.90	9.78	9.48	4.86	41.67	11.42	6.21	59.30
SWEETWATER	-	-	-	-	-	7.68	-	7.49	2.44	-
TAMIAMI CANAL	-	-	-	-	-	4.00	-	4.80	4.50	-
WEST MIRAMAR	-	-	-	-	-	7.18	-	3.32	1.63	-
1994 Basin Average	2.93	7.49	5.54	8.43	10.15	5.30	39.84	8.29	7.51	55.64
LONG TERM AVG.	5.02	8.45	6.23	6.38	6.13	3.81	36.02	2.00	1.60	39.62
% of Normal	58%	89%	89%	132%	166%	139%	111%	415%	469%	140%
Approx. Return Frequency (yrs)										

Table 11B. Rainfall Statistics for the Storm Events in Conservation Areas

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
ANDYTOWN 5W	15.84	5.85	11.13	6.77	6.04	4.65
BONAVENTURE	4.84	2.48	3.82	0.95	1.68	1.48
CHEKIKA EVER	1.60	0.59	1.17	0.00	-	-
COOPERTOWN	7.72	2.73	5.27	0.74	2.48	2.29
CORAL SPR 11W	12.11	4.79	8.49	5.57	3.93	2.76
CORAL SPRING	8.33	3.32	6.66	1.98	4.62	4.30
DELRAY BEACH W	-	-	-	3.73	3.78	3.30
G-155	6.08	3.70	5.36	4.06	2.56	1.56
G-201	5.53	2.11	4.22	7.16	2.56	1.56
HIALEAH W	12.85	5.25	9.94	0.25	3.87	3.79
HILLSBORO CNL	9.82	3.79	6.94	5.87	4.04	2.62
S-124	9.21	4.18	7.25	1.99	4.05	2.69
S-140	10.52	5.30	8.72	2.30	3.11	1.68
S-30	7.63	3.21	5.95	0.53	3.64	3.00
S-338	2.77	1.28	2.34	0.03	2.35	2.17
S-34	8.73	3.27	5.58	3.58	3.88	2.34
S-38	8.89	3.61	8.89	1.74	4.54	2.28
S-39	8.16	3.23	5.84	-	3.91	2.04
S-5A	8.94	4.49	8.03	2.85	4.82	3.55
S-6	8.20	3.45	6.20	7.45	4.16	2.45
S-7	6.06	2.60	4.56	14.33	3.46	2.00
S-8	6.15	2.10	4.10	5.16	3.45	2.00
S-9	10.35	4.28	8.03	1.73	3.59	2.77
SWEETWATER	6.96	2.83	5.27	0.12	1.95	1.88
TAMIAMI CANAL	4.94	2.45	3.97	0.14	2.86	2.60
WEST MIRAMAR	-	-	-	0.79	0.03	0.03
1994 Basin Average	8.01	3.37	6.16	3.19	3.41	2.47

Table 11C. Storm Frequency and Return Period for Conservation Areas

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
Andytown 5W	> 10 Years	> 50 Years	> 10 Years	> 3 Years
Coral Spr11W	> 3 Years	> 10 Years	> 3 Years	-
Coral Springs	-	> 3 Years	-	-
G-155	> 3 Years	> 3 Years	> 3 Years	-
G-201	-	-	> 25 Years	-
Hialeah W	> 5 Years	> 25 Years	-	-
Hillsboro Cnl	-	> 3 Years	> 3 Years	-
S-124	-	> 5 Years	-	-
S-140	> 5 Years	> 10 Years	-	-
S-30	-	> 3 Years	-	-
S-34	-	> 3 Years		-
S-38	-	> 5 Years	-	-
S-5A	-	> 5 Years	-	-
S-6	-	> 3 Years	> 5 Years	-
S-7	-	-	>100 Years	-
S-8	-	-	> 3 Years	-
S-9	> 3 Years	> 10 Years	-	-
Sweetwater	-	> 3 Years	-	-

Table 12A. Monthly Rainfall (Inches) in EAA (West)

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
CLEWISTON	1.89	5.94	6.22	4.02	8.96	3.08	30.11	4.16	5.90	40.17
CLEWISTON FS	1.65	4.93	4.59	4.49	8.22	2.83	26.71	4.65	5.63	36.99
G-136	-	-	-	-	-	5.67	-	3.39	4.25	-
G-155	-	-	-	-	-	4.28	-	6.22	7.09	-
IMMOKALEE	-	-	-	-	-	3.18	-	2.00	0.36	-
IMMOKALEE LF	1.89	7.36	6.38	6.63	12.02	2.71	36.99	3.37	6.30	46.66
S-4	2.90	10.84	6.36	3.60	11.58	4.75	40.03	4.00	5.02	49.05
S-77	5.25	6.99	5.84	4.00	12.31	3.70	38.09	3.78	5.01	46.88
S-8Z	1.31	8.78	8.77	7.79	11.65	1.63	39.93	5.63	6.93	52.49
1994 Basin Average	2.48	7.47	6.36	5.09	10.79	3.54	35.73	4.13	5.17	45.03
LONG TERM AVG.	5.05	8.64	7.35	7.26	7.74	4.24	40.28	1.85	1.72	43.85
% of Normal	49%	86%	87%	70%	139%	83%	89%	223%	300%	103%
Approx. Return Frequency (yrs)					40			20	68	

For EAA Complete (East and West)

Table 12B. Rainfall Statistics for the Storm Events in EAA (West)

Stations	NOV 15-17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
CLEWISTON	3.96	2.98	3.68	0.82	3.58	1.80
CLEWISTON FS	4.53	3.22	3.96	0.68	3.36	1.70
G-136	2.75	2.14	2.46	0.83	1.90	1.20
G-155	6.08	3.70	5.36	4.06	2.56	1.56
IMMOKALEE	1.44	1.12	1.44	-	-	-
IMMOKALEE LF	3.30	2.00	3.00	2.65	3.05	1.90
S-4	3.79	2.74	3.30	0.75	3.49	1.89
S-77	3.12	2.32	2.74	0.39	3.56	2.47
S-8Z	5.05	3.42	4.42	3.24	3.13	1.63
1994 Basin Average	3.78	2.63	3.37	1.68	3.08	1.77

Table 12C. Storm Frequency and Return Period for EAA (West)

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec 5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
G-155	> 3 Years	> 3 Years	> 3 Years	-

Note: This Station is included on Table 10 EAA (East)

Table 13A. Monthly Rainfall (Inches) in EAA (East)

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
BELLE GLADE	-	-	-	-	-	12.16	-	5.74	4.86	-
C-18W	4.50	6.15	7.69	9.34	10.61	5.48	43.77	7.81	7.88	59.46
CANAL POINT	-	-	-	-	-	4.37	-	7.05	4.12	-
CLEWISTON	1.89	5.94	6.22	4.02	8.96	3.08	30.11	4.16	5.90	40.17
CLEWISTON FS	1.65	4.93	4.59	4.49	8.22	2.83	26.71	4.65	5.63	36.99
G-136	-	-	-	-	-	5.67	-	3.39	4.25	-
G-155	-	-	-	-	-	4.28	-	6.22	7.09	-
G-201	-	-	-	-	-	5.28	-	6.68	10.54	-
L006	-	-	-	-	-	2.72	-	3.76	4.18	-
S-153	2.85	2.87	7.13	6.89	8.13	2.63	30.50	3.03	4.96	38.49
S-2	4.45	9.59	7.73	6.24	8.94	8.53	45.48	4.52	7.22	57.22
S-3	3.85	7.51	7.15	8.45	8.21	5.98	41.15	4.28	6.23	51.66
S-352	1.89	6.26	4.49	5.98	8.67	4.67	31.96	6.50	1.81	40.27
S-4	2.90	10.84	6.36	3.60	11.58	4.75	40.03	4.00	5.02	49.05
S-5A	3.48	10.53	7.60	6.96	17.29	8.20	54.06	7.54	8.98	70.58
S-5AX	1.58	10.61	6.59	14.29	5.68	6.99	45.74	5.42	8.95	60.11
S-5AY	0.78	9.27	5.27	11.61	7.58	5.73	40.24	5.58	4.50	50.32
S-6	3.71	5.12	3.94	7.43	10.34	4.62	35.16	8.92	13.80	57.88
S-6Z	4.07	5.50	7.52	9.04	6.65	6.78	39.56	3.18	5.64	48.38
S-7	2.79	5.07	7.40	9.38	12.82	4.47	41.93	6.63	18.99	67.55
S-7Z	1.55	7.47	9.71	7.86	6.72	3.56	36.87	3.73	5.50	46.10
S-8	2.40	9.83	4.33	8.27	5.82	3.49	34.14	6.90	9.26	50.30
S-8Z	1.31	8.78	8.77	7.79	11.65	1.63	39.93	5.63	6.93	52.49
1994 Basin Average	2.69	7.43	6.62	7.74	9.29	5.13	38.89	5.45	7.05	51.39
LONG TERM AVG.	5.05	8.64	7.35	7.26	7.74	4.24	40.28	1.85	1.72	43.85
% of Normal	53%	86%	90%	107%	120%	121%	97%	295%	410%	117%
Approx. return Frequency (yrs)					40			20	68	

For EAA complete (East and West)

Table 13B. Rainfall Statistics for the Storm Events in EAA (East)

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
BELLE GLADE	5.68	3.20	4.43	1.80	1.41	1.41
C-18W	6.97	3.59	6.65	1.15	3.67	2.10
CANAL POINT	6.67	4.39	6.19	-	3.42	1.90
CLEWISTON	3.96	2.98	3.68	0.82	3.58	1.80
CLEWISTON FS	4.53	3.22	3.96	0.68	3.36	1.70
G-136	2.75	2.14	2.46	0.83	1.90	1.20
G-155	6.08	3.70	5.36	4.06	2.56	1.56
G-201	5.53	2.11	4.22	7.16	2.40	1.20
L006	3.71	2.58	3.61	0.73	2.82	1.49
S-153	2.81	1.79	2.74	0.69	2.30	1.20
S-2	4.44	3.14	3.89	1.12	4.03	2.05
S-3	4.12	2.15	3.27	0.80	3.60	1.95
S-352	5.20	3.73	4.98	1.31	3.00	1.64
S-4	3.79	2.74	3.30	0.75	3.49	1.89
S-5A	8.94	4.49	8.03	2.65	4.82	3.55
S-5AX	5.20	3.77	4.53	1.74	4.02	2.42
S-5AY	5.32	4.17	4.95	-	3.65	2.16
S-6	8.20	3.45	6.20	7.45	4.16	2.45
S-6Z	2.98	1.97	2.51	1.19	2.72	1.60
S-7	6.06	2.60	4.56	14.33	3.46	2.00
S-7Z	2.85	1.28	2.34	3.28	-	-
S-8	6.15	2.10	4.10	5.16	3.45	2.00
S-8Z	5.05	3.42	4.42	3.24	3.13	1.63
1994 Basin Average	5.09	2.99	4.36	2.91	3.23	1.86

Table 13C. Storm Frequency and Return Period for EAA (East)

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
C-18 W	-	> 3 Years	-	-
Canal Point	> 3 Years	> 3 Years	-	-
G-155	> 3 Years	> 3 Years	> 3 Years	-
G-201	-	-	> 25 Years	
S-5A	-	> 5 Years	-	-
S-6	-	> 3 Years	> 10 Years	-
S-7	-	-	> 100 Years	-
S-8	-	-	> 5 Years	-

Table 14A. Monthly Rainfall (Inches) in Lake Okeechobee

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
ARCHBOLD	4.30	11.80	4.41	9.03	8.31	2.53	40.38	4.16	3.40	47.94
AVON PARK	-	-	-	-	-	4.14	-	3.05	3.53	-
CANAL POINT	-	-	-	-	-	4.37	-	7.05	4.12	-
CLEWISTON	1.89	5.94	6.22	4.02	8.96	3.08	30.11	4.16	5.90	40.17
CLEWISTON FS	1.65	4.93	4.59	4.49	8.22	2.83	26.71	4.65	5.63	36.99
CV-5	-	-	-	-	-	5.03	-	4.76	8.09	-
FT PIERCE FS	0.34	4.38	9.79	9.34	7.67	2.96	34.48	5.49	8.88	48.85
L005	-	-	-	-	-	2.89	-	2.27	3.45	-
L006	-	-	-	-	-	2.72	-	3.76	4.18	-
LZ40	-	-	-	-	-	1.61	-	4.20	4.28	-
OKEECHOBEE FS	3.18	4.85	4.87	10.93	5.33	2.71	31.87	4.55	5.04	41.46
S-127	3.15	6.56	7.02	6.01	5.13	3.92	31.79	5.22	4.27	41.28
S-129	5.58	4.81	4.81	5.82	6.53	5.33	32.88	2.91	4.80	40.59
S-131	2.49	5.29	3.21	5.52	9.99	3.28	29.78	2.40	3.91	36.09
S-133	3.82	3.72	5.60	11.16	6.43	3.63	34.36	4.93	4.43	43.72
S-135	2.29	5.98	3.64	8.14	5.00	2.55	27.60	4.18	4.75	36.53
S-153	5.94	10.61	5.11	7.45	9.00	2.37	40.48	3.03	4.96	48.47
S-191	-	-	-	-	-	2.75	-	4.25	3.49	-
S-2	4.45	9.59	7.73	6.24	8.94	8.53	45.48	4.52	7.22	57.22
S-3	3.85	7.51	7.15	8.45	8.21	5.98	41.15	4.28	6.23	51.66
S-308	3.82	4.76	4.60	6.62	8.42	4.25	32.47	6.69	6.67	45.83
S-352	1.89	6.26	4.49	5.98	8.67	4.67	31.96	6.50	1.81	40.27
S-4	2.90	10.84	6.36	3.60	11.58	4.75	40.03	4.00	5.02	49.05
S-65D	1.80	13.45	4.98	6.16	9.88	4.27	40.54	5.41	3.65	49.60
S-70	-	-	-	-	-	4.43	-	6.01	5.35	-
S-71	-	-	-	-	-	7.25	-	4.10	5.23	-
S-72	-	-	-	-	-	2.75	-	2.15	3.77	-
S-77	5.25	6.99	5.84	4.00	12.31	3.70	38.09	3.78	5.01	46.88
S-78	3.92	7.85	11.07	4.91	8.47	4.62	40.84	2.93	3.79	47.56
S-79	2.96	9.45	6.11	8.18	9.72	3.56	39.98	1.48	4.35	45.81
1994 Basin Average	3.27	7.28	5.88	6.80	8.34	3.92	35.49	4.23	4.84	44.56
LONG TERM AVG.	4.82	7.26	6.59	6.22	6.25	3.96	35.10	1.43	1.66	38.19
% of Normal	68%	100%	89%	109%	133%	99%	101%	296%	292%	117%
Approx. return Frequency (yrs)					10			19	29	

Table 14B. Rainfall Statistics for the Storm Events for Lake Okeechobee

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
ARCHBOLD	2.06	1.66	1.89	0.46	2.32	1.81
AVON PARK	3.00	2.30	2.81	0.77	1.77	1.27
CANAL POINT	6.67	4.39	6.19	-	3.42	1.90
CLEWISTON	3.96	2.98	3.68	0.82	3.58	1.80
CLEWISTON FS	4.53	3.22	3.96	0.68	3.36	1.70
CV-5	3.98	3.23	3.63	0.85	6.01	3.04
FT PIERCE FS	4.20	2.68	3.88	0.50	3.18	1.19
L005	2.02	1.82	1.92	0.73	2.62	1.34
L006	3.71	2.58	3.61	0.73	2.82	1.49
LZ40	3.80	2.54	3.70	0.64	2.90	1.63
OKEECHOBEE FS	4.39	3.22	4.01	0.45	3.05	1.56
S-127	4.99	4.09	4.84	0.30	2.98	1.73
S-129	2.27	1.74	2.03	0.33	2.99	1.52
S-131	2.15	1.80	2.00	0.33	2.75	1.40
S-133	4.65	3.25	4.35	0.52	2.77	1.47
S-135	3.86	2.45	3.67	0.68	3.05	1.91
S-153	2.81	1.79	2.74	0.69	2.30	1.20
S-191	3.92	3.15	3.89	0.51	2.09	1.20
S-2	4.44	3.14	3.89	1.12	4.03	2.05
S-3	4.12	2.15	3.27	0.80	3.60	1.95
S-308	6.30	3.54	5.45	0.94	2.89	1.64
S-352	5.20	3.73	4.98	1.31	3.00	1.64
S-4	3.79	2.74	3.30	0.75	3.49	1.89
S-65D	5.10	3.40	4.50	0.10	2.12	1.15
S-70	5.74	4.45	5.47	0.16	2.50	1.39
S-71	3.43	3.02	3.29	0.41	-	-
S-72	2.45	1.76	1.58	0.24	2.62	1.42
S-77	3.12	2.32	2.74	0.39	3.56	2.47
S-78	2.55	2.02	2.46	0.24	3.11	1.64
S-79	1.37	0.61	1.08	2.15	2.08	1.06
1994 Basin Average	3.82	2.73	3.49	0.64	3.00	1.64

Table 14C. Storm Frequency and Return Period for Lake Okeechobee

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
Canal Point	> 3 Years	> 3 Years	-	-
S-127	> 3 Years	-	-	-
S-308	-	> 3 Years	-	-
S-65D	> 5 Years	> 3 Years	-	-

Table 15A. Monthly Rainfall (Inches) for the Lower Kissimmee

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
ARCHBOLD	4.30	11.80	4.41	9.03	8.31	2.53	40.38	4.16	3.40	47.94
AVON PARK	-	-	-	-	-	4.14	-	3.05	3.53	-
COLEY	-	-	-	-	-	1.90	-	2.85	4.05	-
CV-5	-	-	-	-	-	5.03	-	4.76	8.09	-
OKEECHOBEE FS	3.18	4.85	4.87	10.93	5.33	2.71	31.87	4.55	5.04	41.46
S-127	3.15	6.56	7.02	6.01	5.13	3.92	31.79	5.22	4.27	41.28
S-129	5.58	4.81	4.81	5.82	6.53	5.33	32.88	2.91	4.80	40.59
S-131	2.49	5.29	3.21	5.52	9.99	3.28	29.78	2.40	3.91	36.09
S-133	3.82	3.72	5.60	11.16	6.43	3.63	34.36	4.93	4.43	43.72
S-65	1.54	12.89	11.68	4.54	8.24	4.67	43.56	4.41	2.63	50.60
S-65A	2.81	9.02	11.27	8.25	5.68	4.43	41.46	3.29	2.71	47.46
S-65B	4.30	12.30	8.59	5.93	6.44	2.52	40.08	4.67	2.95	47.70
S-65C	3.25	7.88	6.84	4.86	5.16	5.28	33.27	3.70	2.71	39.68
S-65D	1.80	13.45	4.98	6.16	9.88	4.27	40.54	5.41	3.65	49.60
S-65E	2.95	16.17	6.08	5.97	7.75	5.51	44.43	5.37	5.26	55.06
S-68	1.25	10.30	2.95	3.55	7.10	2.50	27.65	7.50	2.95	38.10
S-70	-	-	-	-	-	4.43	-	6.01	5.35	-
S-71	-	-	-	-	-	7.25	-	4.10	5.23	-
S-72	-	-	-	-	-	2.75	-	2.15	3.77	-
S-75	-	-	-	-	-	1.83	-	2.70	6.48	-
S-82	-	-	-	-	-	2.78	-	1.15	2.94	-
S-83	-	-	-	-	-	4.18	-	3.65	5.83	-
S-84	-	-	-	-	-	1.92	-	5.91	3.95	-
1994 Basin Average	3.11	9.16	6.33	6.75	7.07	3.77	36.19	4.12	4.26	44.58
LONG TERM AVG.	4.28	7.48	7.70	6.98	6.91	3.65	37.00	1.64	1.55	40.19
% of Normal	73%	112%	82%	97%	102%	103%	98%	251%	275%	111%
Approx. Return Frequency (yrs)		4						15	35	

Table 15B. Rainfall Statistics for the Storm Events in the Lower Kissimmee

Stations	NOV 15 -17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
ARCHBOLD	2.06	1.66	1.89	0.46	2.32	1.81
AVON PARK	3.00	2.30	2.81	0.77	1.77	1.27
COLEY	2.76	2.44	2.72	2.58	1.24	1.24
CV-5	3.98	3.23	3.63	0.85	6.01	3.04
OKEECHOBEE FS	4.39	3.22	4.01	0.45	3.05	1.56
S-127	4.99	4.09	4.84	0.30	2.98	1.73
S-129	2.27	1.74	2.03	0.33	2.99	1.52
S-131	2.15	1.80	2.00	0.33	2.75	1.40
S-133	4.65	3.25	4.35	0.52	2.77	1.47
S-65	4.31	3.16	3.91	0.11	1.85	1.15
S-65A	3.21	2.46	2.96	0.05	1.56	1.20
S-65B	4.50	2.65	4.00	0.05	2.30	1.80
S-65C	3.57	3.02	3.37	0.02	2.00	1.20
S-65D	5.10	3.40	4.50	0.10	2.12	1.15
S-65E	4.73	4.11	4.43	0.25	2.72	1.38
S-68	7.25	6.85	7.15	0.05	1.90	1.45
S-70	5.74	4.45	5.47	0.16	2.50	1.39
S-71	3.43	3.02	3.29	0.41	-	-
S-72	2.45	1.76	1.58	0.24	2.62	1.42
S-75	2.45	1.76	2.17	0.09	5.27	3.11
S-82	1.09	0.76	1.05	0.11	2.19	1.44
S-83	3.39	2.01	3.21	0.09	4.16	2.57
S-84	5.19	4.34	4.79	0.22	-	-
1994 Basin Average	3.77	2.93	3.49	0.37	2.72	1.63

Table 15C. Storm Frequency and Return Period for Lower Kissimmee

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
S-127	> 3 Years	-	-	-
S-65E	> 3 Years	-	-	-
S-68	> 25 Years	> 10 Years	-	-
S-70	> 3 Years	> 3 Years	-	-
S-84	> 3 Years	-	-	-

Table 16A. Monthly Rainfall (Inches for the Upper Kissimmee

Stations	MAY	JUN	JUL	AUG	SEP	OCT	Total Wet Season	NOV	DEC	TOTAL
COLEY	-	-	-	-	-	1.90	-	2.85	4.05	-
KISSIMMEE FS	4.47	11.10	8.02	10.88	10.23	2.33	47.03	4.74	4.90	56.67
KISSIMMEE SP	1.95	10.41	5.18	5.63	6.76	3.71	33.64	4.51	3.35	41.50
LAKE ALFRED	-	-	-	-	-	1.07	-	0.65	3.43	-
MC COY	2.76	10.47	13.30	6.23	7.68	5.33	45.77	7.18	3.08	56.03
S-61	2.39	9.28	11.47	8.77	6.38	4.91	43.20	8.58	2.68	54.46
S-65	1.54	12.89	11.68	4.54	8.24	4.67	43.56	4.41	2.63	50.60
S-65A	2.81	9.02	11.27	8.25	5.68	4.43	41.46	3.29	2.71	47.46
ST CLOUD	6.85	9.37	7.77	7.28	9.52	6.57	47.36	6.69	2.92	56.97
1994 Basin Average	3.25	10.36	9.81	7.37	7.78	3.88	42.46	4.77	3.31	50.53
LONG TERM AVG.	4.29	7.37	6.29	6.90	6.38	3.20	34.43	1.80	2.04	38.27
% of Normal	76%	141%	156%	107%	122%	121%	123%	265%	162%	132%
Approx. return Frequency (yrs)		8	70				12	17	6	

Table 16B. Rainfall Statistics for the Storm Events in the Upper Kissimmee

Stations	NOV 15-17	1 DAY MAX	2 DAY MAX	DEC 5	DEC 21-22	1 DAY MAX
COLEY	2.76	2.44	2.72	2.58	1.24	1.24
KISSIMMEE FS	3.87	3.22	3.57	1.40	2.66	1.61
KISSIMMEE SP	4.06	3.16	3.96	0.50	2.20	1.30
LAKE ALFRED	-	-	-	1.15	1.61	1.22
MC COY	5.75	3.64	5.42	0.62	1.36	0.78
S-61	7.81	6.85	7.71	0.15	1.95	1.09
S-65	4.31	3.16	3.91	0.11	1.85	1.15
S-65A	3.21	2.46	2.96	0.05	1.56	1.20
ST CLOUD	6.09	5.42	6.02	0.01	1.95	1.47
1994 Basin Average	4.73	3.79	4.53	0.73	1.82	1.23

Table 16C. Storm Frequency and Return Period for Upper Kissimmee

Station	Storm Duration and Return Frequency			
	Nov. 15 - 17		Dec.5	Dec 21 - 22
	1 Day Max	2 Day Max		1 Day Max.
S-61	> 10 Years	> 5 Years	-	-
St Cloud	> 5 Years	> 3 Years	-	-

ISOHYETAL MAPS

Monthly rainfall amounts listed in Tables 4A through 16A are point rainfall values. These values were plotted for the entire District in order to estimate the rainfall amounts in areas where there are no rainfall measuring stations. Isohyetal maps provide an estimate of the spatial distribution of rainfall.

Figure 6A is the long-term isohyetal map of the average wet season rainfall in the District (Tech. Pub. 81-3). This isohyetal map is presented to compare the long-term wet season average rainfall of the District with the 1994 wet season rainfall totals shown in Figure 6B. The average wet season (Figure 6A) map shows approximately 36 inches of rainfall for the Kissimmee Basin (both Upper and Lower Basin). However, Figure 6B shows that Upper Kissimmee received 42 to 46 inches of rainfall during the 1994 wet season. The Lower Kissimmee Basin received 34 to 42 inches of rainfall depending on the location. The average wet season rainfall for the West Palm Beach area varies from 44 to 46 inches, whereas the 1994 wet season for the area varied from 44 to 48 inches. Around the Homestead area the average wet season rainfall is approximately 46 inches in comparison to almost 52 to 54 inches of rainfall for the 1994 wet season.

Figure 7A depicts the long-term monthly average rainfall for November and Figure 7B shows the 1994 November rainfall for the District. In the Homestead area, November rainfall is expected to be about 2.25 inches, whereas during November 1994 it was almost 9 inches. Figure 7C shows the isohyetal map for the 1994 November 15-17 (3 days) storm event. In the Upper Kissimmee basin the total amount of rainfall received during the 3-day storm event was 5 to 6 inches. Figure 7D depicts the 1-day maximum amount of rainfall the District received during Tropical Storm Gordon (Nov. 15-17,1994). The maximum amount of rain fell in the Upper Kissimmee basin (4-5 inches) as well as in a small area around Broward County. Figure 7E shows the 2-day maximum rainfall amount during the storm (November 15-17). It can be observed from Figure 7E that the 2-day maximum rainfall fell in Broward County.

Figure 8A shows the long-term average December rainfall for the District and Figure 7B depicts the December 1994 monthly rainfall. Figure 8A shows that in the western Boca Raton area the average December monthly rainfall is between 1.75 and 2 inches; however, this area received 10 to 12 inches during December 1994. Figure 8C depicts the isocontour map of the December 5, 1994 storm event. The rainfall concentration during this event was also centered on the same area (western Boca Raton). Figures 8D and 8E depict the total rainfall for the December 21-22 storm event as well as the 1-day maximum rainfall during the storm. During this event coastal areas bordering the Palm Beach/Broward County line received 3 to 6 inches of rainfall. The 1-day maximum rainfall was 4 inches.

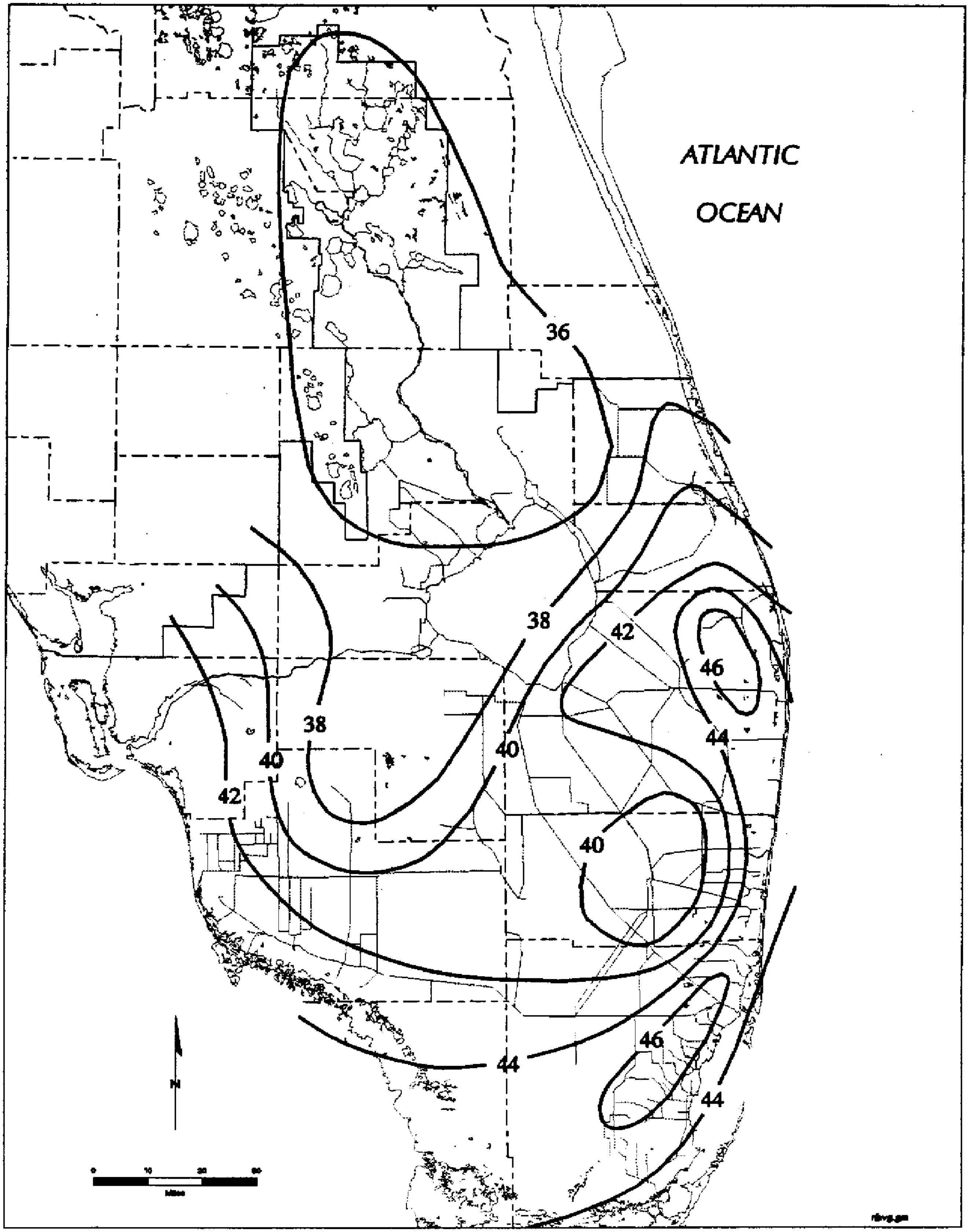


Figure 6A. Average Wet Season Rainfall (May-October 31).

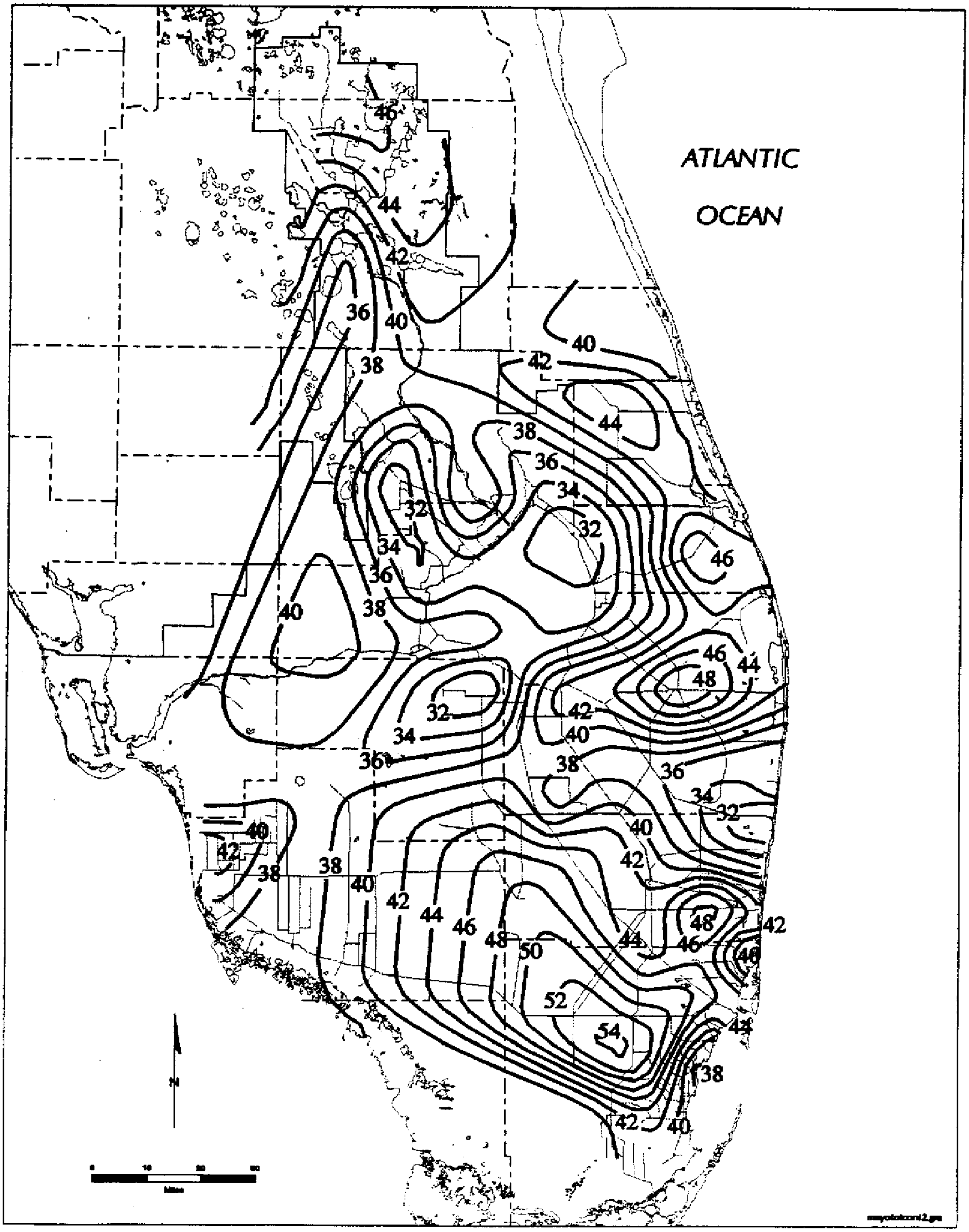


Figure 6B. Wet Season Rainfall (May 1-October 31, 1994).

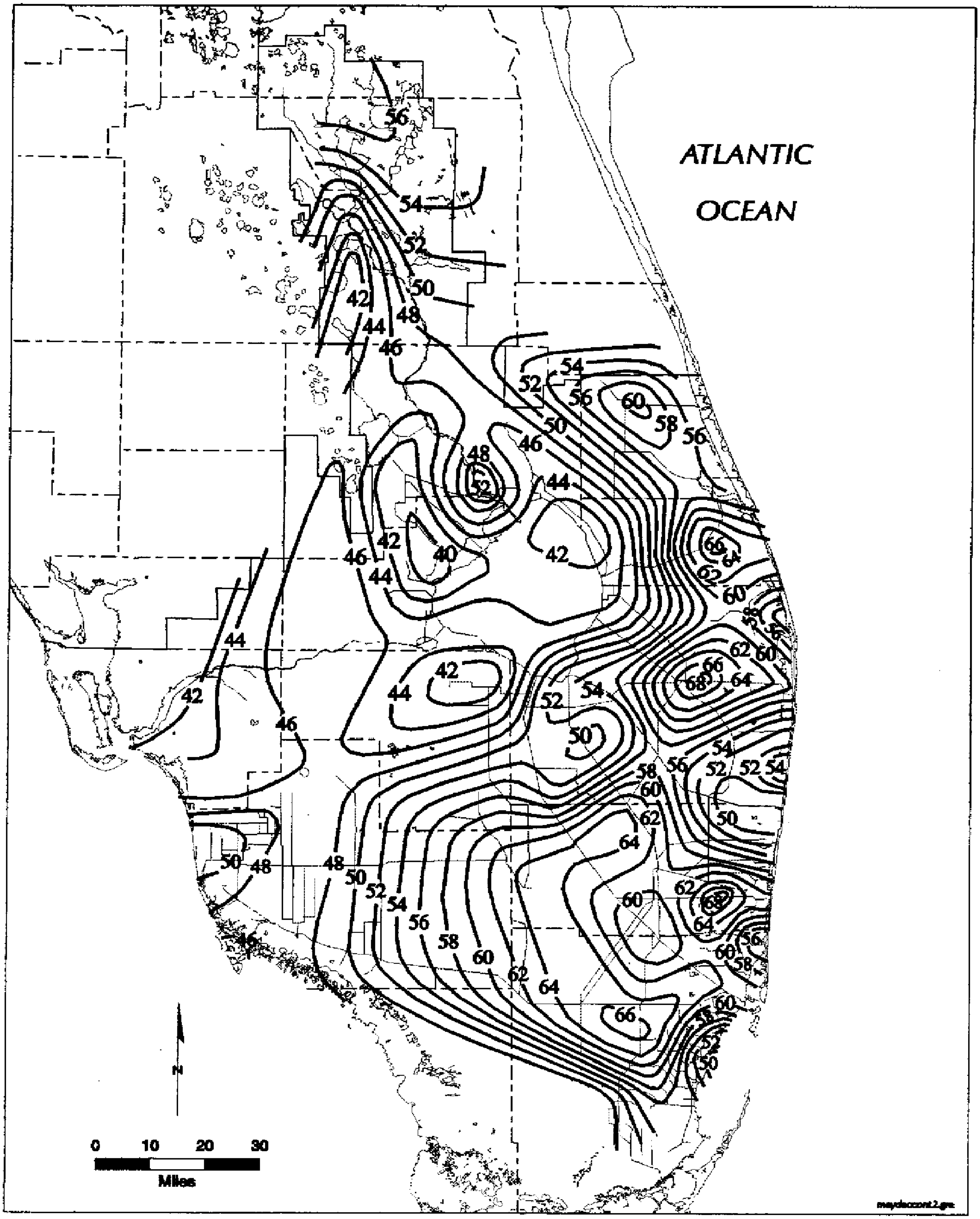


Figure 6C. Rainfall Total for May through December 1994.

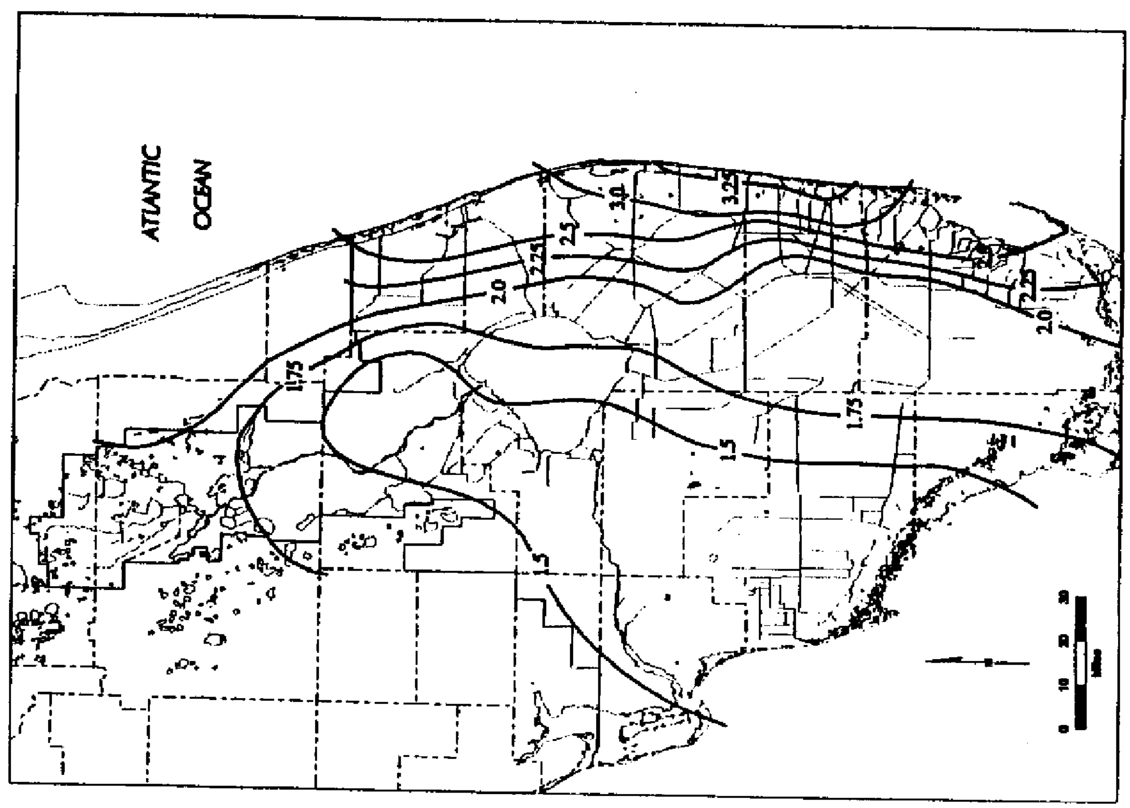


Figure 7A. Monthly Average Rainfall for November.

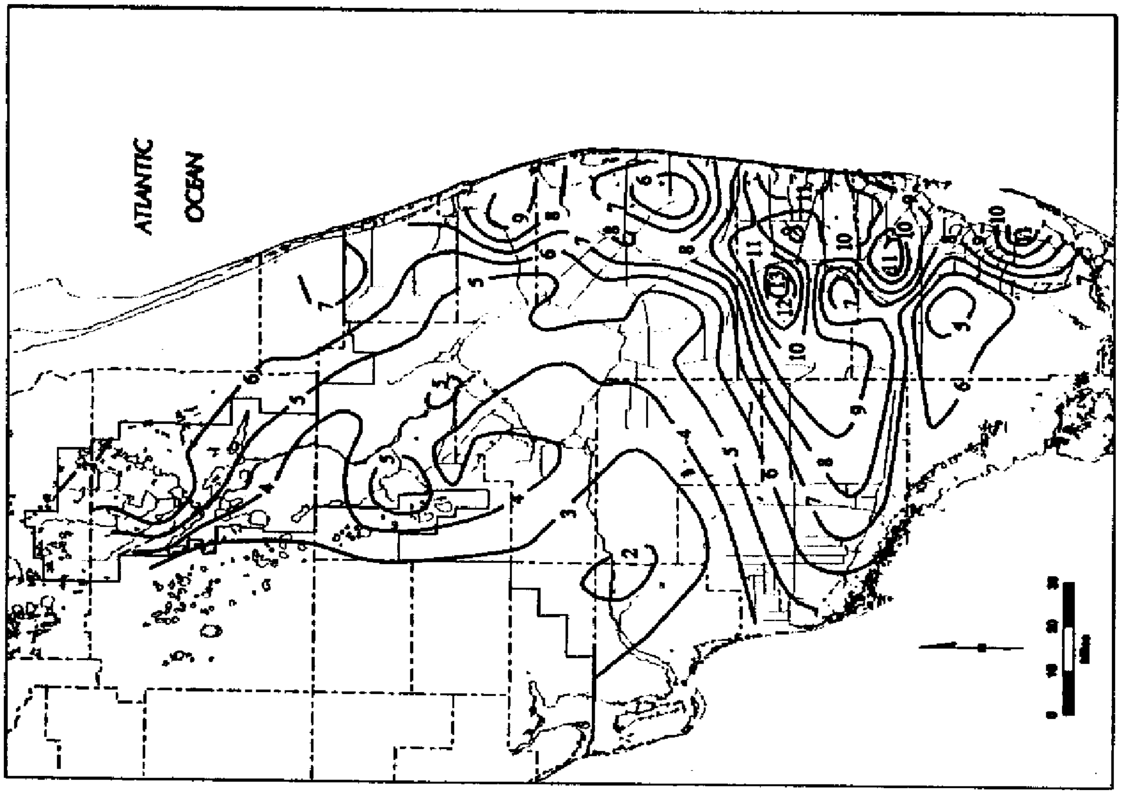


Figure 7B. Monthly Rainfall for November 1994.

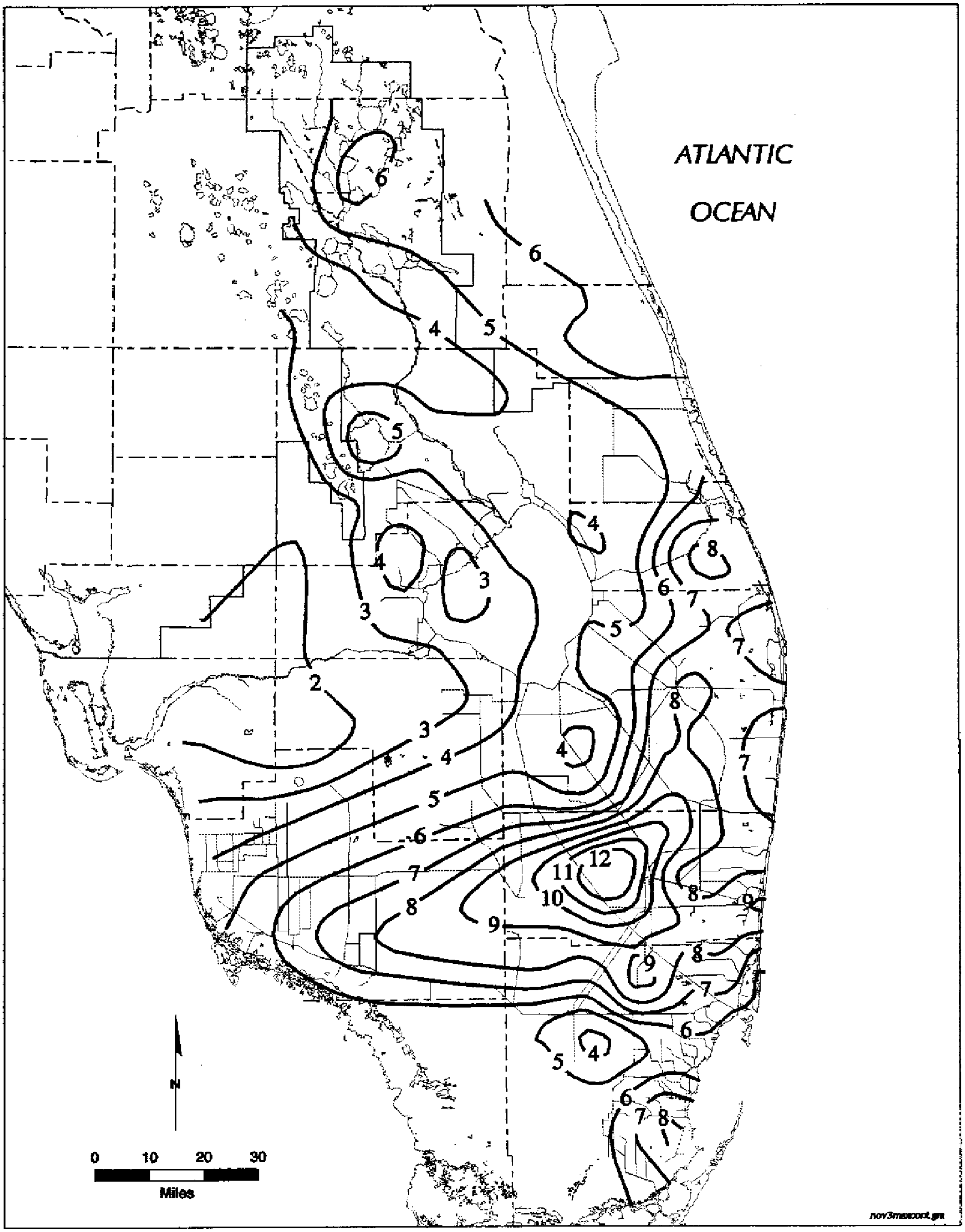


Figure 7C. Tropical Storm Gordon (November 15-17, 1994) Rainfall Totals.

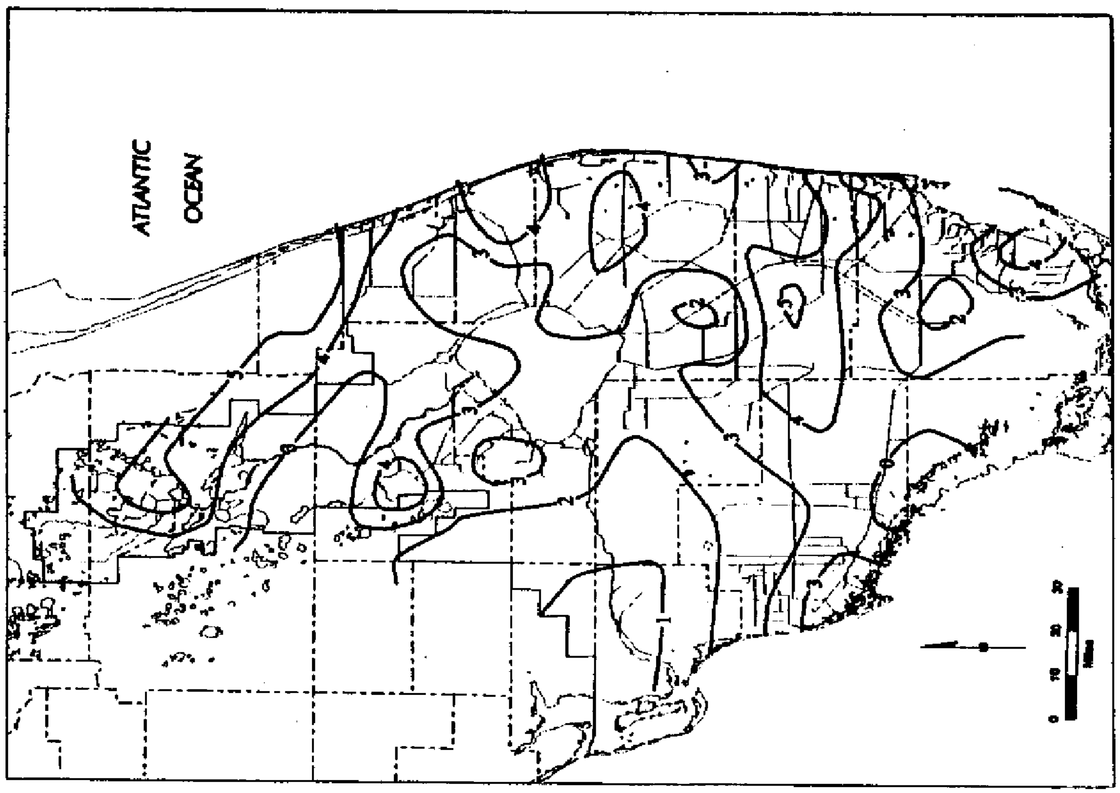


Figure 7D. Tropical Storm Gordon (Nov. 15-17, 1994) Rainfall 1-Day Maximum.

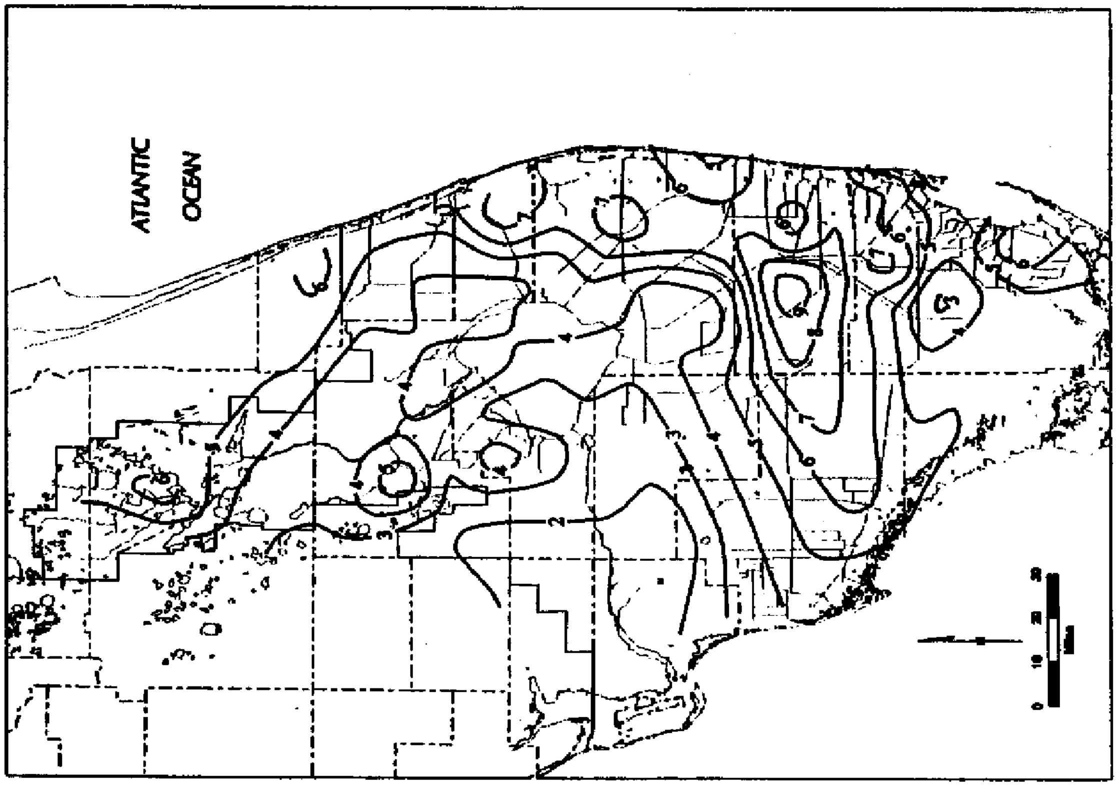


Figure 7E. Tropical Storm Gordon (Nov. 15-17, 1994) Rainfall 2-Day Maximum.

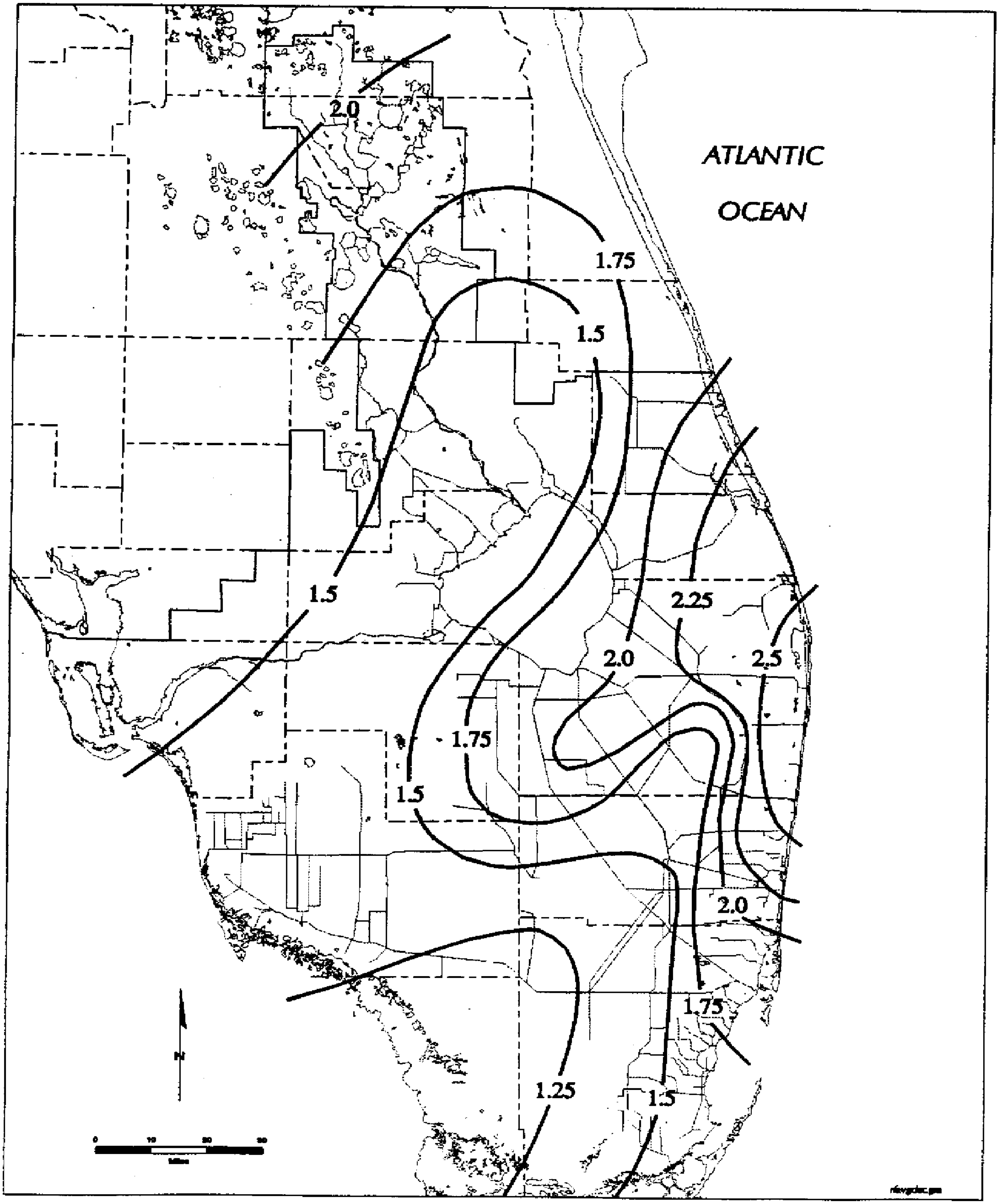


Figure 8A. Monthly Average Rainfall for December.

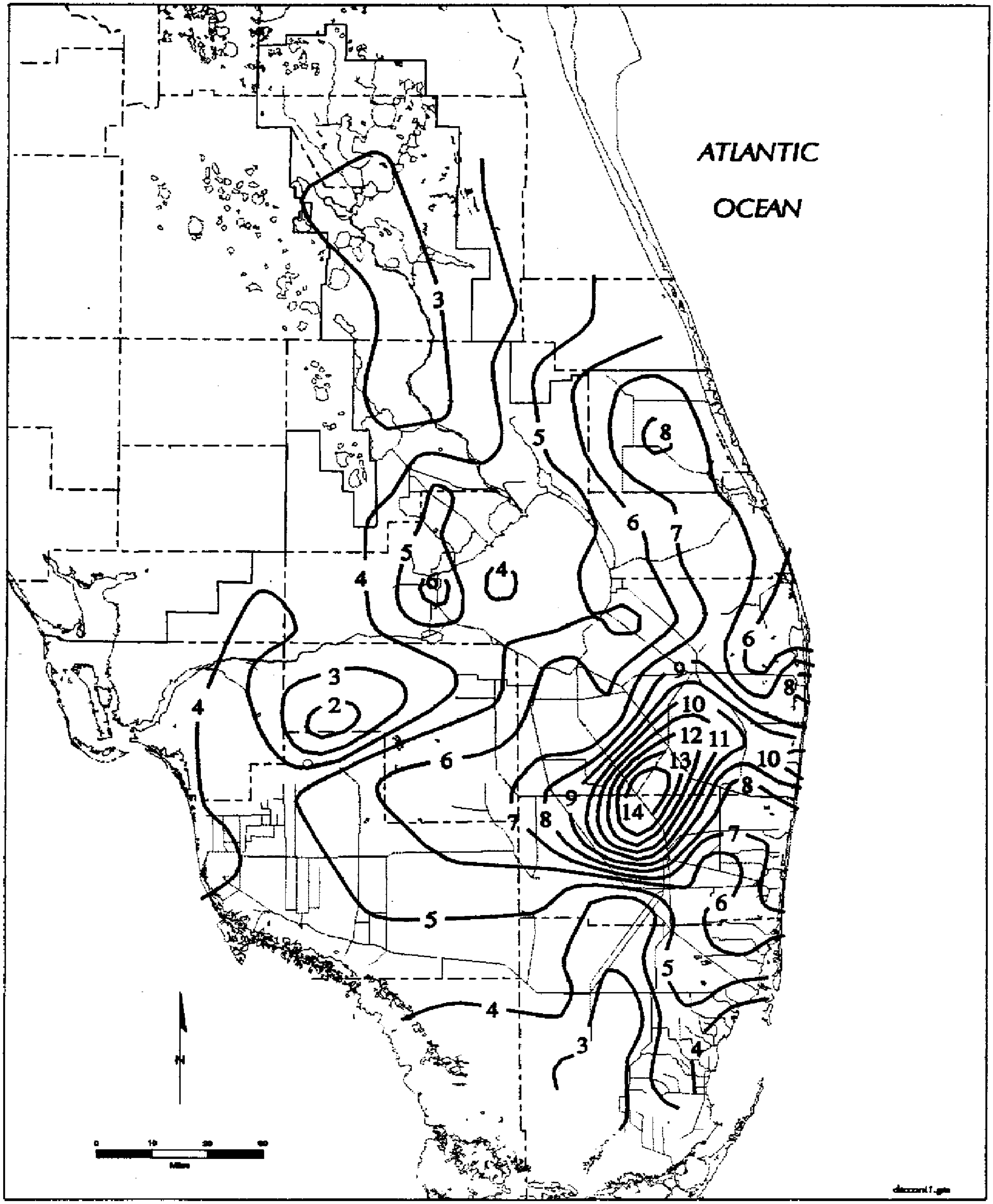


Figure 8B. Monthly Rainfall for December 1994.

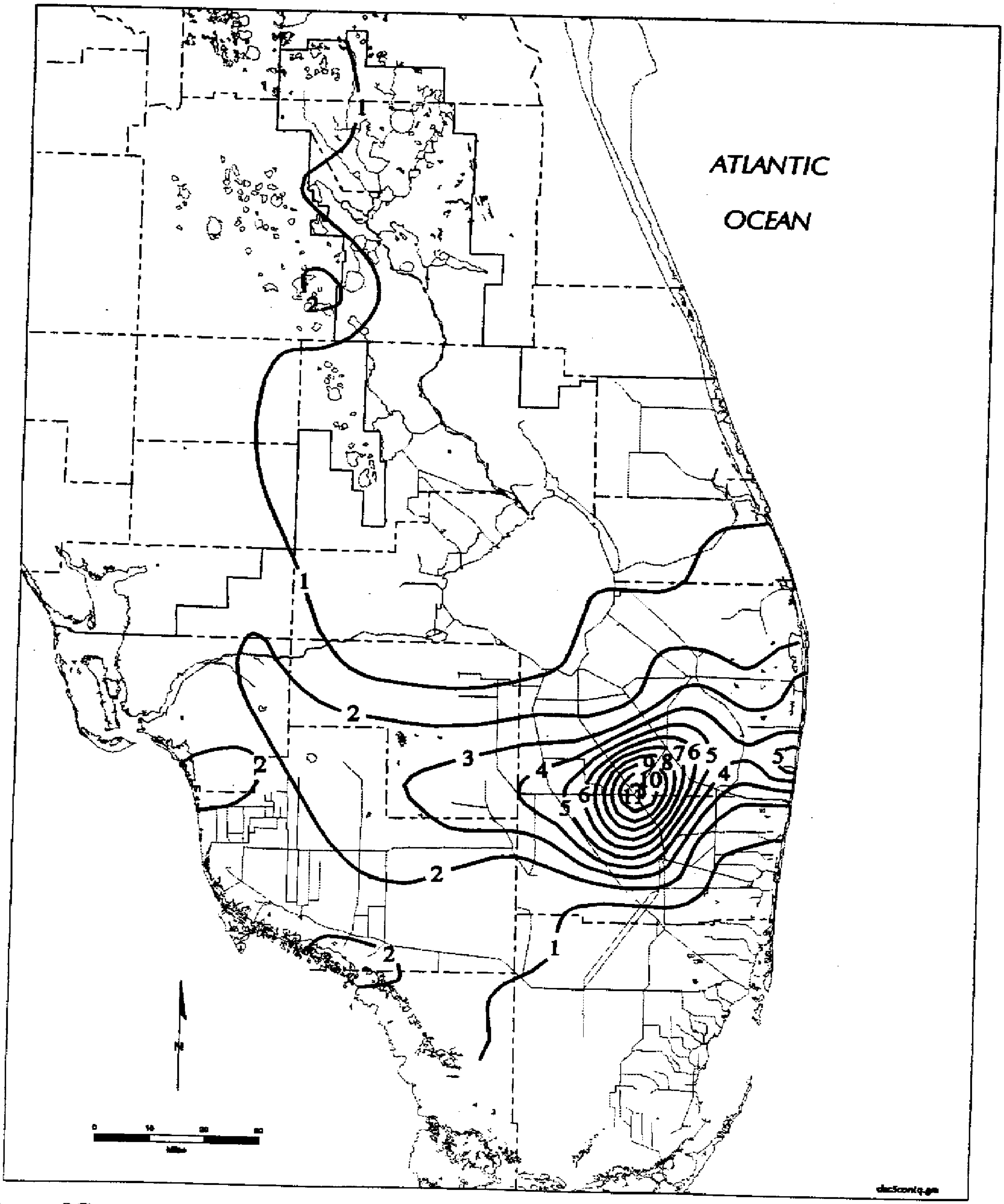


Figure 8C. Rainfall Total for December 5, 1994.

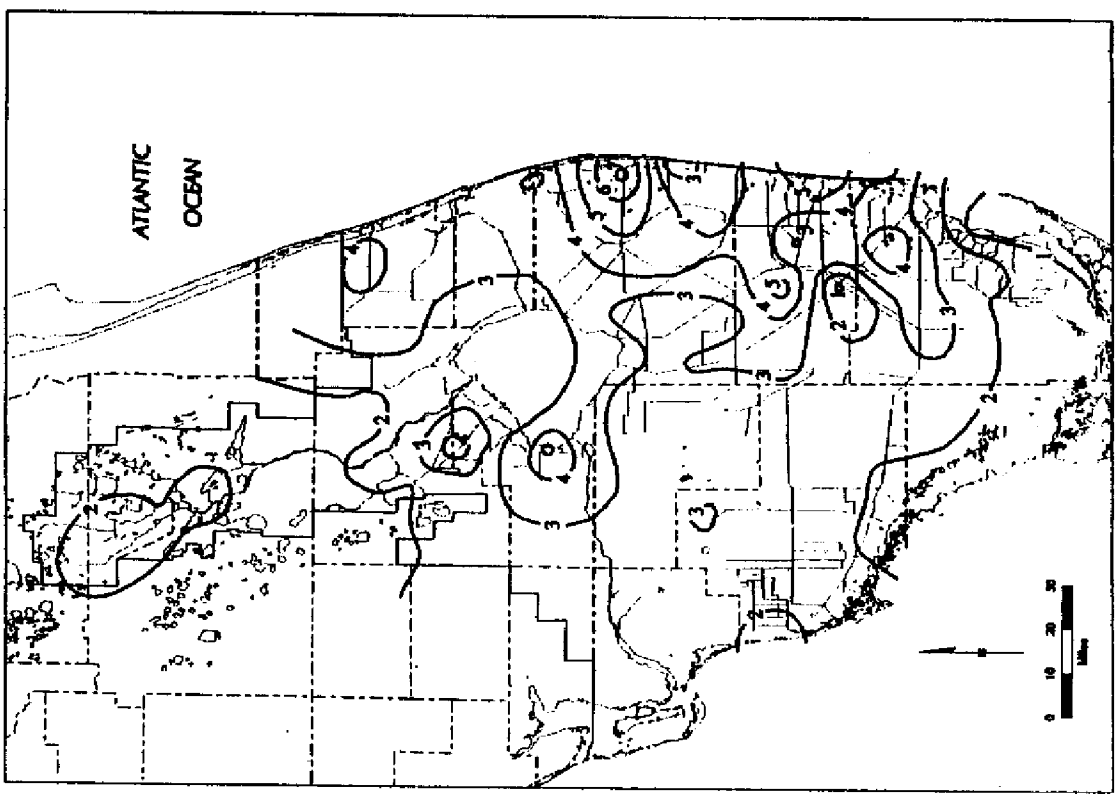


Figure 8D. Rainfall Total for December 21-22, 1994.

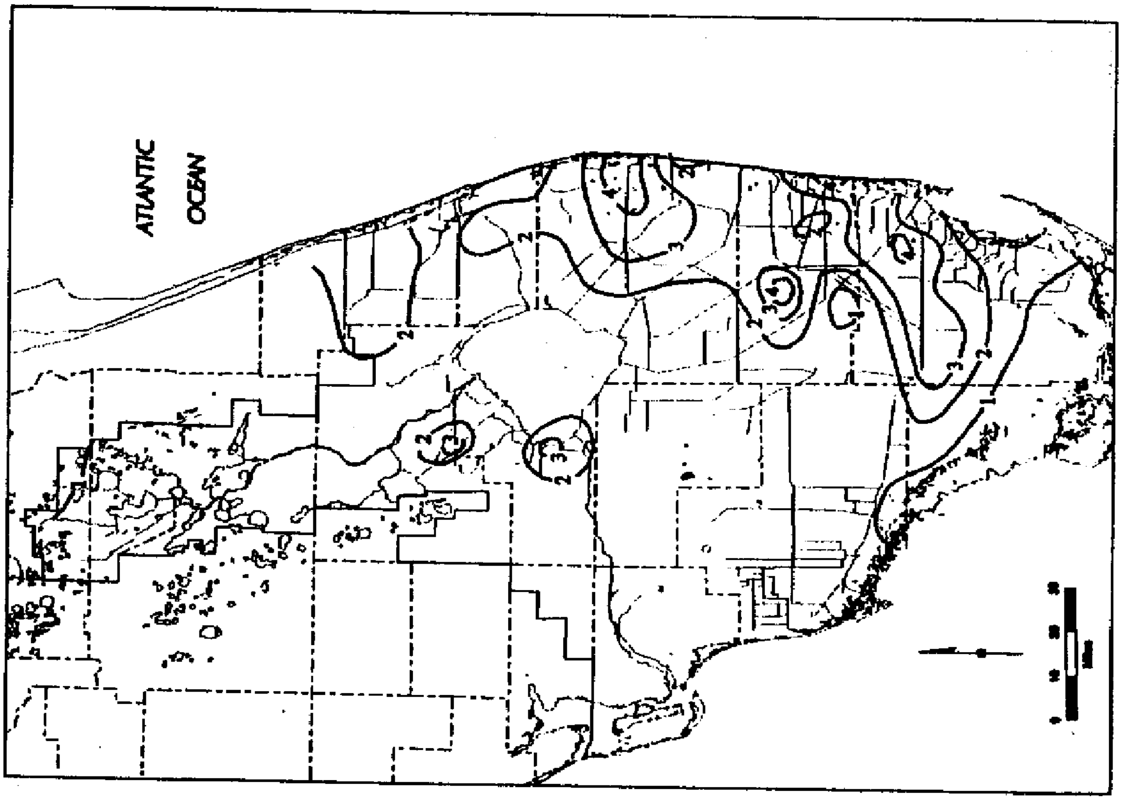


Figure 8E. December 21-22, 1994 Rainfall 1-Day Maximum.

CHAPTER 4

SYSTEM OPERATION (WATER LEVELS AND DISCHARGES)

DISTRICT-WIDE WATER LEVELS

Water levels throughout the District were generally within normal ranges in May, prior to the onset of the 1994 wet season. With the continual and widespread heavy rainfall during the beginning of the wet season, regional storage areas throughout the District filled up rapidly. By August and September, water was being discharged from regional storage areas throughout the District, in an effort to lower water levels. Prior to Tropical Storm Gordon in mid-November, water levels in the Kissimmee River basin were at or close to regulation schedule; Lake Okeechobee and the WCAs 2A and 3A were above schedule but declining as a result of regulatory discharges; and WCA 1 was about 0.3 feet above schedule. Rainfall from Tropical Storm Gordon during November 13-17 caused water level increases throughout the District; only Lake Kissimmee remained at or close to schedule on November 17th. All other storage areas were above schedule. Water levels in the Kissimmee River basin were generally back to regulation schedule by early December as a result of regulatory discharges. Efforts to lower levels in Lake Okeechobee and the WCAs were hampered by additional rainfall from the storms of December 4 and 20-21. Regulatory discharges from Lake Okeechobee and the WCAs are continuing. The following is a detailed discussion of water levels and operations strategies in individual regions of the District during the period May-December 1994. Water levels as well as discharges made from major structures within the District area are presented in Appendices.

UPPER KISSIMMEE RIVER BASIN

Water Levels

Water levels and regulation schedules for the major lakes in the Upper Kissimmee River basin are shown in Figures 9-10. Lake levels declined to their annual minimum at the end of May, in keeping with their regulation schedules. Lake schedules rose to their wet season levels on June 1 and the heavy rainfall in June brought water levels up meet the regulation schedules. In spite of heavy rains from June through September in the Upper Kissimmee region, water levels in most of the lakes were maintained at or close to regulation schedule by substantial regulatory releases from all lakes to Lake Okeechobee. Water levels in Lake Tohopekaliga and East Lake Tohopekaliga rose to about 1 foot above schedule between early July and mid-August because structure S-61 was taken out of service from June 24-August 6 for repairs. Water levels were lowered to schedule by mid-August on Lake Tohopekaliga and by late September on East Lake Tohopekaliga. Heavy infestations of Hydrilla in the northern portions of Lake Cypress restricted the large releases required from Lake Tohopekaliga through S-61 during August.

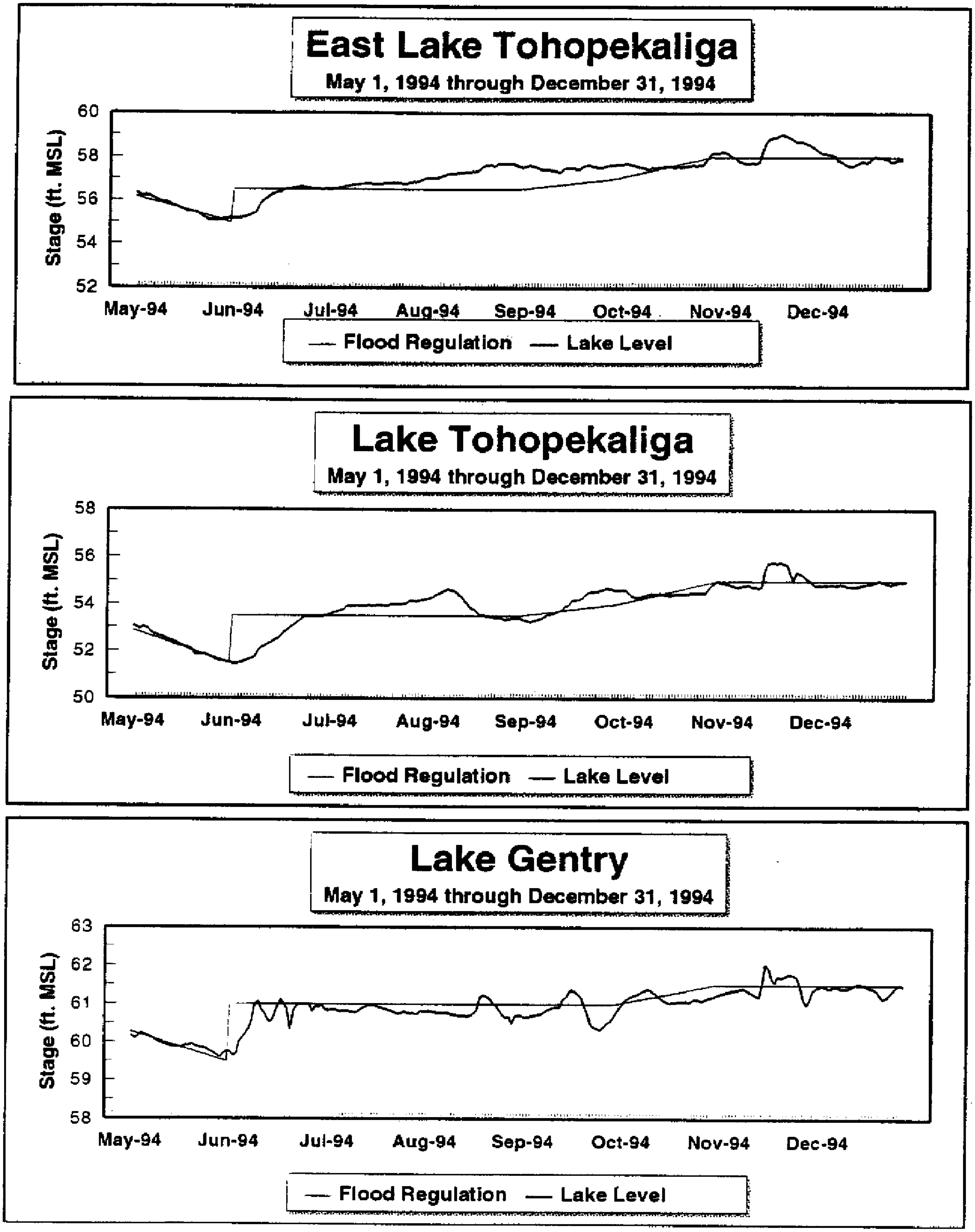
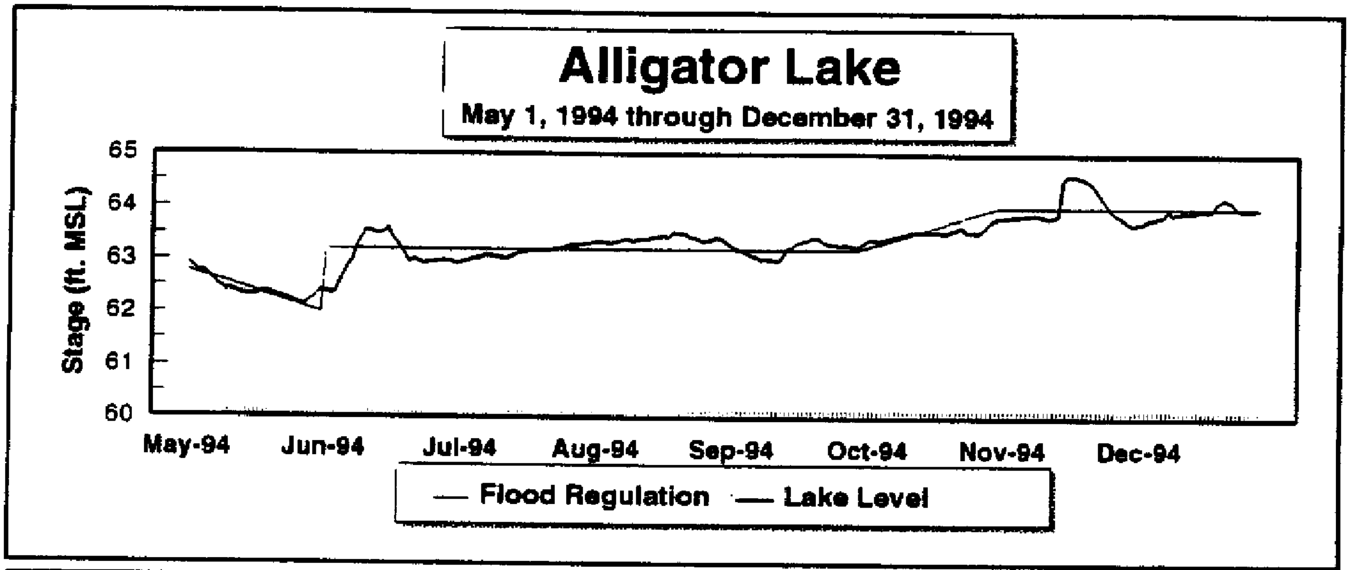
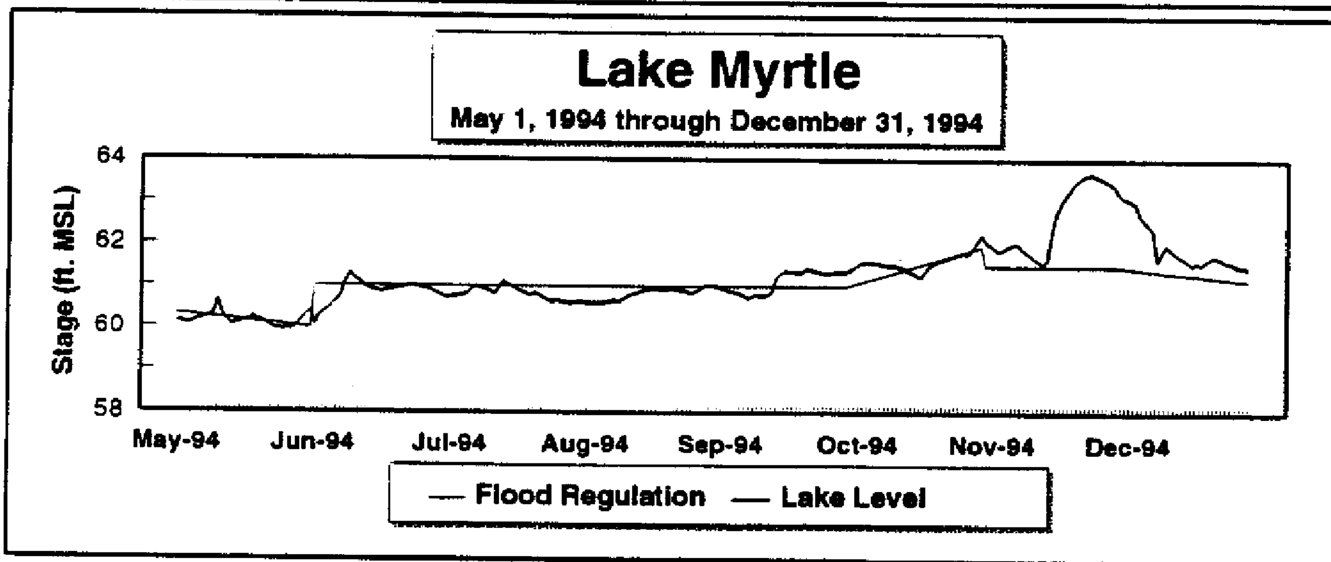


Figure 9A. Water Levels and Regulations Schedules for Major Lakes in the Upper Kissimmee River Basin.





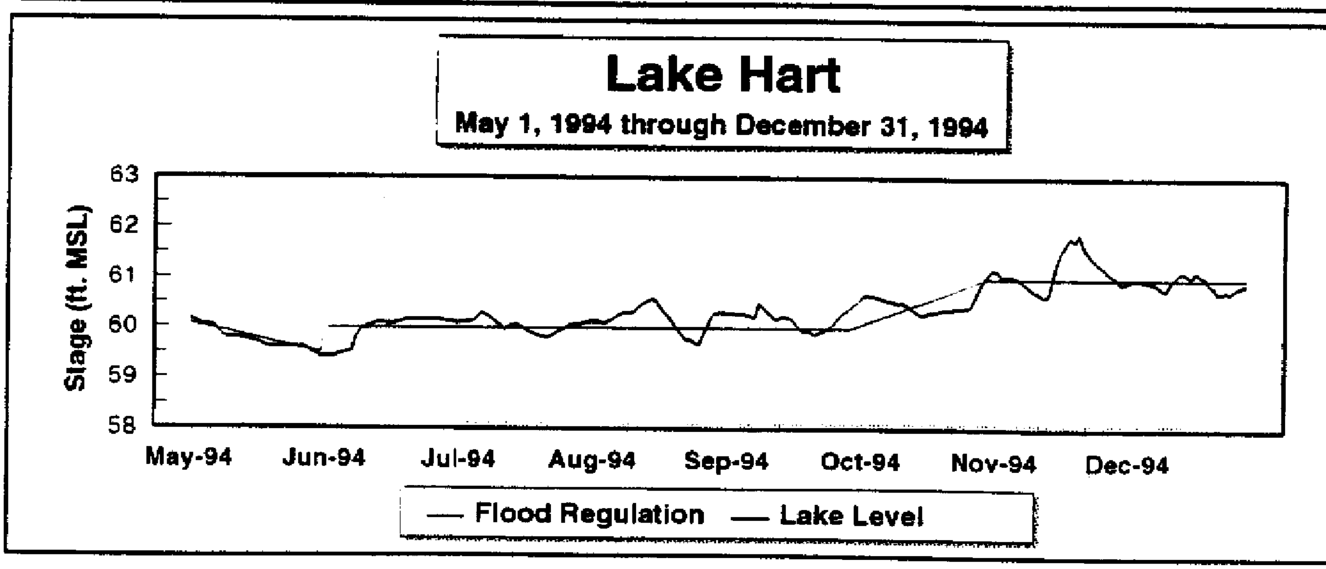


Figure 9B. Water Levels and Regulation Schedules for Major Lakes in the Upper Kissimmee River Basin.

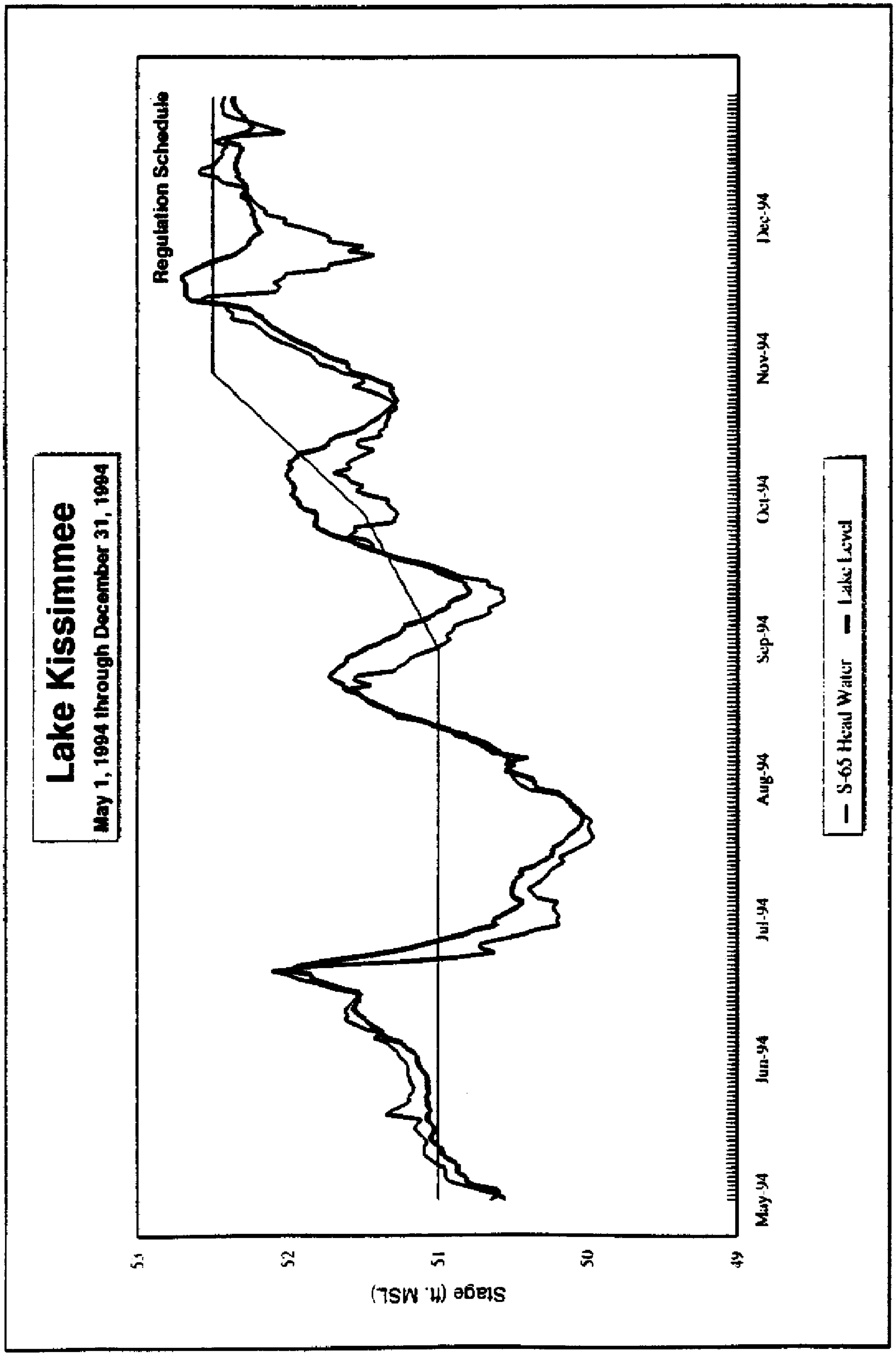


Figure 10. Water Levels and Regulation Schedule for Lake Kissimmee.

The combination of mechanical clearing of flow paths through the submerged vegetation and the large flow releases required to bring Lake Tohopekaliga back to regulation schedule in August, removed enough of the vegetation to effectively reduce flow obstructions during subsequent discharges. While the biological and recreational/navigation benefits of Hydrilla control are widely recognized, more resources are needed for controlling the Hydrilla infestation in the Kissimmee chain of lakes to ensure that flood control is not compromised.

Lake Kissimmee operations were modified this year to facilitate placement of the test plug in the Kissimmee River Restoration Project. In accordance with this modification, the lake level was lowered to 50 feet by mid-April and no releases were to be made unless lake levels exceeded 51 feet. The District started to make minor releases from Lake Kissimmee on May 6, after lake levels exceeded schedule. In spite of these releases, water levels continued to rise and normal regulatory releases were resumed in late June to bring water levels down to schedule. The Corps of Engineers suspended placement of the test fill because of high flows in the river. Once water levels declined below regulation schedule, releases were scaled back gradually in order to avoid fish kills downstream, and the water level was about a foot below schedule by the middle of July. Placement of the test fill resumed in July and was completed in August. Regulatory releases from Lake Kissimmee resumed in mid-August because of rising lake levels and heavy regulatory discharges from upstream lakes.

All lakes were back down to regulation schedule by October 17th and regulatory releases were terminated from all the lakes except Lake Kissimmee. Releases from Lake Kissimmee were again reduced gradually and finally terminated on the October 25. Water levels in the area continued to decline until heavy rains from Tropical Storm Gordon caused sharp increases in lake levels. Large inflows from Boggy Creek and Shingle Creek during Tropical Storm Gordon combined with direct rainfall and local runoff to exceed the regulation schedule on Lake Tohopekaliga and East Lake Tohopekaliga by 0.5-0.8 feet. In order to forestall even more severe flooding as water levels in Lake Tohopekaliga and East Lake Tohopekaliga continued to rise, outflow at S-59 and S-61 was allowed to exceed the design discharge rate while induced erosion downstream of the structures was closely monitored. Since the downstream erosion was not excessive, maximum discharges were continued as long as required. Water levels reached over 2 feet above regulation in the Lake Myrtle/Lake Preston group of lakes because insufficient downstream capacity was available to realize design discharge capacity until the last week in November. Water levels approximately one foot above regulation common place in all controlled lakes in the upper chain except Lake Kissimmee, which was maintained near its regulation schedule by releases at S-65. Water levels in Lake Tiger, Lake Cypress, and Lake Hatchineha which normally are about the same as Lake Kissimmee under low flow conditions, were all considerably higher during the peak of the storm event.

By the beginning of December, the lake levels had been lowered to close to their schedules and regulatory releases were diminishing.

There was initially some concern that components of the Kissimmee River Restoration Plan now in place (namely the three weirs and the test plug in Pool B) would adversely impact the ability to move water from the upper Kissimmee Basin. However, this did not occur during Tropical Storm Gordon. Discharges at S-65A, in excess of 6000 cfs were realized without backwater effects on Lake Kissimmee and without unreasonably high stages upstream of S-65A. Additional head losses, however, are likely after complete de-channelization.

It may be possible to improve estimates of the additional head loss by re-examining the original modeling assumptions with the additional information gained from Tropical Storm Gordon. In particular, improved flow resistance estimates for overbank flow along the Kissimmee River may be derived from flow and stage data obtained during and after Tropical Storm Gordon. Water level information which was not previously available for the lakes immediately upstream of Lake Kissimmee will be incorporated into the Corps' headwaters study for the Kissimmee River Restoration Project (scheduled for completion August 1995) and will allow refinement of backwater curves between lakes and a better evaluation of impacts to water control structures upstream of Lake Kissimmee.

Local interests have requested that consideration be given to incorporating more flexibility into the regulation schedules for the Upper Kissimmee lakes. For example, it may be possible in lakes upstream of Lake Cypress to hold the water level in the lakes somewhat lower than the current regulation schedule when upstream conditions are very wet and allow levels to go somewhat higher when upstream conditions are very dry. It may also be possible to add this flexibility without significantly reducing either water supply or flood protection criteria if an appropriate index of upstream basin water conditions can be developed. It is not clear at the present time, however, what the ecological effects of the additional flexibility would be. The Corps of Engineers and the South Florida Water Management District will take the lead in preliminary assessment of the feasibility of adding flexibility to the rule curves with input from federal and state environmental agencies.

Discharges

Discharge from the Upper Kissimmee basin to the Lower Kissimmee basin is regulated through structure S65; while the Discharge from the Lower Kissimmee basin to Lake Okeechobee is controlled by structure S65E. The discharge capacity of S65E varies from 3,000 to 11,000 cfs (cubic feet per second) depending on the pool levels and water storage capacity. The design capacity of S65E is 24,000 cfs. The headwater and tailwater stages (feet msl) and discharges (cfs) from S65 and S65E are presented in Appendix A. The mean daily headwater stage during Tropical Storm Gordon was about 52.5 ft msl (which is the regulatory stage for Lake Kissimmee) on November 16, and the tailwater was 46.68 ft. Discharge from structure S65 was 4,640 cfs; however the maximum discharge of 7,770 cfs occurred on November 23. The highest mean daily headwater elevations for S65E during Tropical Storm Gordon occurred on November 18 and was 21.42 ft msl. The highest mean daily tailwater elevation of 17.34 ft msl occurred on November 29. The maximum discharges from S65E during the November and December storm events varied from 9,610 (Nov. 18) to

6,180 cfs (Dec. 24). During the month of November and December a total of 393,600 acre-feet was discharged from the Upper Kissimmee to the Lower Kissimmee basin. Water level and discharges from the Upper and Lower Kissimmee basin is presented in Appendix A.

Flooding Complaints (Figures 11 and 12)

Note: Projects with numbers indicate SFWMD Surface Water Management Permits.

May 1 - October 31, 1994: The wet season brought the usual flooding complaints caused by either locally heavy rains or by an activity that interrupted the drainage of an area. There were complaints of flooded roads and flooded agricultural and residential property. No flooding of homes was reported.

Orange County

Butler Chain of Lakes - Concern about high water levels in lakes.

Polk County

53-00034-S, River Ranch - Docks under water.

November 16 - December 4, 1994 (Response to Tropical Storm Gordon): Tropical Storm Gordon caused wide-spread flooding of streets and property in central Florida and on the east coast of Florida. The west coast of Florida had no flooding. There were numerous complaints of lake levels being too high in Orange and Osceola Counties with several inquiries as to District structures operation. There were also large areas of agricultural land inundated in Central Florida. There were no known cases of residential homes being flooded.

Orange County

Oakcrest Mobile Home Park - High water with entrance road flooded.

Shingle Creek Area - Flooding.

Lake Hart - Flooding.

Lake Mary Jane - High water.

Osceola County

City of St. Cloud - City Engineer called with a complaint that release from East Lake Tohopekaliga to Lake Tohopekaliga were backing up into the city's drainage system and flooding several streets (Blackberry Creek Subdivision). By the end of the day of November 16 the high water had receded. The city engineer requested that the District look at modifying the operation of the structure from East Lake Tohopekaliga to perhaps hold more water until the peak of storms pass and the discharge of water would have less of an impact on the city's drainage system.

Ajay Lakes Area - Streets flooded and lake level high.

Center Lake - High water levels flooding yards.

Lake Hatchineha - Property flooded.

Lake Kissimmee - High water.

Alligator Lake - High water.

Lake Cypress - Water flooding property.

An aerial inspection on November 20 revealed a failure of the east dike south of S-63.

December 5-20, 1994: No flooding complaints reported for this period.

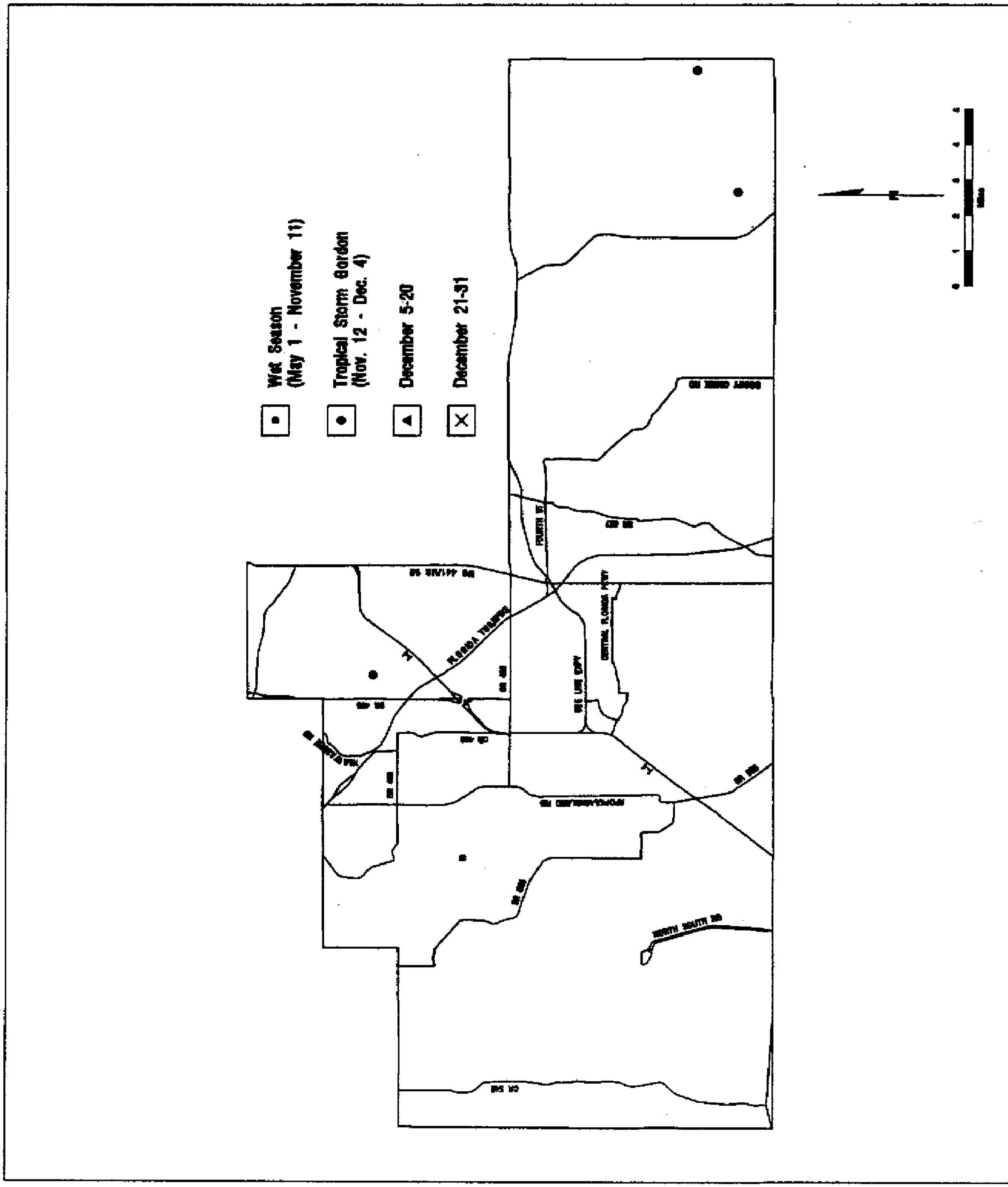


Figure 11. Orange County Flooded Areas.

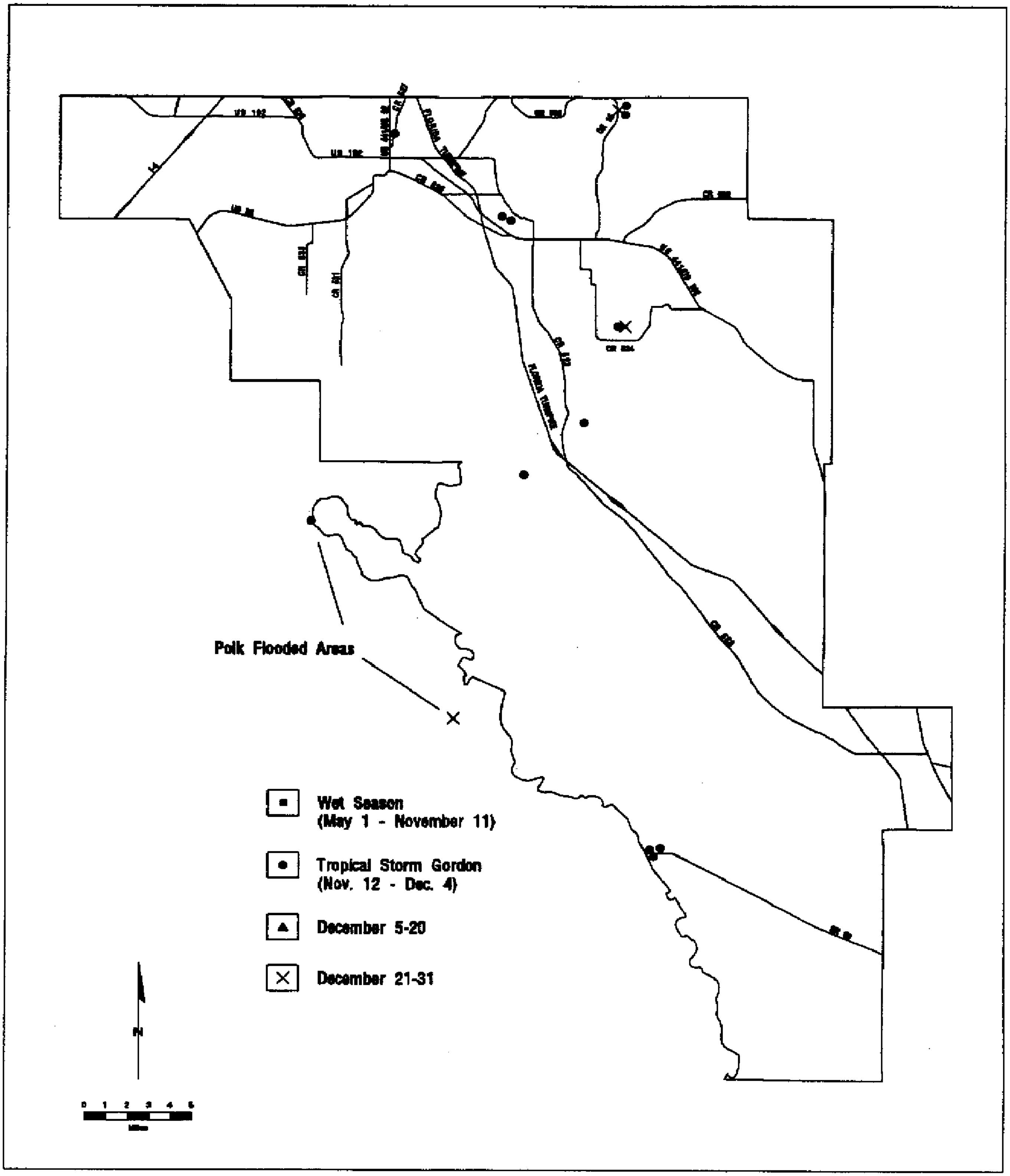


Figure 12. Osceola County Flooded Areas.

UPPER EAST COAST

Water Levels

Canals in the Upper East Coast were operated at low settings in May through late October because of local rainfall. In late October, water levels were raised to the dry season setting but were lowered in mid-November in anticipation of Tropical Storm Gordon. Since then, the canal operating levels have been adjusted between the high and low ranges depending on weather conditions. Remote monitoring and control of the S-99, S-49, and S-97 through the new north loop of the District's telemetry system facilitated the District's ability to maintain water levels within acceptable limits.

Flooding Complaints (Figures 13 and 14)

Note: Projects with numbers indicate SFWMD Surface Water Management Permits.

May 1 - October 31, 1994: The wet season brought the usual flooding complaints caused by either locally heavy rains or by some activity that interrupted the drainage of an area. There were complaints of flooded roads and flooded agricultural and residential property. No flooding of homes was reported.

Martin County

#43-00316-S, Pinecroft - Parking lot and street flooded.

Allshore MHP - Streets flooded.

#43-00370-S, Hobe Sound Golf Course - Course flooded.

Miles Grant Golf Course - Course flooded.

#43-00187-S, Ranch Colony - Streets flooded.

Ranchland Road Area - Neighbors complained about illegal pumping causing flooding but investigation revealed no pumping was occurring. Roads flooded.

Florida Power and Light Indiantown Cooling Pond - Due to heavy rainfall, the pond elevation exceeded the maximum allowable level so that water had to be discharged from the cooling pond to the St. Lucie Canal. The discharge continued at low discharge rates for a total of 18 days before the spillway was closed.

St. Lucie County

#56-00565-S, Tropicana Plant - Extraordinary discharge of process water needed.

Savannas - DEP won't allow County to clean Preserve ditches.

Residential site - Adjacent project causing flooding.

#56-00458-S, Savanna Club - Inoperable pump causing flooding of neighbors.

Midway Road - Flooding from adjacent grove.

November 16 - December 4, 1994 (Response to Tropical Storm Gordon): Tropical Storm Gordon caused wide-spread flooding of streets and property in central Florida and on the east coast of Florida.

Martin County

U.S. 1 - Flooded and closed for several days.

#43-00316-S, Pinecroft - Parking lot flooded.

Allshore MHP - Streets flooded.

#43-00103-S, Jupiter Hills Golf Course - Golf course flooded causing the course to be closed.

Stuart Yacht Club- High water.

Fox Brown Road - Road flooded.

#43-00370-S, Hobe Sound Golf Course - Half of course (110 acres) under water. Course was closed.

Rocky Point - Streets flooded.

Ranchland Road - Road flooded.

#43-00187-S, Ranch Colony - Streets and yards flooded.

St. Lucie County

Areas along the North Fork of the St. Lucie River and surrounding the Savannahs experienced road and yard flooding.

56-00692-S, Lakewood Park - Flooding.

December 5-20, 1994: No reported flooding in this Upper East Coast Planning basin during this period.

December 21-31, 1994:

Martin County (Western Area)

Springhaven Estates - Flooding of yards with complaint of neighbor blocking drainage.

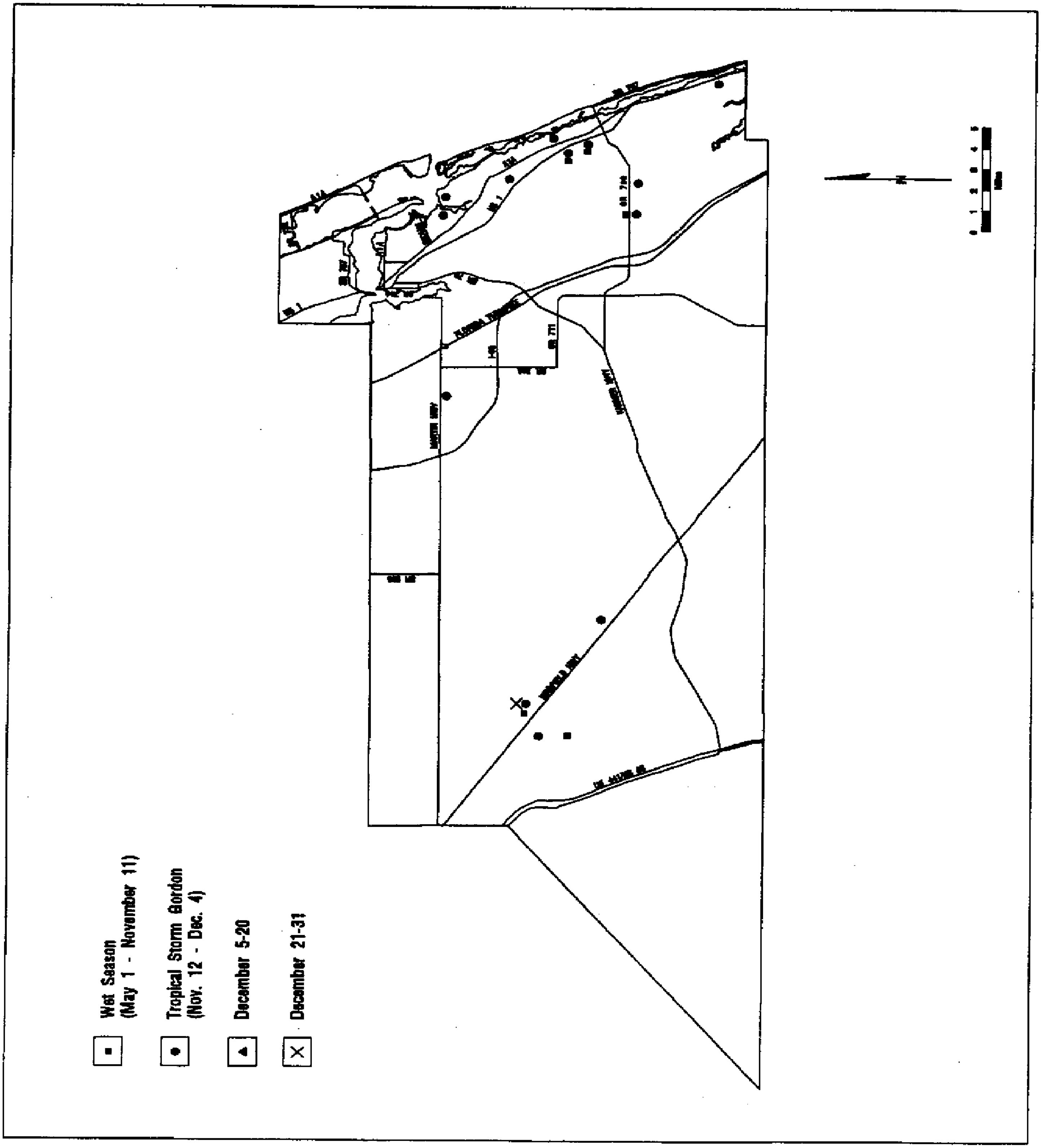


Figure 13. Martin County Flooded Areas.

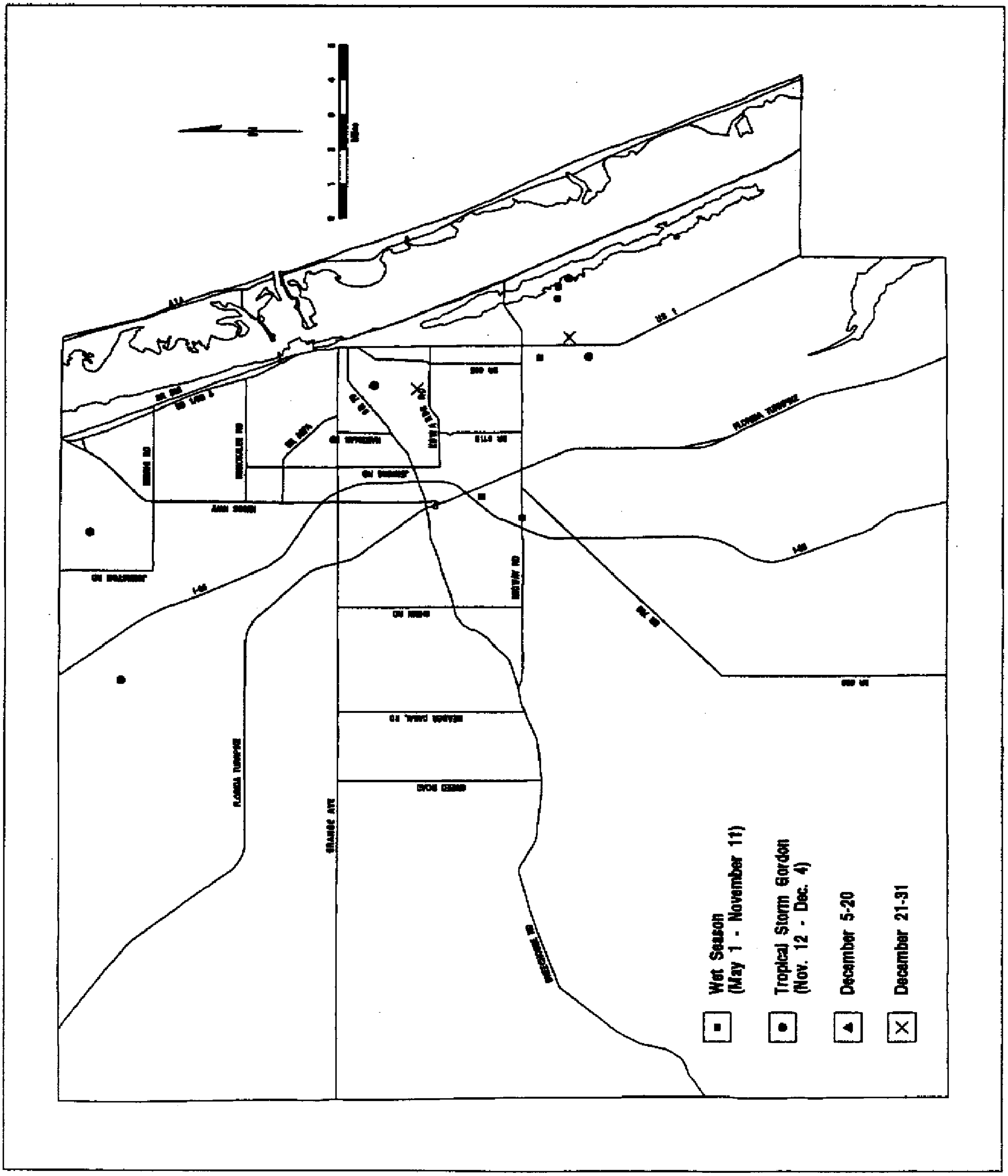


Figure 14. St. Lucie County Flooded Areas.

LAKE OKEECHOBEE

Water Levels

Lake Okeechobee water levels and regulation schedules for the period May-December 1994 are shown in Figure 15. The Lake level reached its lowest for the year during the last week of May and first week of June. During May and early June, significant water supply releases were being made from the lake to meet irrigation demands in the EAA, the Caloosahatchee and St. Lucie river service areas and the C-19 basin. The lake level declined to 13.6 feet which is about 2 feet below regulation schedule.

Pulse Releases and Regulatory Discharges

Above-normal wet season rainfall in the Kissimmee River basin generated heavy flows into Lake Okeechobee, and lake levels rose significantly as a result. From the first week of June to the middle of September, the lake level increased by more than 2 feet to meet and then exceed the non-harmful release regulation schedule. Under these conditions (Zone D), operating criteria call for pulse releases to the St. Lucie and Caloosahatchee rivers, with prescribed daily flow rates measured at the outlet from the lake to the Caloosahatchee River and at the outlet from the St. Lucie River to the estuary. These flow rates vary daily, gradually increasing then decreasing in order to simulate runoff from a rainfall event in the upstream basin. The intent of these pulse releases is to discharge water from the lake in a non-harmful manner before lake levels are high enough to require more extensive and prolonged releases.

Level 1 pulse releases were made through the Caloosahatchee River during September 21-30. Since the daily pulse releases to the St. Lucie River are measured at the coastal outlet structure from the river to the estuary, high local inflows into the St. Lucie River severely limited pulse releases from Lake Okeechobee into the St. Lucie River. The District also made regulatory releases from the Lake into WCAs 1 and 2A, as long as canal capacity in the EAA was available. Water was not released to WCA 3A or the Holeyland because of the high water levels in those areas. Despite these releases, the lake level continued to rise and Level 3 pulse releases were made October 1-29. Heavy rainfall in September and October necessitated backpumping into the lake for two days at pump station S-3 in September; three days in October; and three days at pump station S-2 in October. Discharges from the lake to WCA 1 and 2A continued whenever canal capacity through the EAA was available. Because of high water conditions in WCA 3A, water routed from the lake to WCAs 1 and 2A was discharged through coastal outlets to the ocean. Pulse releases were reduced to Level 2 on October 30 due to the declining lake level.

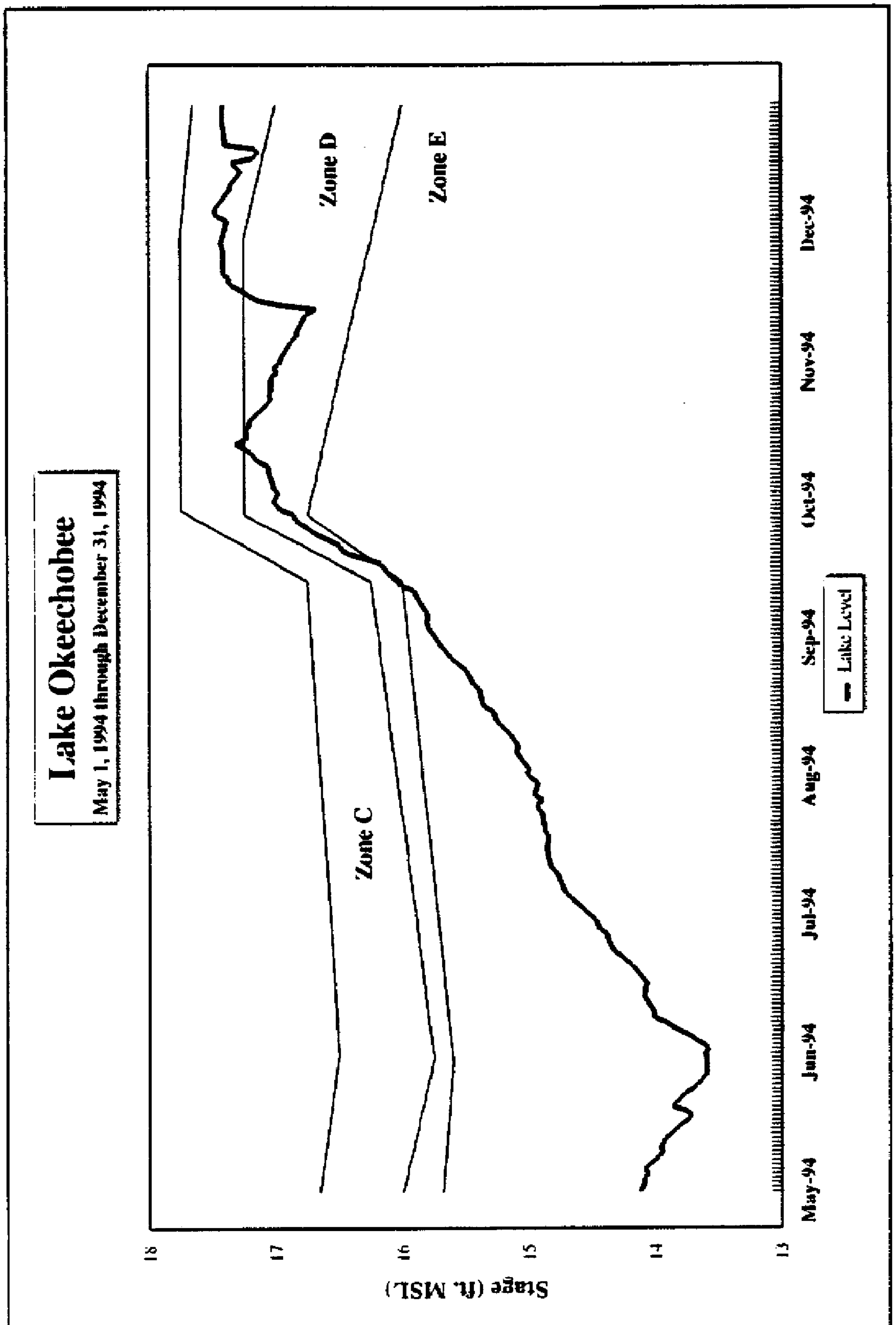


Figure 15. Lake Okeechobee Water Levels and Regulation Schedules (May-Dec.).

As a result of the pulse releases, water levels in Lake Okeechobee had declined over 0.5 foot from its peak to 16.65 feet prior to Tropical Storm Gordon. Heavy rainfall from Tropical Storm Gordon (November 13-17) caused the lake level to increase sharply to 17.4 feet, and exceed its flood regulation schedule (Zone C). In response, on November 16, the Corps of Engineers ended pulse releases and started required Level C releases from the lake. Level C releases call for steady discharges of 4,500 cfs to the Caloosahatchee Estuary and 2,500 cfs to the St. Lucie Estuary.

Discharges from Lake Okeechobee to the WCAs were terminated on November 13 in anticipation of Tropical Storm Gordon and have not been resumed, because of high water levels in the EAA and the WCAs. High water conditions created by Tropical Storm Gordon required backpumping for six days at pump station S-2 and three days at pump station S-3. Heavy rainfall on December 4 and December 20-21 again required backpumping at stations S-2 and S-3.

After Tropical Storm Gordon, the lake level declined briefly in response to continued Level C releases, but rose again as a result of the storm of December 20-21. Lake levels at the end of December was 17.4 feet, about 0.75 foot higher than pre-Gordon levels. Level C releases which began November 16 continued through January 1995. Average mean daily Lake Okeechobee stages are presented in Appendix B. Water levels and discharges from structures S77 (Caloosahatchee outflow) and S308 (St. Lucie outflow), as well as the stage for Fisheating Creek are presented in Appendix C.

Flooding Complaints (Figures 16-20)

Note: Projects with numbers indicate SFWMD Surface Water Management Permits.

May 1 - October 31, 1994: The wet season brought the usual flooding complaints caused by either locally heavy rains or by an activity that interrupted the drainage of an area. There were complaints of flooded roads and flooded agricultural and residential property. No flooding of homes was reported.

<u>Okeechobee County</u>

Fish Slough - Agricultural land flooded. Owners requested exemption for emergency works.

U.S. 98 Project - Several complaints that flooding caused by road construction.

V Bar 2 Ranch - Neighbor's berm causing flooding.

Rural Homesites - Neighbor blocking drainage.

#47-00049-S, Quailwoods - Subdivision flooding.

Pastures and homes - SFWMD holding C-38 too high.

Rural Homesites - Nursery next door is backing up water.

Rural Homesites - Neighbor blocked natural drainage.

Improved Pasture on South 441 - Flea market adjacent to pasture is flooded and being pumped.

Cypress Slough - Water level rising in slough.

Subdivision - Go cart track will disrupt drainage.

Rural Homesites - Landowner wants County to ditch his property.

Spot in the Sun - No surface water management system exists causing flooding of lots.

Lazy 7 Estates - No surface water management system exists causing flooding of lots.

Basswood - Neighbor dug ditch across adjacent yard.

Otter Creek Estates - County filled drainage easement.

Okeechobee Golf Estates - Neighbors flooded by incomplete project.

Highlands County

Davis Ranch - SFWMD raising level of Lake Istokpoga.

#28-00127-S, Spring Lake - Adjacent pasture flooding yard.

Homesites - Driveway culvert alleged to cause flooding.

Lake Placid - County paving project disturbed drainage.

Oscar Clemons Ranch - Neighboring grove causing flooding.

Highland Park Estates - Flooding due to County road building and drainage project.

Lee County

Buccaneer Trailer Park - Backyard and swale flooding.

Nalle Grade Road - Standing water in yards.

E. Bonita Springs - Standing water.

Orange River - Streets and yards flooded.

Penzance - Street flooded.

Devore Lane - Street flooded.

Bedman Creek - Standing water in backyard swales.

Suncoast - Streets and yards flooded.

Collier County

Acker Maker Road Area - Backyards and roads flooded.

Golden Gate Estates Area - Numerous complaints of standing water and yard flooding.

39th Street - Roads underwater.

Corkscrew Island - Flooded roads and yards.

Farm Fields - Fields flooded.

Naples Park - Yards flooded.

Krape Road - Yards flooded.

#11-00350-S, Crowne Pointe - Water coming from outside project boundary.

County Barn Road Area - Yard flooded.

#11-00096-S, Six L's Farm / NTG Farms - Flooding due to pumping by area farms.

Hendry County

Felda Area - An historically wet area. Roads were constructed in the 1960s with no provisions for drainage.

Pioneer Plantation - Flooding of streets and contamination of wells. Emergency authorization for emergency relief works and directed to actively pursue a solution for this historically flood-prone area.

Ladeca Acres - Backyard flooding and standing water.

Phillips Road - Backyard flooding and standing water.

Evans Road, B Road - Backyard flooding and standing water.

November 16 - December 4, 1994 (Response to Tropical Storm Gordon): The west coast of Florida had no flooding.

Okeechobee County

Northern Okeechobee Agricultural Areas East of S-65B - Agricultural and pasture lands were flooded.

Fish Slough - Agricultural land flooded.

#47-00049-S, Quail Woods - Street and yard flooding.

Collier County

Randy Riner - Downstream drainage blocked.

December 5-20, 1994: No flooding was reported for this period.

December 21-31, 1994:

Lee County

East Bonita Springs - Standing water.

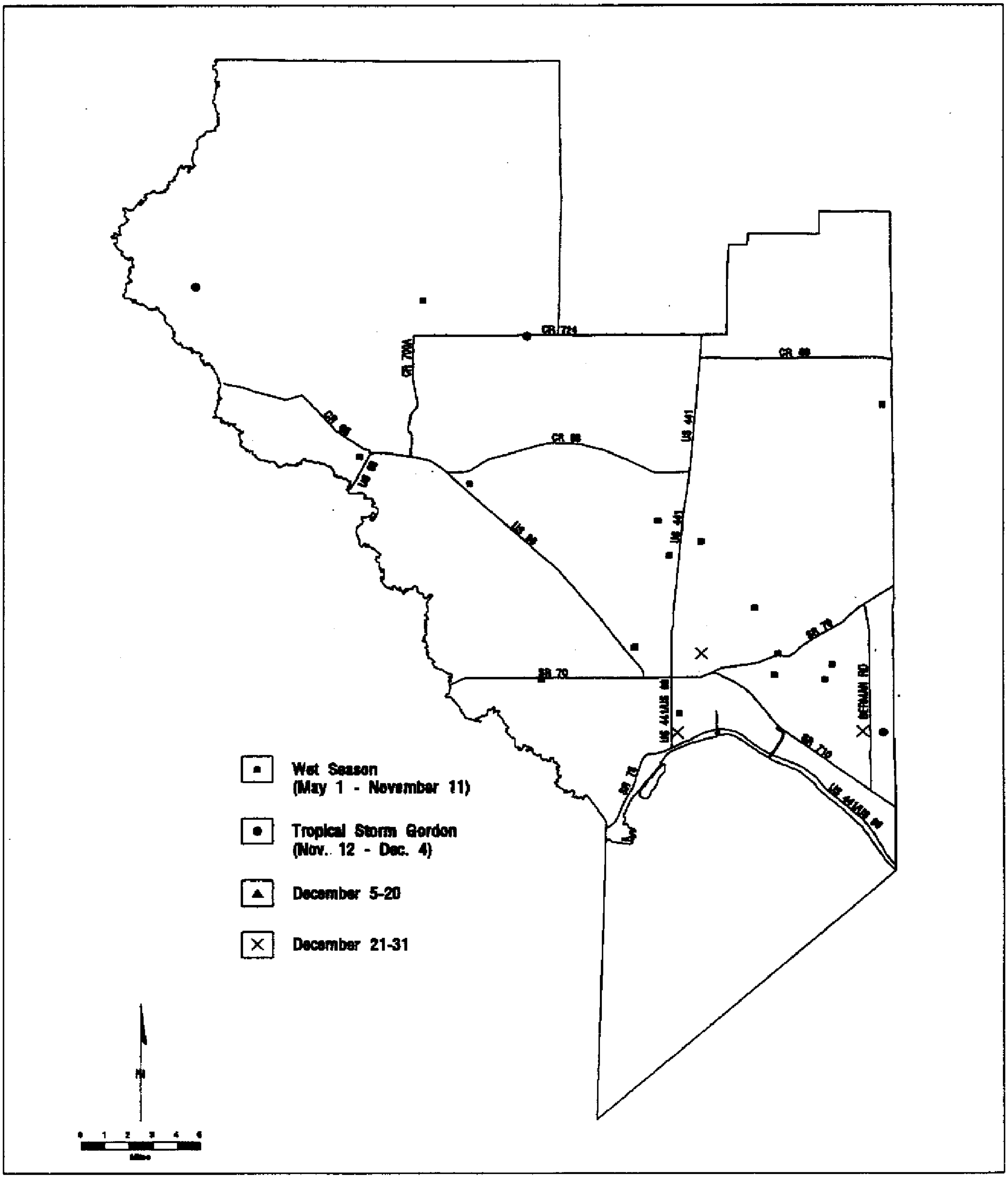


Figure 16. Okeechobee County Flooded Areas.

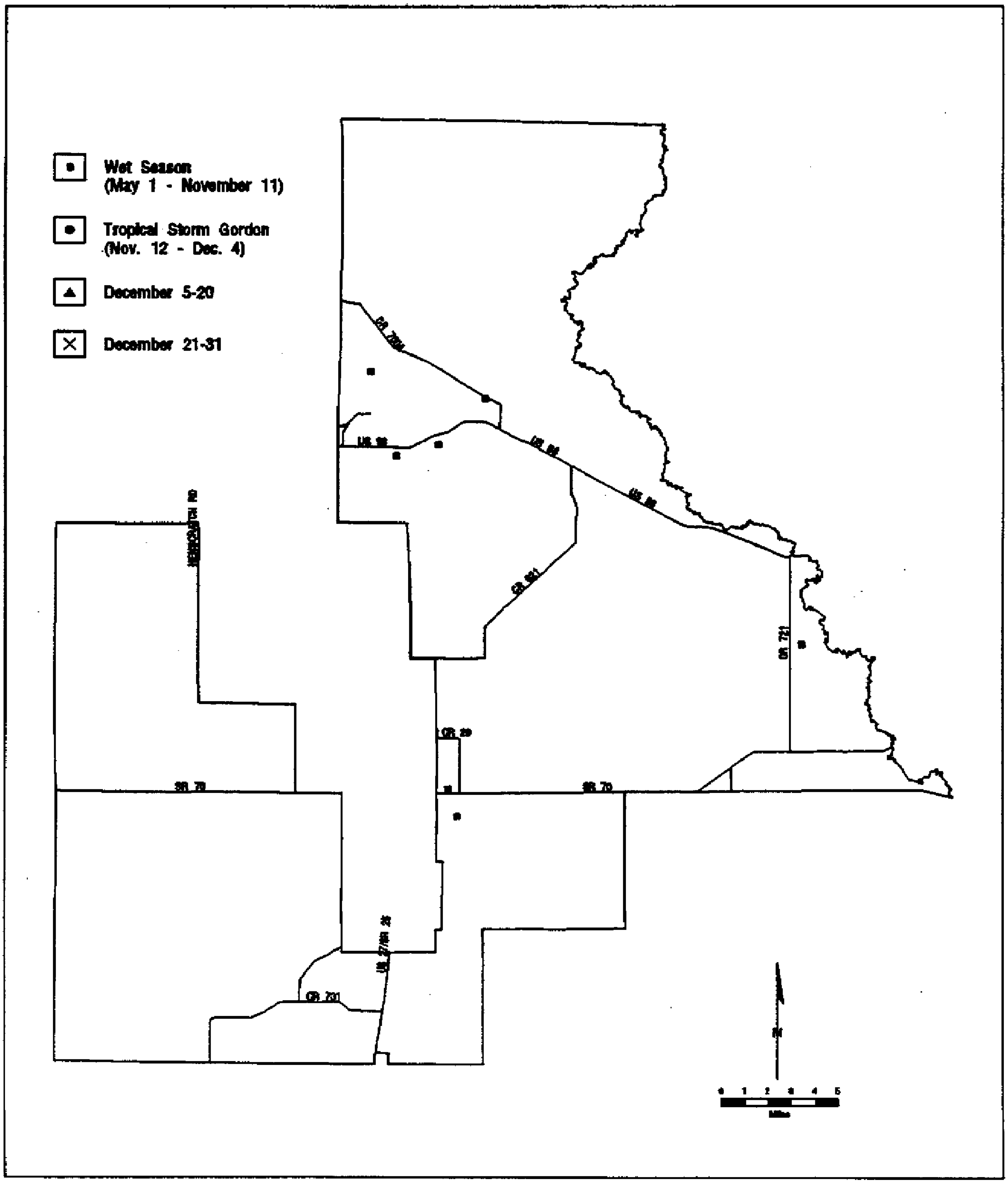


Figure 17. Highlands County Flooded Areas.

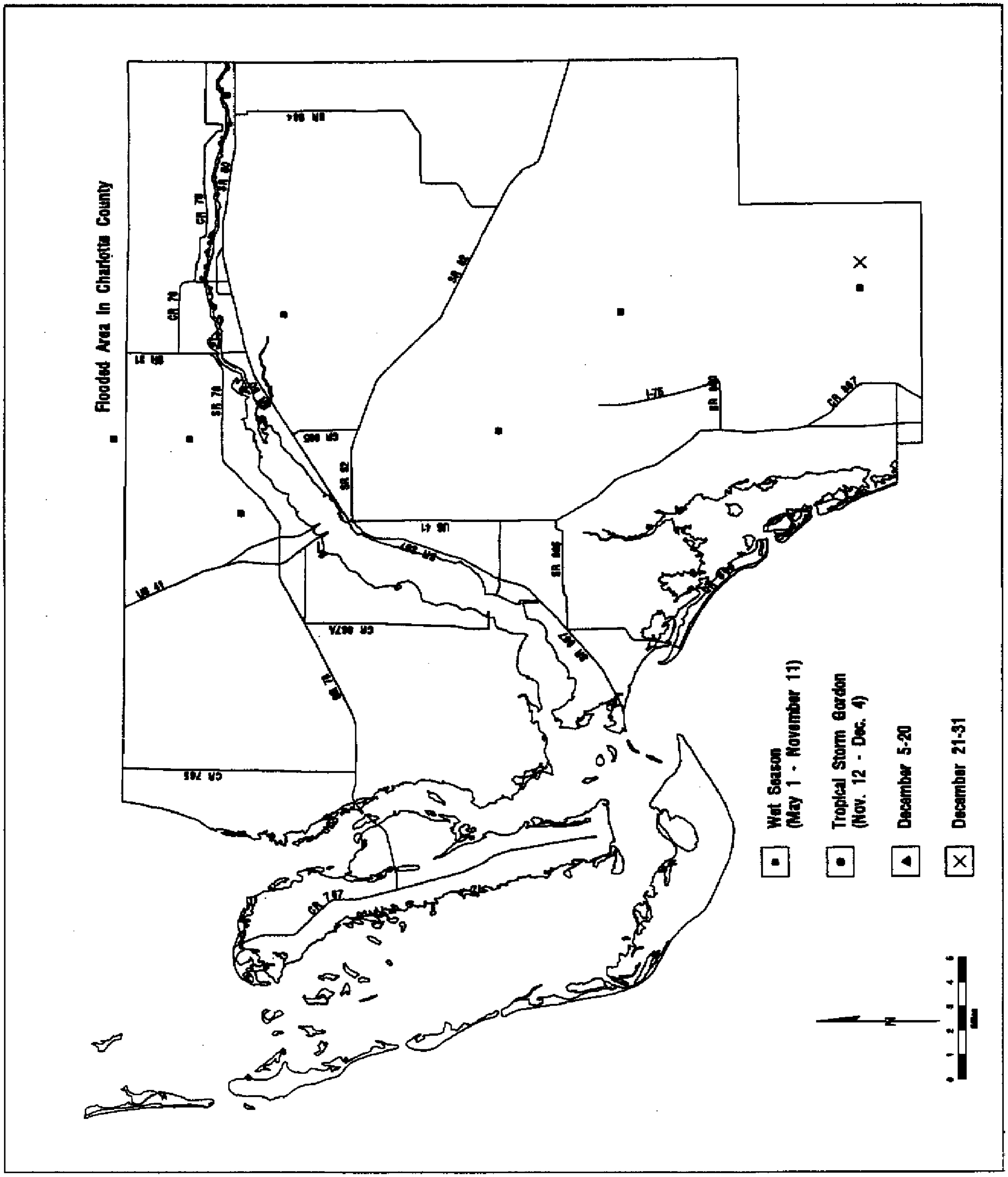


Figure 18. Lee and Charlotte Counties' Flooded Areas.

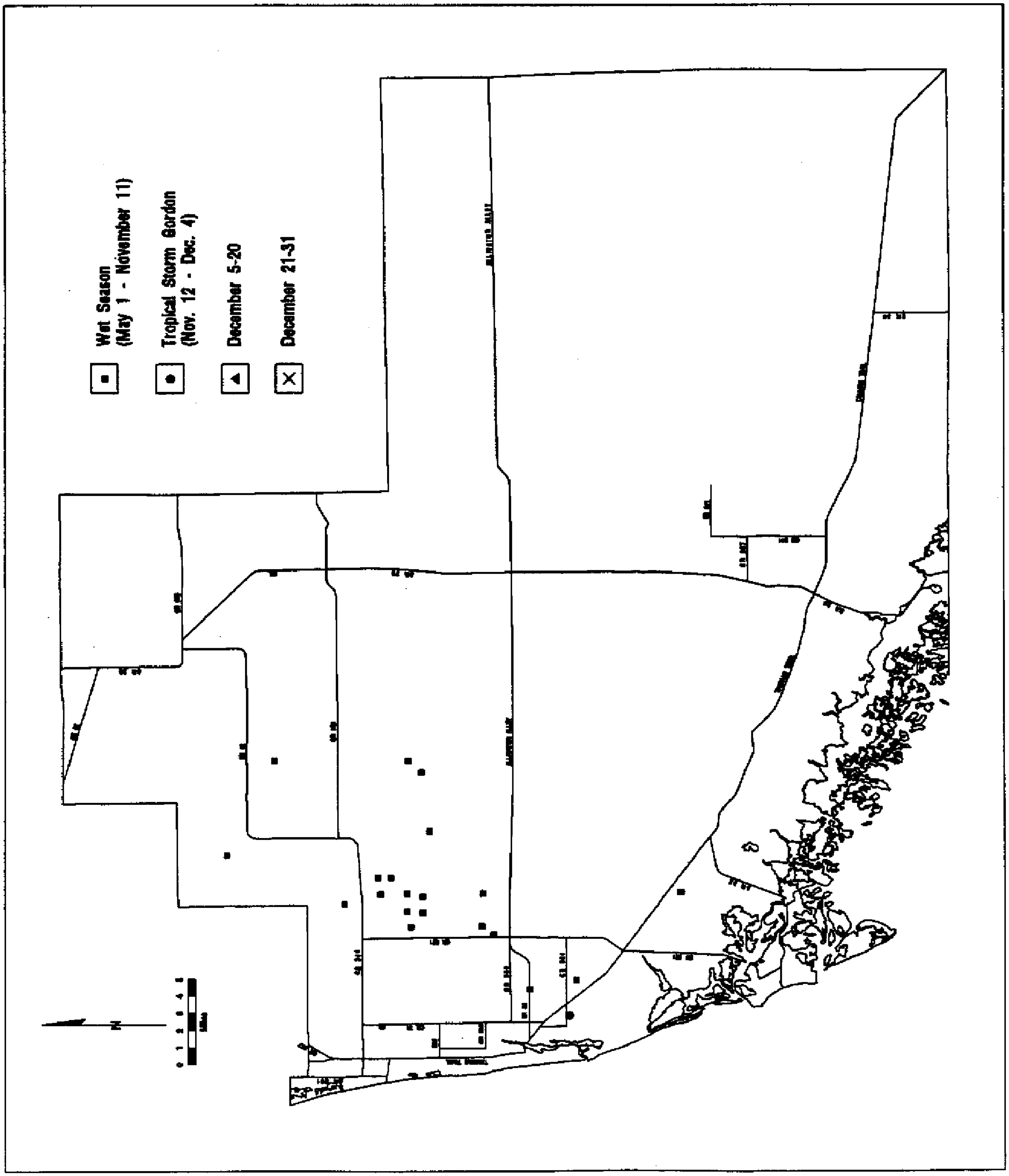


Figure 19. Collier County Flooded Areas.

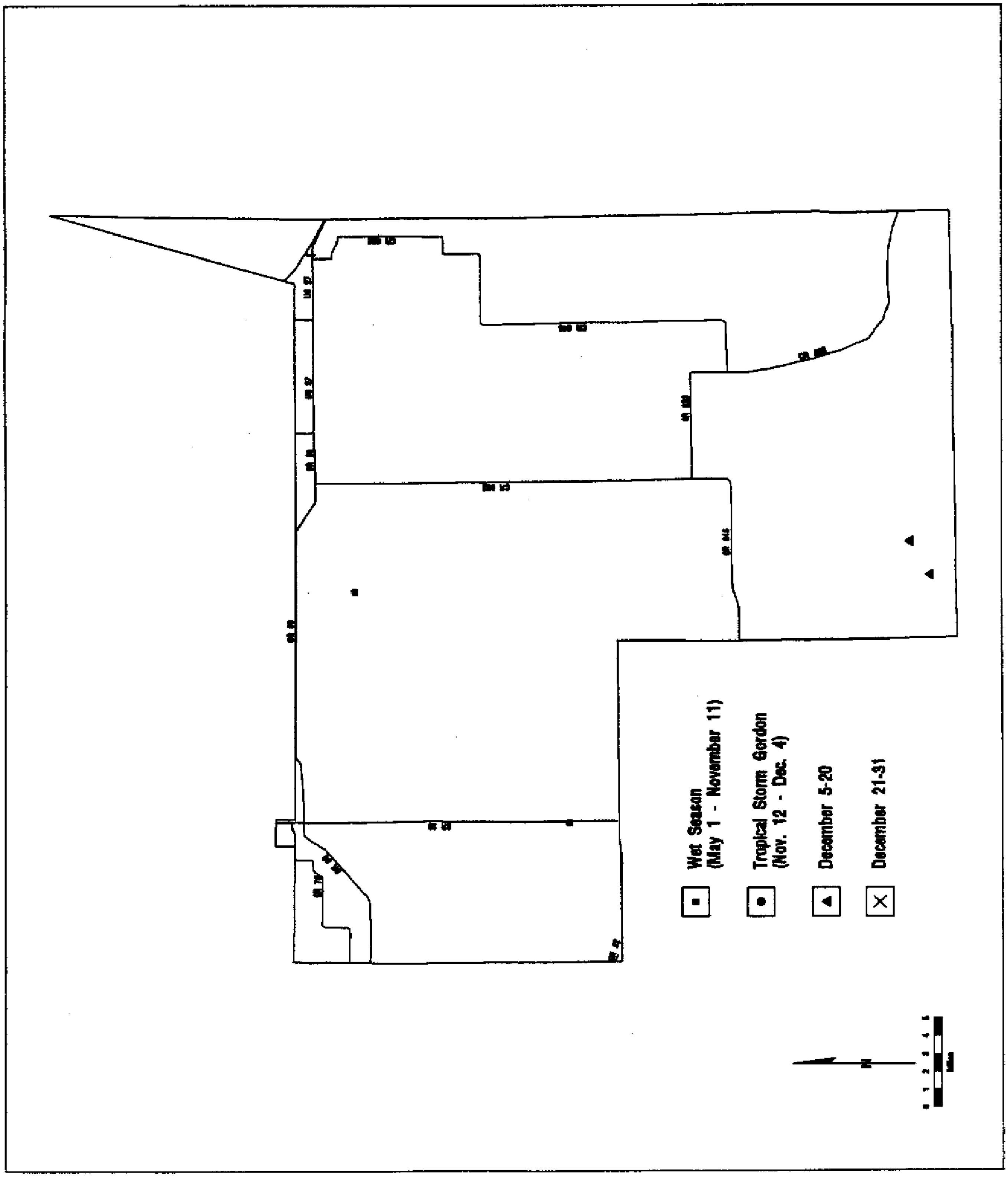


Figure 20. Henry County Flooded Areas.

EVERGLADES AGRICULTURE AREA (EAA)

At the end of the dry season, in May, water supply demands in the EAA were high and water was being delivered to the area from Lake Okeechobee and the WCAs. Flood control pumping was minimal. As a result of the wet season rainfall in June and July, water supply needs diminished, and flood control pumping was necessary for most of June and the first and last weeks of July. From July through late October, stages in the western basins (L-1; L-2 and L-3) were very high and extended pumping at S-8 was necessary to help alleviate the problem. Heavy rainfall in August through December required continual flood control pumping throughout the area. Of the 153 days during this period, pumping was required 108 days at S-5A, 142 days at S-6, 141 days at S-7 and 123 days at S-8, with extended periods of 24 hour pumping. Backpumping into Lake Okeechobee was required at S-2 for two days in September and three days in October; and at S-3 for two days in September. From late September through early November, regulatory discharges were made from Lake Okeechobee to WCAs 1 and 2A as canal capacity was available.

In preparation for Tropical Storm Gordon, discharges from Lake Okeechobee were discontinued and were not resumed as of January 31. Heavy rains from Tropical Storm Gordon in November, necessitated backpumping at pump station S-2 for 6 days and at S-3 for three days. Rainfall from the storms of December 4 and December 20-21 storm required backpumping at S-2 and S-3. The western basins experienced high water conditions as a result of Tropical Storm Gordon, as well as the December 4 and December 20-21 storms. This area normally discharges by gravity to WCA 3A, but because of high water levels in WCA 3A, excess water had to be removed by pumping at S-8 in order to provide flood relief. Mean daily stages and discharges for the EAA from Lake Okeechobee is presented in Appendix D.

Inflows to Lake Okeechobee from EAA

Backpumping to Lake Okeechobee is controlled through structures S-2 and S-3. Guidelines for the allowable volume of water to be backpumped to the Lake were established in the Interim Action Plan (IAP) through an operating permit (#50-0679349) issued to the South Florida Water Management District from the Department of Environmental Regulation. Table 17 shows the amount of inflow to the Lake from the Agricultural Area during the storm events. A total of 58,940 acre-feet of water was backpumped to the Lake.

As a result of the pulse releases, water levels in Lake Okeechobee had declined over 0.5 foot from its peak to 16.65 feet prior to Tropical Storm Gordon. Heavy rainfall from Tropical Storm Gordon (November 13-17) caused the lake level to increase sharply to 17.4 feet, and exceed its flood regulation schedule (Zone C). In response, on November 16, the Corps of Engineers ended pulse releases and started required Level C releases from the lake. Level C releases call for steady discharges of 4,500 cfs to the Caloosahatchee Estuary and 2,500 cfs to the St. Lucie Estuary.

Table 17. Water Backpumped from the EAA to lake Okeechobee (acre-feet)

DATES	Structure S-2	Structure S-3
October 11-14	7,895	0
November 16- 8	-	7,045
November 16-21	27,540	0
December 5-7	8,815	0
December 22-24	0	7,645
Totals	44,250	14,690

Flooding Complaints (see Figures 20 and 27)

Note: Projects with numbers indicate SFWMD Surface Water Management Permits.

May 1 - October 31, 1994:

Brina Farm (Flo Sun) on Cross Canal - Dike overtopped in August.

November 16 - December 4, 1994 (Response to Tropical Storm Gordon):

Western Palm Beach County

#50-00761-S, M-1 Acreage - Complaints of street and yard flooding.

#50-00754-S, M-2 Acreage - Streets and yards flooded.

#50-00491-S, Deer Run - Widespread street and yard flooding. Requested lowering of the L-8 canal for relief.

Tall Pines - Agricultural interests in the area were causing flooding of low lying areas, but voluntarily cut back to provide some relief.

#50-00215-S-02, Morningstar Groves (U.S. Sugar) - Installed a pump to replace a broken pump.

Royal Palm Beach (La Mancha) - Streets flooded.

Loxahatchee - Widespread street and yard flooding.

Four Leaf Clover Farms - Nursery flooded.

Sugar Pond Manor - High Water.

Rustic Acres - Streets and yards flooded.

Palm Beach Little Ranches - Neighborhood flooded.

715 Farms on L-8 Canal - Pump failed and had to use replacement pump on SFWMD right-of-way after approval.

Widespread flooding in Cross and Bolles Canals - Several local dikes breached.

Cross Canal at six mile bend - Dike failure.

December 5-20, 1994:

Everglades Agricultural Area

The area around S-7 received about 14 inches of rain on December 5. This caused widespread agricultural flooding in the area.

Sod Farm - This sod farm was completely inundated. The sod crop was destroyed.

Okeelanta Sugar - Sugar cane fields were inundated. They requested to use an additional pump. It was discovered that they were permitted to use more pumping capacity than they were currently using so approval was given.

Hendry County

Alico - After 12 inches of rain, the farm was flooded.

Mr. Neal Brown - Pasture land was inundated.

December 21-31, 1994:

Western Palm Beach County

Loxahatchee - Roads and yards flooded.

Heritage Farms Road - Road flooded.

Flying Cow Road - Has been under water for 3 months.

WATER CONSERVATION AREAS

Figures 21-23 show water levels and regulation schedules for WCAs 1, 2A and 3A respectively. WCAs 1 and 2A were both slightly above schedule in May and regulatory releases were being made to WCA 3A, which was below schedule. Excess water was also being released to the EAA and coastal Broward and Palm Beach counties to meet water supply needs. Releases from WCA 3A were being made to Everglades National Park in accordance with the rainfall plan. By the middle of May, WCA 1 had declined below regulation schedule and releases from WCA 1 were being made for water supply purposes only. By the end of June, the levels in all WCAs were at or close to their regulation schedules. Water supply releases were minimal because of abundant rainfall in June. Releases from WCA 3A to Everglades National Park were continuing in accordance with the rainfall plan.

Water levels in all of the WCAs increased in June and July due to heavy rainfall, but were maintained close to regulation schedule by regulatory releases. Widespread, heavy rainfall in August-October, however, resulted in significant water level increases in the WCAs and only WCA 1 could be maintained closed to schedule. Maximum regulatory releases were being made during this period. Releases from WCA 2A to WCA 2B and from WCA 3A to WCA 3B were discontinued in September because of high stages in those areas. Similarly, releases from WCA 1 to WCA 2A and from WCA 2A to WCA 3A were terminated in October because of high water levels in WCA 2A and 3A. Regulatory releases from the WCAs were being made to tide, but water levels continued to rise until mid-October.

From mid-October to mid-November water levels declined gradually until heavy rainfall from Tropical Storm Gordon caused substantial increases in all of the WCA levels. Maximum releases were being made from all available outlets and high levels in WCA 3A were causing problems for the deer population. The District and the Corps minimized inflows and maximized outflows from WCA 3A in an effort to bring water levels down. Despite these efforts, WCA 3A experienced only a slight reduction in water levels. The storms of December 4 and December 20-21 brought even more rain to the area, raising water levels in WCA 2A and 3A to above post-Gordon stages. Because of the very high stages in WCA 3A, the Corps of Engineers, with input from U.S. Fish and Wildlife Service and the District, authorized a temporary deviation from the operating schedules for WCA 1 for 1995 (See Figure 24). The Corps has also authorized, with concurrence from the District and the Florida Game and Freshwater Fish Commission, a 1995 temporary deviation from the operating schedule for WCA 2A to hold stages at 14.5 feet rather than 11.5-11.0 feet. These temporary deviations allow the Corps and the District to hold more water in WCA 1 and 2A, thereby reducing regulatory discharges to WCA 3A.

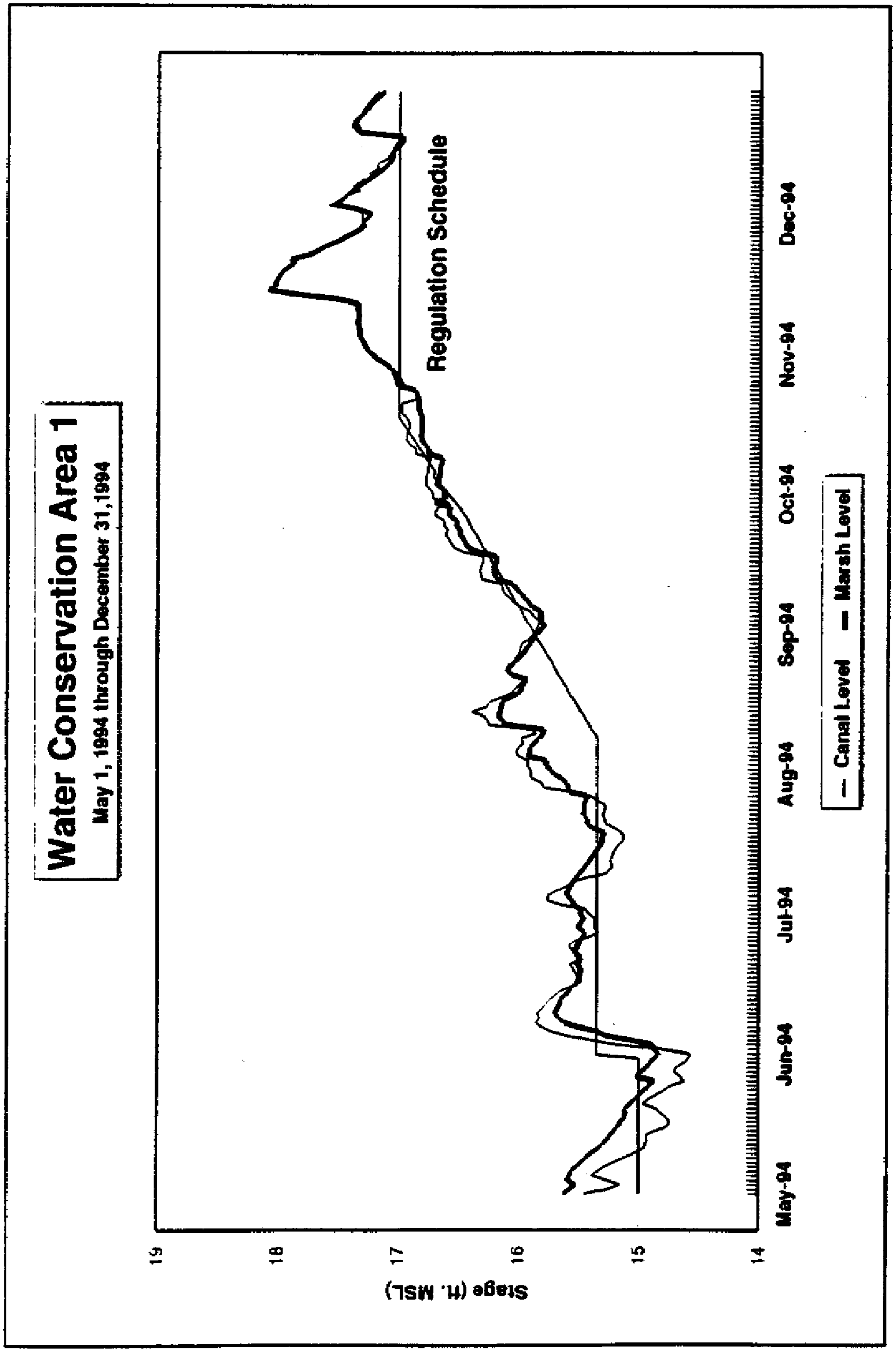


Figure 21. Water Levels and Regulation Schedules for WCA 1 (May-Dec. 1994).

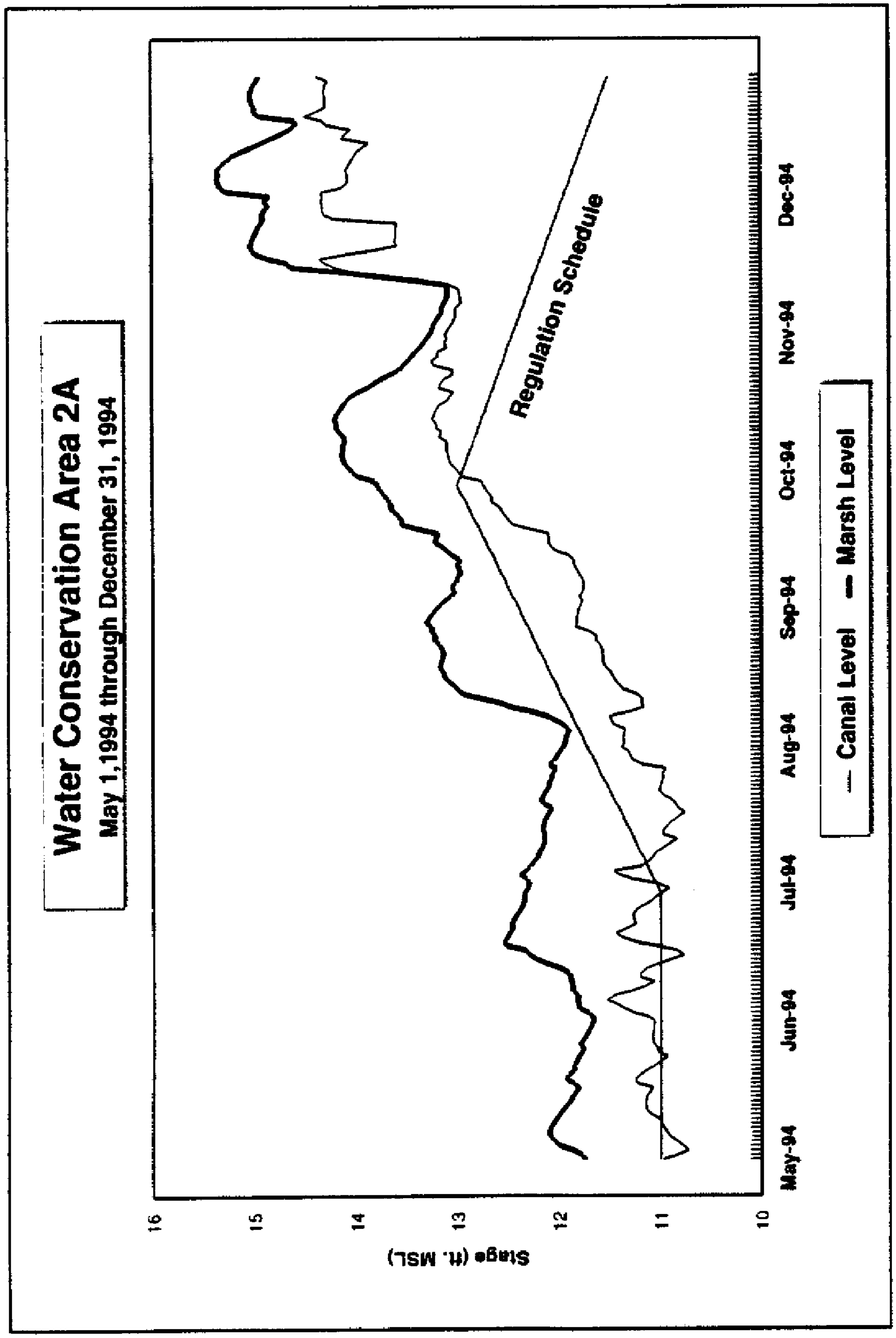


Figure 22. Water Levels and Regulation Schedules for WCA 2A (May-Dec. 1994).

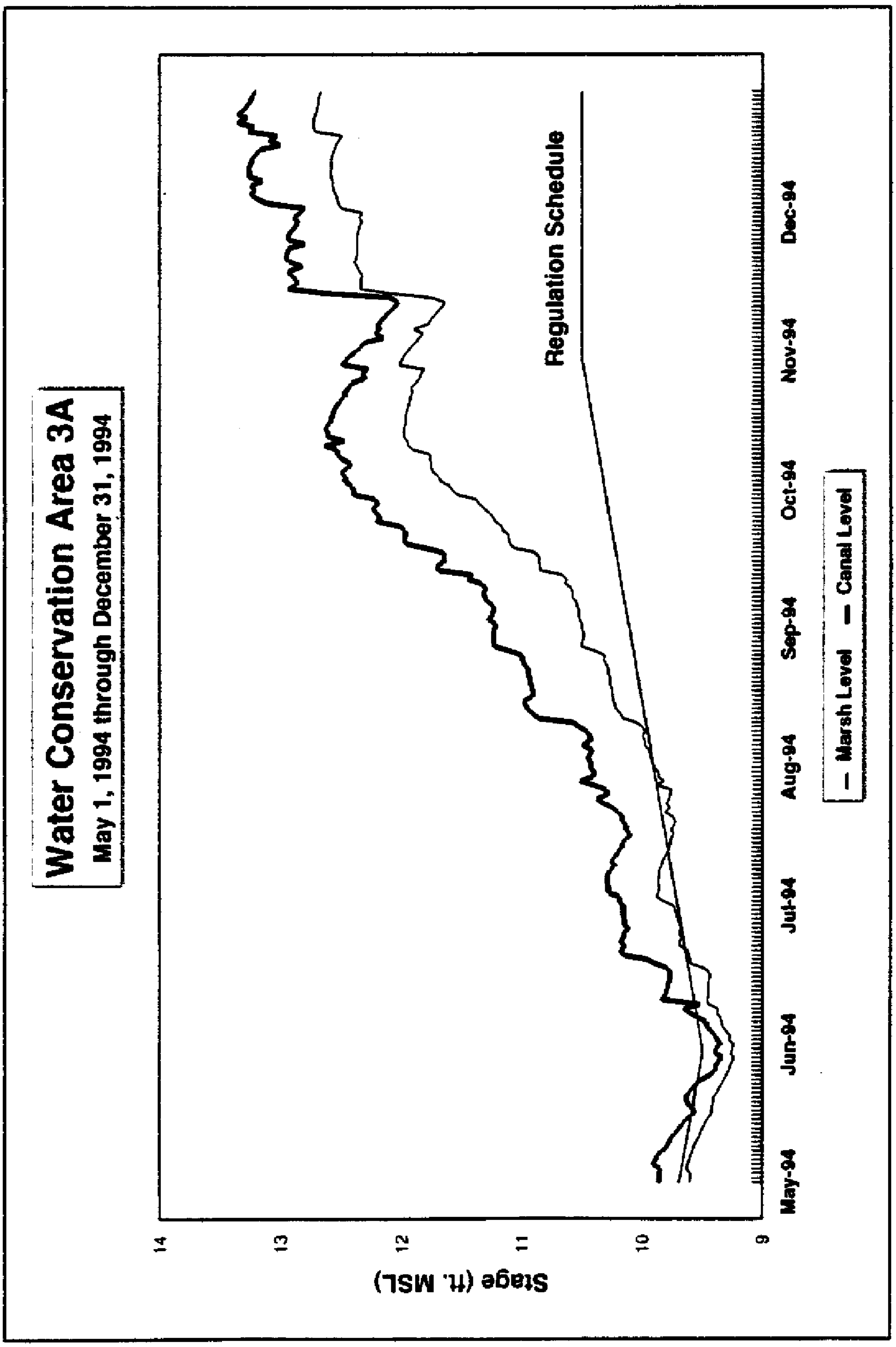


Figure 23. Water Levels and Regulation Schedules for WCA 3A (May-Dec. 1994).

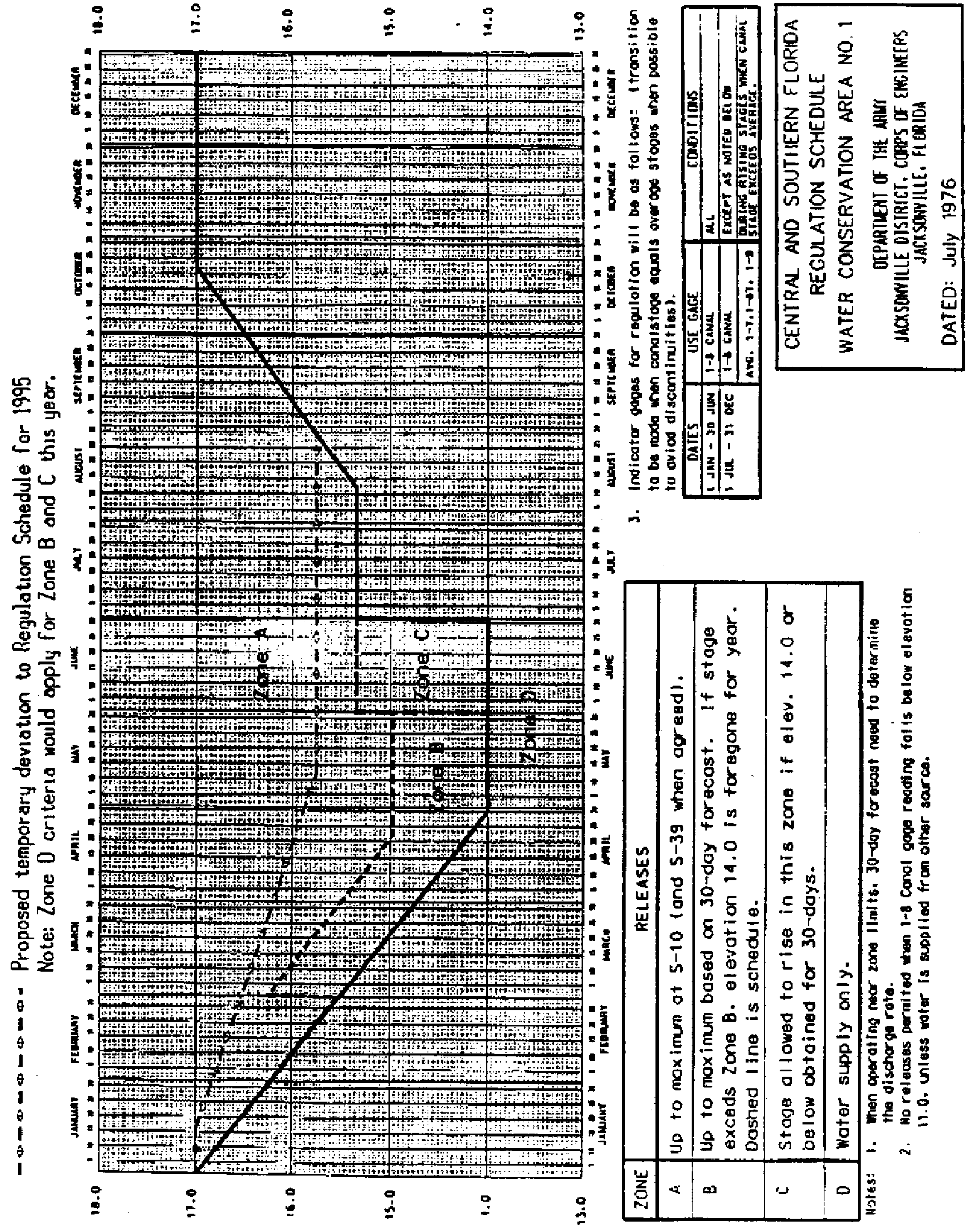


Figure 24. Proposed Temporary Deviation to Regulation Schedule for 1994

On December 31, water levels in WCA 1 was at 17.2 feet, close to the regulation schedule level of 17 feet. WCA 2A was at 14.95 feet, about the same as post-Gordon levels and more than 1.5 feet higher than the pre-Gordon level. WCA 3A was at 12.65 feet, slightly higher than its post-Gordon level and 1 foot higher than the pre-Gordon level. Regulatory discharges.

Record high water levels in WCA 3 at first glance may seem disproportionally high in relation to rainfall levels. There has been some speculation that changes in agricultural operations, particularly in the EAA, may account for a large portion of the additional water. Closer examination indicates that this is not possible due to physical constraints at the farm and the regional pump stations. It is highly probable that disproportionate contributions from areas west of the L-28 and L-1,L-2, L-3 levees, together with significantly higher than normal rainfall over the WCAs are important factors in explaining this perceived discrepancy.

Mean daily stages and discharges to the Water Conservation Areas from the EAA is presented in Appendix E.

LOWER EAST COAST

The Lower East Coast consists of Palm Beach, Broward, and Dade Counties. Because of dry weather in May, water was being delivered from the WCAs to the coastal areas for water supply purposes, and releases to tide were minimal. Water deliveries were being made to Everglades National Park from WCA 3A through the S-12 structures and S-333, according to the rainfall plan and water levels in the coastal canals were at normal levels.

Water Levels

In the South Dade area, there was flood control pumping at S-331 for one week in May in response to high water conditions in the "eight and a half square mile area." On June 1, operations criteria for the L-31N and L-31W canals changed from dry season to wet season levels, according to the experimental program of water deliveries to Everglades National Park. Since the wet season operations allow higher water levels in the L-31N and L-31W canals, pumping at S-332 between June 1 and July 25, was reduced to a rate of 5 cfs. This minimal pumping rate was maintained at S-332 to keep the downstream area aerated, in order to avoid a fish kill in Taylor Slough. The water level in the L-31W canal was low compared to normal wet season levels during this period.

Heavy rain in late July through October prompted substantial pumping at S-331 and S-332. In August, releases to Everglades National Park, through S-333 were terminated in accordance with operational guidelines, due to high downstream conditions. Those discharges have not been resumed because of continued high water levels through the end of the year. High water levels in the C-111 canal triggered the criteria for opening three culverts at structure S-197 for three days in September and for four days in October.

In response to heavy rains in September and October, water levels in the coastal canals throughout the Lower East Coast were lowered to facilitate secondary drainage. By late October, canals were returned to their normal settings except at structures S-20F, 20G and 21A, which remained at low settings to facilitate agricultural activities.

Canal levels were again lowered in mid-November in anticipation of Tropical Storm Gordon, to facilitate local drainage. Strong on-shore winds coupled with very high seasonal tides hampered efforts to discharge excess water to the coast. High water conditions again triggered opening criteria for S-197 but the structure could not be opened until tidal levels fell below inland water levels. By that time, all 13 culverts had to be opened. Thirteen culverts remained open November 16-19. On November 19, six of the culverts were closed. Four more were closed on November 20 and the remaining three culverts remained open until November 23. Pumping at S-331 was discontinued on November 14 because of high downstream water conditions S-331 resumed pumping November 20th and remained in operation through January 1995. Pump station S-332 was in continuous operation during Tropical Storm Gordon and remained in operation through January 1995. Coastal canal levels were returned to their normal settings by late November.

All canals were lowered in anticipation of the December 20-21 storm and remained at low operating levels for the rest of the year. In addition to facilitating local drainage, lower levels have also been maintained in some of the coastal canals to facilitate discharges from the WCAs. Mean Daily stages and discharges for S-18C and S-197 are presented in Appendix F.

Flooding Complaints (Figures 25-27)

Note: Projects with numbers indicate SFWMD Surface Water Management Permits.

May 1-October 31, 1994: The wet season brought the usual flooding complaints caused by either locally heavy rains or by an activity that interrupted the drainage of an area. There were complaints of flooded roads and flooded agricultural and residential property. No flooding of homes was reported.

<u>Broward County</u>

Lakebridge Townhomes - Flooding in the parking lot.

Runway Growers, Inc. - Flooding of nursery.

Estates of Stirling Lake - Back yard flooding.

Oriole Presidential Estates - Back yard flooding.

<u>Dade County</u>

Kaplan Nursery - Tree nursery under water.

<u>Palm Beach County</u>

#50-00632-S, Boca Greens - High water levels in lake due to lack of maintenance of culvert interconnecting other lakes.

#50-01184-S, Lakes at Boca Raton - High water levels due to temporary blockage of control structure.

#50-00485-S, Long Lake Estates / #50-00665-S, Boca Azul - The southern berm of Long Lake Estates broke, causing flooding in Boca Azul to the south.

#50-00474-S, Caloosa - Streets and yards flooded.

#50-00491-S, Deer Run - Roads and lots flooded.

Sandtree Drive - Street flooding.

November 16 - December 4, 1994 (Response to Tropical Storm Gordon): Tropical Storm Gordon caused wide-spread flooding of streets and property in central Florida and on the east coast of Florida. The west coast of Florida had no flooding. The most serious observed residential areas of flooding were located in southern Palm Beach County in the Boynton Beach and Boca Raton areas. There were also significant areas of serious flooding in the Palm Beach Gardens and Jupiter areas and in the western communities of Palm Beach County. In addition, numerous areas of Broward and Dade County experienced street and property flooding. Agricultural areas around Homestead also experienced significant flooding. There were numerous complaints of lake levels being too high in Orange and Osceola Counties with several inquiries as to District structures operation. There were also large areas of agricultural land inundated in Central Florida. There were no known cases of residential homes being flooded.

Broward County

Davie Boulevard I-95 Exit - Turbidity into the South Fork of the New River caused by construction on I-95.

Southwest Broward - Roads, yards and agricultural areas were flooding.

#06-00732-S, Winston Park (Lauren's Turn) - Yards and streets flooded to 16 inches.

Coconut Creek - Streets flooded in several locations.

Green Meadows Area - Streets flooded.

Swaying Palm Mobile Home Park - Canal stages very high.

#06-00713-S, Ivanhoe - Roads and yards flooded.

#06-00636-S, Flamingo Lakes Townhomes - Streets flooded.

Orangetree Homes - Yards flooded.

Plantation Acres - Water rose over seawall.

Royal Park Condos - Water came over seawall and flooded yard.

Dade County

Eight Square Mile Area - Streets and large areas of rural residential and agricultural lands under water for extended periods of time.

Miami Field Station Area

Tropical Storm Gordon caused localized flooding of roadways in Dade County and localized ponding was observed throughout the County on residential properties but no houses were identified to have flooded. At peak stages following the storm, canals were seen to have exceeded their banks at various locations. Agricultural areas were impacted by the high water levels and some tree farms in the northwest portion of the County are still unable to conduct business.

The Miccosukee Tribe was severely impacted by the culmination of water at L-67 Extension causing surface water to flow westerly in the old Tamiami Trail borrow ditch. The normal flow pattern is easterly. To prevent this westerly flow, staff from the Miami Field Station placed boards in the S-12F structure, removed a section of the Old Tamiami Trail 125 feet west of L-67 Extension and removed the boards from three structures on the L-67 Extension. These efforts seem to have improved the southerly flows but surface flows were still identified to be flowing westerly. The Corps of Engineers also placed plugs at each end of the borrow ditch at the Miccosukee Village to prevent water from entering from the west and east in their immediate area through the borrow ditch.

Water levels in the Conservation Areas are still extremely high and impacting the northwest portion of Dade County. Concerns with high water levels out at the Miccosukee Indian Village is causing the Operations & Maintenance Department to look at further remedial actions.

C-2 Canal

Red Rd. & 100th St. - Streets flooded and canal (C-2) out of banks.

C-2 & SW 100th St. - Water cresting banks.

C-2 & 99th Ave. - Water over banks of canal (C-2).

C-3 Canal

6020 SW 34 St. - Streets flooded and canal (C-3) high.

C-3 & SW 64th Ave. - Flooding.

C-4 Canal

C-4 near Pan Am Hospital - Streets flooded upstream of S25A.

C-4 between 102nd & 107th Ave. - Water going under fence.

122nd to 127th Ave. & C-4 - Canal out of banks in backyard.

12900 - 12950 SW 6th St. - Canal (C-4) out of banks.

C-4 & 137th Ave. - Water over banks.

C-5 Canal

3380 NW 14th St. - Streets flooded and canal (C-5) out of banks.

3340 NW 14th St. - Yard under water.

3436 NW 14th St. - Streets flooded and canal (C-5) out of banks.

3220 NW 13 Lane - Streets flooded and canal (C-5) out of banks.

2801 NW 11th St. - Streets flooded and water in canal (C-5) high.

32nd Ave. & NW 13 Terr. - Streets flooded and canal (C-5) out of banks.

11th St. & 29th Ave. - C-5 canal high.

C-7 Canal

1070 NW Little River Dr. - Streets flooded and canal (C-7) high.

1230 NW Little River Dr. - Streets flooded and canal (C-7) out of banks.

Between Little River Dr. & 95th St.- Canal (C-7) over bank.

C-8 Canal

11150 Griffing Blvd. - Streets flooded and canal (C-8) high.

C-9 Canal

740 NW 203rd St. - Streets flooded and canal (C-9) high.

C-9 @ I-75 - Water out of banks.

Arch Creek

1860 NE 143 St. - Streets flooded, canal (Arch Creek) high.

Arch Creek - Some areas out of banks.

C-100 Canal

16940 SW 87th Ave. - Streets flooded and canal (C-100) high.

C-100A Canal

SW 69th Ct. & 128th St. - Streets flooded and canal (C-100A) high.

C-100A & 168th St. - Canal almost out of banks.

12725 SW 69th Ave. - Streets flooded and canal (C-100A) high.

18044 SW 89th Pl. - Streets flooded and canal (C-100A) high.

12200 SW 70th Ct. - Streets flooded and canal (C-100A) out of banks.

7220 SW 109th Terr. - Water high in canal (C-100A).

C-100B Canal

18301 SW 90 Ct. - Streets flooded and canal (C-100B) high.

8961 SW 182 Terr. - Streets flooded and canal (C-100B) high.

C-100C Canal

7900 SW 102 Place - Street flooded and canal (C-100C) out of banks.

8021 SW 140th Terr. - Streets flooded and canal (C-100C) high.

7971 SW 140th Terr. - Streets flooded and canal (C-100C) high.

14550 SW 77th Ct. - Streets flooded and canal (C-100C) out of banks.

10300 SW 92nd St. - Canal (C-100C) out of banks.

Other Areas

6171 SW 109th Ct. - Canal (County canal) out of banks.

6161 SW 109th Ct. - Streets flooded and canal (County canal) out of banks.

17901 SW 91st Ave. - Canal high.

1456 W 29th St. - Water coming into business (not from canal).

5345 SW 112 Ct. - Water out of banks of County canal.

1780 S. Glades Dr. - Canal out of banks.

12490 SW 6th St. - More water in yard than in others.

3901 SW 124th Ct. - County canal out of banks.

5104 SW 131 Ave. - County canal high.

18701 NW 49th Ct. - County canal over banks.

772 NW 76 Ave. - Water over road.

5104 SW 131st Ave. - Canal overflowing.

2261 SW 122nd Ct. - Lake flooding.

32nd Ave. downstream of S-25 - Canal out of banks.

11575 W. Biscayne Canal Rd. - Water coming over bank.

444 NW 136th Pl. - Water going into backyard.

19021 NW 49th Ct. - Water coming over bank.

3120 SW 144th Ave. - County canal out of banks.

Honey Hill Mobile Home Park - Local ponding.

Homestead Field Station Area

U.S. 1 - A portion of U.S. 1 was closed due to flooding

Eastern sections of regional area (U.S. 1 south to the coast) - There was moderate flooding of agricultural fields. Fields south of S.W. 312th St. completely under water and 85% of the agricultural land from S.W. 344th St. to S.W. 216 St. completely under water.

Villages of Homestead - Streets flooded with 4 to 6 inches of water.

Ridge sections of regional area (U.S. 1 west to Krome Avenue) - Minor flooding in agricultural fields.

Western sections of regional area (Krome Avenue to L-31N) - Moderate flooding along western fringes. Agricultural flooding in the C-111 - Loveland Road area. Areas north of Homestead General Aviation Airport have standing water in the fields along L-31N.

City of Homestead - Minor street and agricultural flooding in western section, 8th Street, Country Club, S.W. 312th Street and S.W. 202nd Avenue.

Florida City - Some standing water in the streets. Agricultural areas southwest of the city are flooded.

189th Ct. - Bel Air canal water too high.

21760 SW 244th St. & 368th St. near S-178 - Grove flooded.

272nd St. near Krome Ave. - Culvert needs to be opened.

268th St. &189th Ave. - Standing water in yards. Canal almost overflowing.

Acosta Farms (168th St. & 192nd Ave.) - Grove is under water.

13195 SW 209th Ave. - E. Everglades (8 1/2 Sq. Mile Area) had rising water.

SW 184th St between 207th Ave & 212th Ave. - Flooding in grove.

21850 SW 154th St. - Flooding.

13090 SW 199th Ave. - 8 1/2 Sq. Mile Area flooded.

21801 SW 152nd St. - High water.

14700 SW 208th Ave. - Flooding.

SW 194th Ave. & 120th St. - Flooding with 3 feet of water.

154th St. & 205th Ave. - Street flooded.

14700 SW 207th Ave. - Whole neighborhood under 2 feet of water.

252nd St. & 117th Ave. - High water.

19001 SW 270th St. - High water.

Palm Beach County

Jupiter

Harbor Links - Turbid water being discharged to the Loxahatchee River.

Jupiter Farms - Streets and property flooded.

#50-00885-S, Jupiter Hospital - Drainage being backed up.

Island Country Estates - Flooding.

#50-02228-S, Cypress Cove - Streets and yards flooded.

#50-00153-S, The Hamptons at Maplewood - Streets flooded.

Cypress Gardens - Flooding in yards and streets.

Palm Beach Gardens

#50-02144-S, Garden Oaks - All streets severely flooded, some to 2 feet. Used portable pump (83,000 GPM) to relieve flooding.

#50-00617-S, PGA National - Yards flooded.

#50-02268-S, Lake Catherine - High water.

#50-00532-S, Eastpointe - Streets flooded to about 1 foot with water in at least one garage.

Steeple Chase - Streets flooded.

Palm Beach Country Estates - Streets and yards flooded.

#50-00457-S, Sienna Oaks - High water.

Horseshoe Acres - Canal overflowing.

Riviera Beach

Lone Pine Estates - Roads flooded.

City of Riviera Beach - Some street flooding reported.

West Palm Beach

#50-01817-S, Foxhall - Severe flooding of streets and yards up to 2 feet.

City of West Palm Beach - Several streets and yards reported flooding.

Greenacres

#50-00967-S, Park Point - Street flooding.

Lake Clarke Shores

Lake overflowing and septic system overflowing.

Lake Worth

Covered Bridge - High water with yards flooded.

#50-00631-S, Willow Bend - Streets flooded.

Cypress Trails - Water not draining.

#50-01625-S, Lake Charleston (Waters Edge) - High water with entrance road flooded.

Country Lake Estates - Streets flooded.

Summer Chase - Streets flooded.

#50-01713-S, Cypress Woods - Yards flooded.

#50-01573-S, Woods Walk - Streets and yards flooded.

Hypoluxo

Hypoluxo Village - Flooding close to house.

Lantana

#50-00945-S, Lacuna - Yards flooded.

#50-00152-S, Lakes of Sherbrooke - High water.

Holiday of Lantana - High water.

Pirates Creek - High water over docks.

Boynton Beach

#50-01126-S, Rainbow Lakes / Water Chase - Extensive flooding of roads to about 1 foot.

Country Greens - Extensive flooding of garages, streets and yards.

Colors/La Palais - Streets flooded.

#50-00744-S, Westchester - Major street flooding to more than 1 foot.

Alden Ridge - Streets and yards flooded.

#50-00806-S, Leisureville - High water levels.

#50-02014-S, Palm Isles - High water levels.

Lake Ida Area - Yards flooded.

Pleasant Greenway - Streets flooded.

#50-01693-S, Citrus Glen - High water.

#50-01487-S, Sun Valley - Streets and yards flooded to garages.

Chanticleer Village - Yards flooded.

Bay Estates - Road and yard flooded.

Boynton Beach Estates - Flooding.

Delray Beach

Bel-Air Development - Discharge structure gate is closed / broken.

Waterways - Yards flooded.

#50-00151-S, Kings Point - Streets flooded.

#50-01139-S, Rainberry Lakes - Streets flooded.

Monterray Lake - High water.

#50-01587-S, Pine Ridge - Minor to major street flooding to 16 inches.

Pinewood Cove - Streets flooded.

Boca Raton

#50-01165-S, Boca Fontana - Lake overflowing.

#50-01284-S, Whisper Walk (Boca Gardens) - High water.

#50-01170-S, Boca Golf and Tennis - High water.

#50-00632-S, Boca Greens - Streets and yards flooded.

#50-00400-S, Escondido - Minor to major street flooding to more than 1 foot.

Lox Road - Agricultural land flooded.

Hillsboro Canal - Reported to be over its banks.

#50-00603-S, Hidden Valley - Streets and yards flooded.

December 5-20, 1994: This storm was short duration but intense in some areas, causing large areas of agricultural land to be inundated in western Palm Beach and Broward Counties and in Hendry County. In addition, a portion of U.S. 27 was flooded and various isolated areas on the east coast complained of flooded streets and property.

Palm Beach County

Lake Worth

Coconut Road South - Yards flooded.

Boynton Beach

#50-00743-S, Colours at Rainbow Lakes / Le Palais - Entrance road flooded.

Boca Raton

Windwood - Yards flooded and lakes are overflowing into adjacent canal (El Rio Canal).

Broward County

U.S. 27 - The north bound lane was under water for about 2 miles. The south bound lane was dry. One lane of the north bound lane was closed and the State Police were escorting drivers through the flooded section.

December 21-31, 1994: This rainstorm, which occurred on December 21, caused numerous areas on the lower east coast to experience flooding of roads and property. In some areas, December 21 was the wettest day of 1994. Again, there were no reports of homes being flooded.

Broward County

Pembroke Pines

Pembroke Lakes Mall - Parking lot flooded with one car flooded with 4 inches of water.

Dade County

Miami

Vicinity of S-28 - Flooding.

Homestead

16601 SW 217th Ave. (East Everglades) - High water levels.

SW 168th Street - Property flooded.

Palm Beach County

Jupiter

Old Jupiter Beach Road - Flooding possibly caused by blocked drainage.

Jupiter Farms - Yards flooded.

Palm Beach Gardens

Square Lake - High water levels.

#50-02144-S, Garden Oaks - Concerned about flooding.

#50-01151-S, Westwood Gardens - High water.

West Palm Beach

Scott Drive - Road flooded.

Westgate - Flooding around house.

47th Place North - Road flooded.

Knotty Pine Acres - Canal overflowing.

Collins Drive - Water backing up in yard.

Greenacres

#50-00967-S, Park Point - Street flooding.

Lake Worth

Lake Osborne - High water levels.

Violet Circle - High water levels.

John Prince Park - High water levels.

Whipporwill Lakes - Water backing up into lakes.

Melaleuca Lane - Street flooded near Kirk Road.

Lantana

#50-01667-S, Lawrence Groves - Yards flooded.

West Lantana Road - High water.

Boynton Beach

#50-00744-S, Westchester - Possibly drain clogged with debris causing water to back up.

#50-01693-S, Citrus Glen - Flooding.

Golfview Harbor - High water.

Boca Raton

#50-00792-S, Boca Pointe - Filled in swale caused water to back up.

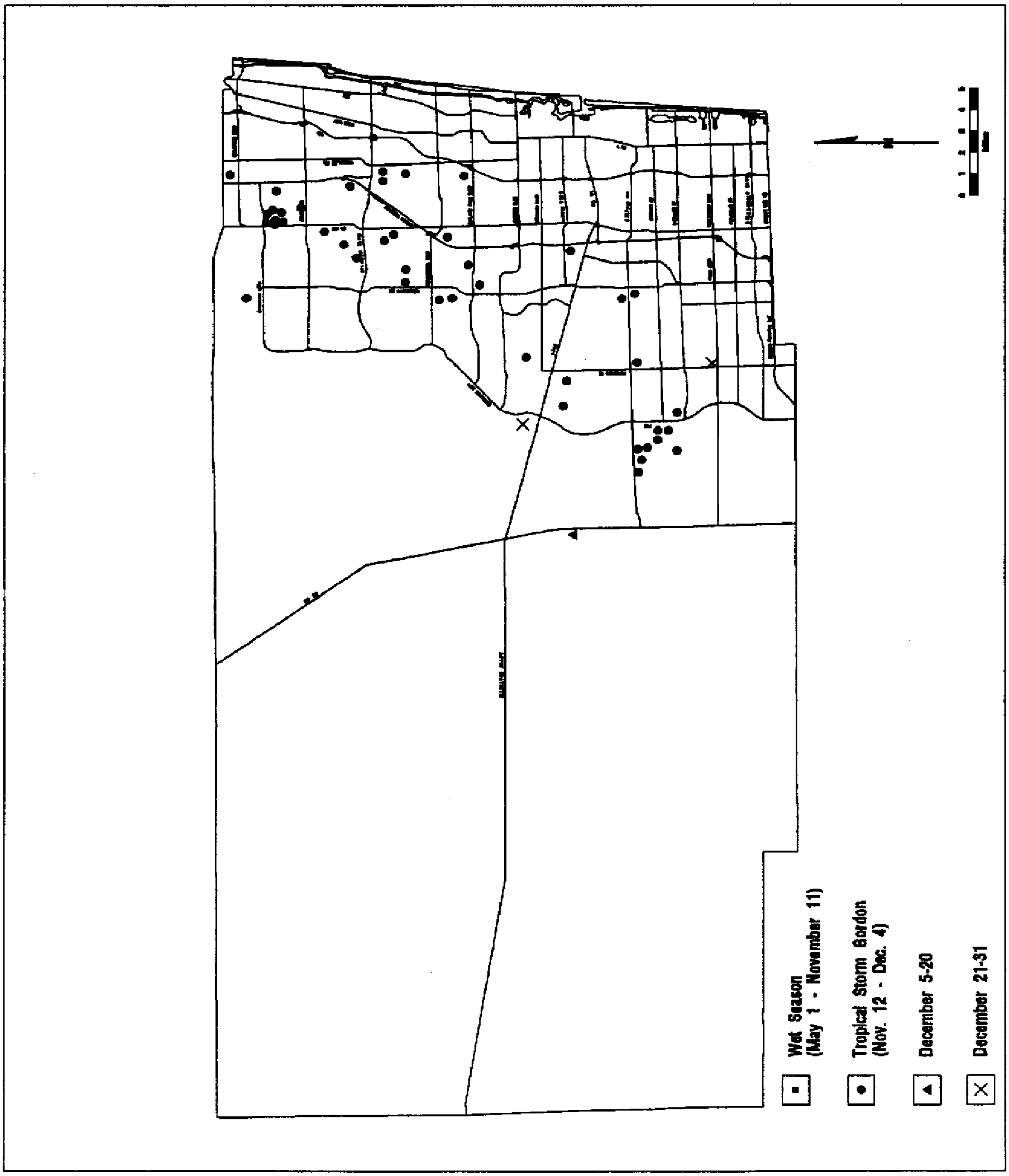


Figure 25. Broward County Flooded Areas.

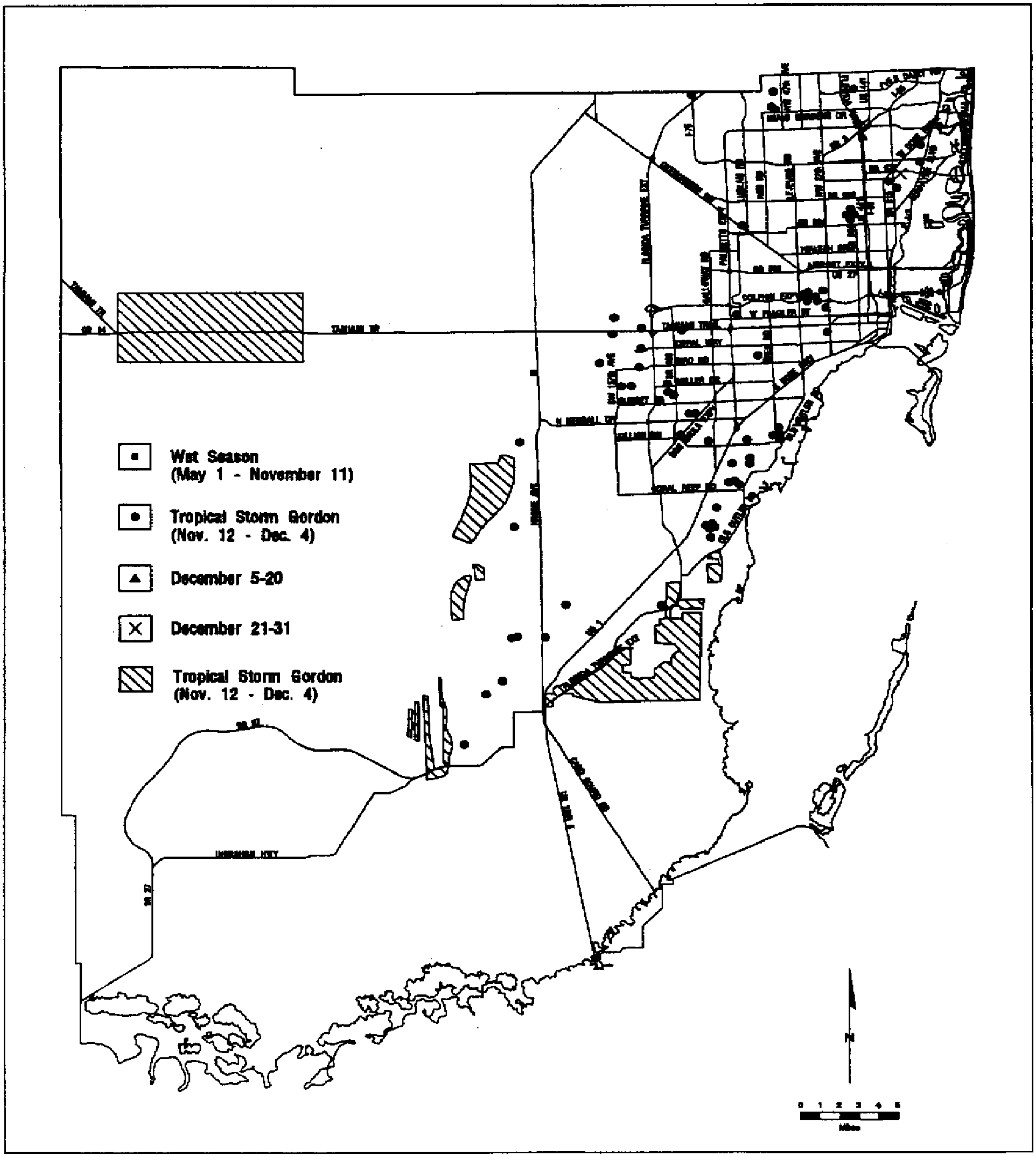


Figure 26. Dade County Flooded Areas.

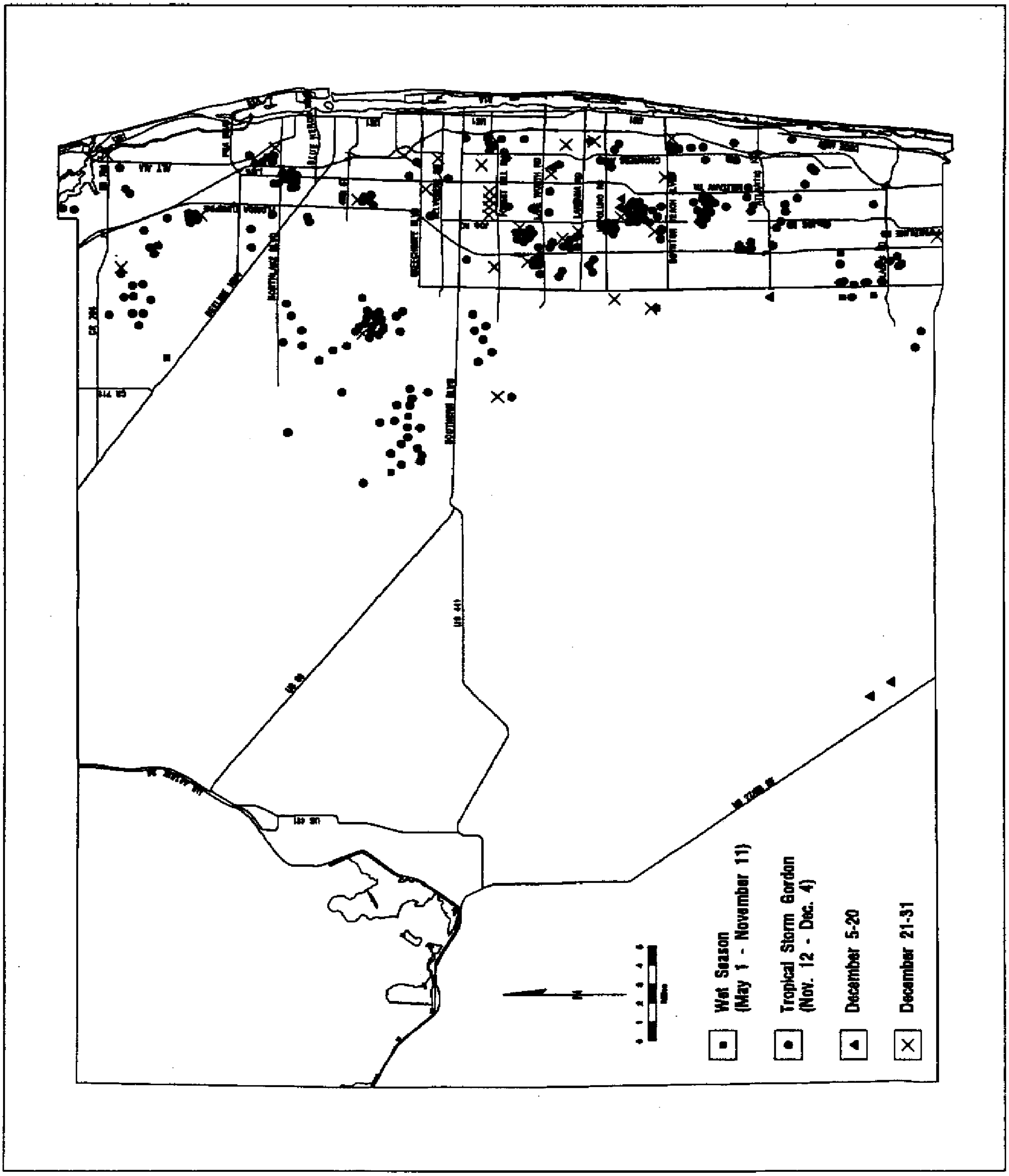


Figure 27. Palm Beach County Flooded Areas.

This page intentionally left blank.

CHAPTER 5

IMPACTS TO ESTUARIES AND BAYS

Throughout the period May-December 1994, much of south Florida experienced higher than normal rainfall. This increased rainfall resulted in higher than normal freshwater discharges to the Caloosahatchee and St. Lucie Estuaries which included regulatory releases from Lake Okeechobee. In addition, Florida Bay received increased freshwater inflows from the Everglades.

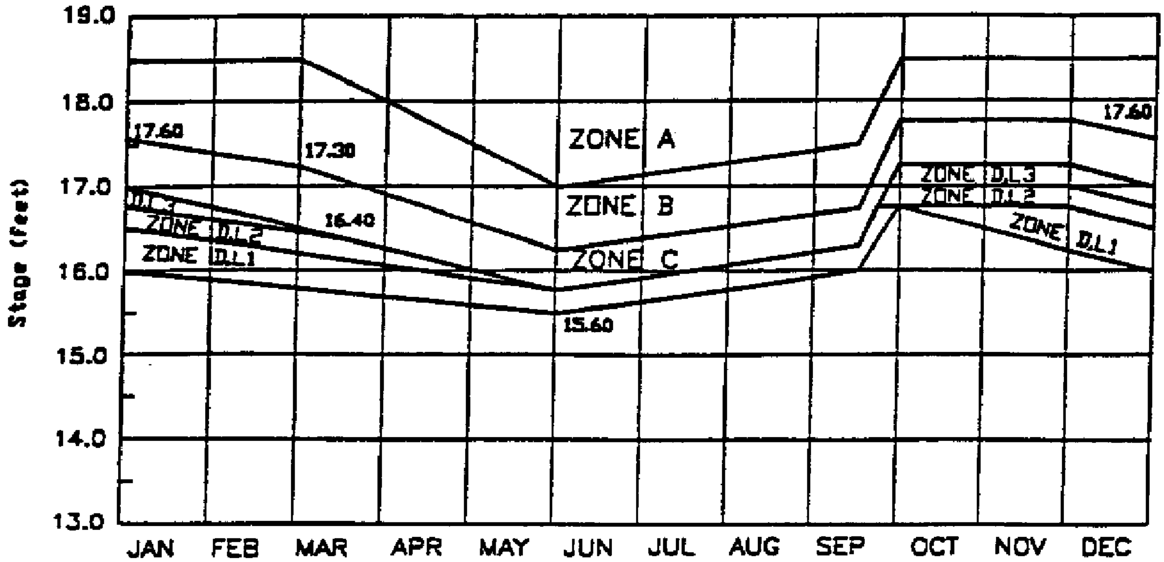
The Caloosahatchee and St. Lucie Estuaries are impacted by freshwater flows from surrounding basins and flood control discharges from Lake Okeechobee. Water levels in Lake Okeechobee are managed according to a schedule which regulates the magnitude of flood control releases downstream to the estuaries. Currently, "Run 25" is utilized to manage discharges from Lake Okeechobee.

Run 25 contains four management zones: Zones A-D as shown in Figure 28. Zone D is further divided into three "Best Management Zones" identified as Level I, II, and III in which pulse releases are conducted at increasing flow rates as lake stage approaches Zone C. Specific pulse discharge criteria were developed for the Caloosahatchee and St. Lucie Estuaries (Table 18).

Table 18. Pulse Release Schedule for the St. Lucie and Caloosahatchee Estuaries.

Day	St. Lucie Estuary (cfs/day)			Caloosahatchee Estuary (cfs/day)		
	I	II	III	I	II	III
1	1200	1500	1800	1000	1500	2000
2	1600	2000	2400	2800	4200	5500
3	1400	1800	2100	3300	5000	6500
4	1000	1200	1500	2400	3800	5000
5	700	900	1000	2000	3000	4000
6	600	700	900	1500	2200	3000
7	400	500	600	1200	1500	2000
8	400	500	600	800	800	1000
9	0	400	400	500	500	500
10	0	0	400	500	500	500

These discharges were designed to mimic natural inflows from a storm event and to reduce the potential for larger sustained regulatory releases. When the lake stage is below the Zone D line, no discharges to the Caloosahatchee or St. Lucie Estuaries are made for regulatory reasons. When the lake stage rises above Zone C line, regulatory releases are made in accordance with the regulation schedule. In Zone A, maximum capacity discharges to all outlets are conducted to protect the structural integrity of the Lake Okeechobee levee system.



Lake Okeechobee Releases
as used by the South Florida Regional Routing Model

Zone	Agricultural Canals	Caloosahatchee River at S-77	St. Lucie Estuary at S-80 including runoff from C-44 Basin
A		Up to Maximum Capacity at S-77	Up to Maximum Capacity at S-80
B	Maximum Practicable Releases to Water Conservation Areas	6500 CFS	3500 CFS
C		4500 CFS	2500 CFS
D LEVEL 1 LEVEL 2 LEVEL 3		10-day Pulse with a Mean Discharge of: Level 3 = 3000 CFS Level 2 = 2300 CFS Level 1 = 1600 CFS	10-day Pulse with a Mean Discharge of: Level 3 = 1170 CFS Level 2 = 900 CFS Level 1 = 730 CFS

Figure 28. Lake Okeechobee Regulation Schedule Run 25 with the 3 Pulse Release Levels.

Dependent upon available water within Lake Okeechobee, releases from the Lake may also be made for the purpose of reducing excessively saline conditions in the St. Lucie Estuary associated with the dry season.

Unlike the Estuaries, Florida Bay is indirectly affected by regulatory discharges from Lake Okeechobee. Instead, the Bay receives its freshwater inflows via overland flow from the Everglades and Taylor Slough as well as discharges from S197 and C-111 gaps.

This chapter of the report will evaluate the effects of high freshwater discharges and inflows on the Caloosahatchee Estuary, St. Lucie Estuary, and Florida Bay that occurred during the 1994 wet season.

IMPACTS TO THE CALOOSAHATCHEE ESTUARY DURING THE 1994 WET SEASON

Although a field sampling program designed to quantify effects of this year's wet weather was initiated in October 1994, that effort is ongoing and the data set is not of sufficient magnitude to analyze with confidence. In lieu of direct field observations the following approach was taken.

First, the freshwater discharges experienced in 1994 were placed in a historical perspective by comparing them with long-term means calculated from a 28-year data set (January 1963-December 1990). The longitudinal estuarine salinity gradient resulting from these flows was calculated from a steady state model specifically formulated to represent conditions in the Caloosahatchee (Bierman, 1993). Salinity is emphasized because: (1) both the spatial location and strength of the estuarine salinity gradient are heavily influenced by freshwater input, and (2) salinity exerts a profound influence on the distribution of estuarine organisms, the structure of estuarine communities and the organization of food webs. The predicted salinity distributions were, in turn, compared with the range of those resulting from minimum and maximum discharge limits established by Haunert and Chamberlain (1994). These limits were chosen such that the ensuing range of salinity distributions define an envelope of salinities that fall within the tolerance limits of important estuarine species. Although these flow limits are provisional and require experimental validation, they do provide a sense of ecologically reasonable and unreasonable levels of freshwater discharge. In the present case, they allow us to evaluate potential ecological effects of the 1994 discharges. Lastly, we present preliminary results of monthly sampling of seagrasses in San Carlos Bay, initiated in November 1994. Seagrasses are the main structural component of an important estuarine habitat type in south Florida.

Caloosahatchee River System

The Caloosahatchee River system is comprised of a freshwater reach (Caloosahatchee River or C-43) and an estuary (Caloosahatchee Estuary). The freshwater reach extends 42 miles from Lake Okeechobee to the Franklin Lock and Dam (S-79), where it discharges to the

Estuary (Figure 29). The Caloosahatchee River (C-43) serves as a waterway, and provides freshwater for municipal and agricultural needs. The major sources of water for C-43 are its 850 square mile watershed and discharges from Lake Okeechobee. The latter occur via the S-77 structure at Moore Haven and are made both to provide water to downstream users and to maintain lake levels according to prescribed schedule.

The Caloosahatchee Estuary, located in Lee County, stretches about 26 miles from S-79 to Shell Point, where it empties into San Carlos Bay at the southern end of Charlotte Harbor (Figure 30). Although the Estuary itself drains a watershed of about 500 square miles, the major source of freshwater to the Estuary is the Caloosahatchee River (C-43). Thus, both drainage from the C-43 watershed and discharges from Lake Okeechobee largely determine the amount of freshwater entering the Caloosahatchee Estuary.

Salinity Envelope for the Caloosahatchee Estuary

The recommended minimum and maximum mean monthly discharges to the Caloosahatchee Estuary at S-79 are 500 and 2500 cfs (Haunert and Chamberlain, 1994). Flows within this discharge envelope maintain tolerable salinities within the distributional range of important species in the Caloosahatchee (Figure 31). Flows outside this envelope may be problematic, causing mortality of some species and allowing others to invade.

Freshwater Input May-December 1994

During May 1994 low level (about 500 cfs) releases from Lake Okeechobee occurred at S-77 to fulfill downstream municipal and agricultural requirements. No releases from Lake Okeechobee occurred during June, July, August and the first half of September. Because of rising lake levels, a 10 day Level 1 pulse release, peaking at 3200 cfs, began at S-77 on September 21. This release was immediately followed by a series of five Level 3 pulses, each lasting 10 days. Level 3 pulsing commenced on September 30 and ended on November 18 with the five pulses peaking at mean daily flows of 5950, 5810, 5880, 4920, and 4450 cfs respectively. In response to Tropical Storm Gordon (November 13-17), constant Zone C discharges (4500 cfs) commenced on November 21 and continued through December 31. Because the lake regulation schedule provides for a falling lake level between January and June, Zone C discharges have continued into 1995.

During May, June, July and August monthly mean discharge to the Estuary at S-79 ranged between 400 and 2000 cfs. As releases from the Lake began in September, average monthly discharges for the period September-December increased and ranged between 4300 and 6100 with peak daily average discharges reaching 9500 cfs.

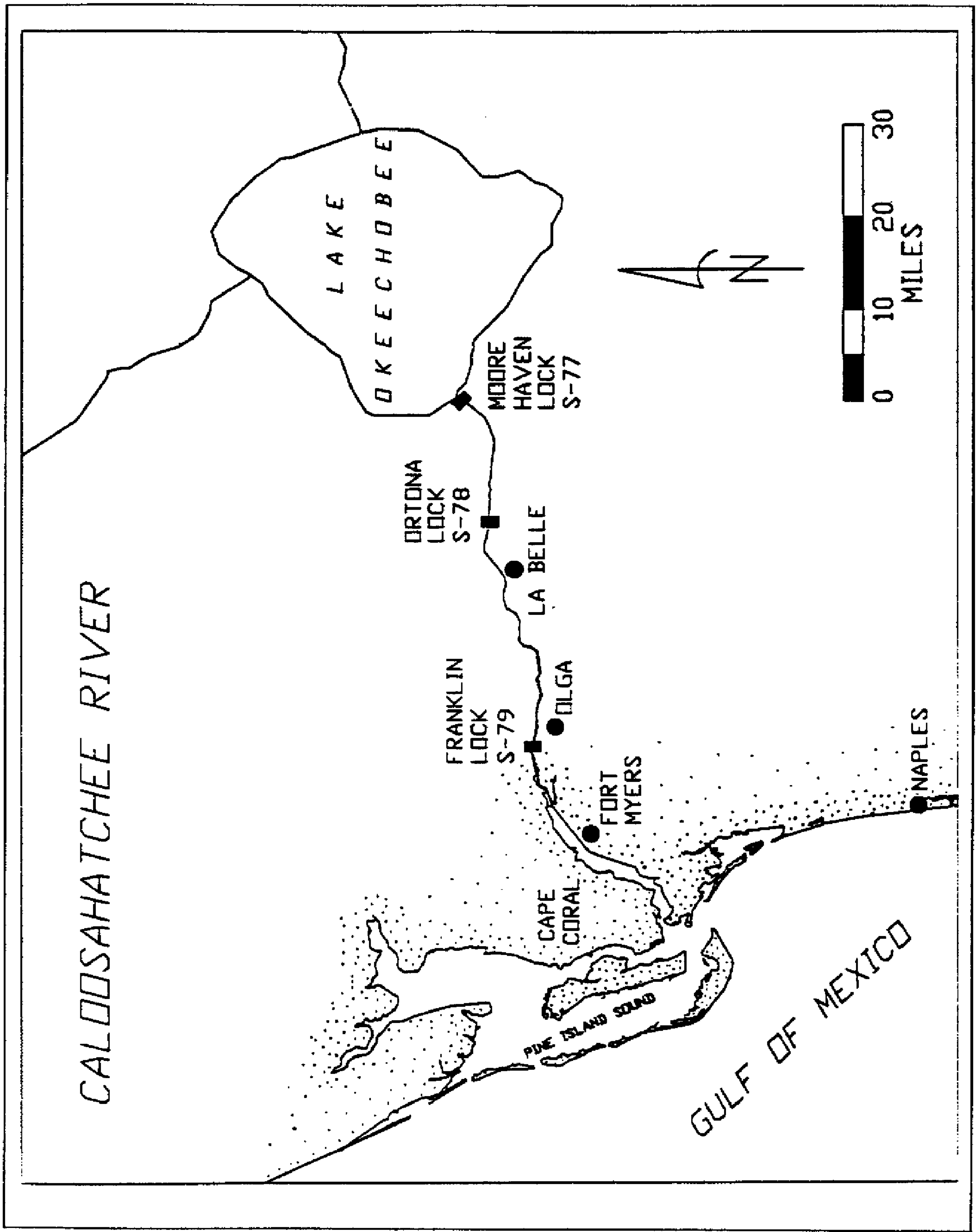


Figure 29. Caloosahatchee River System.

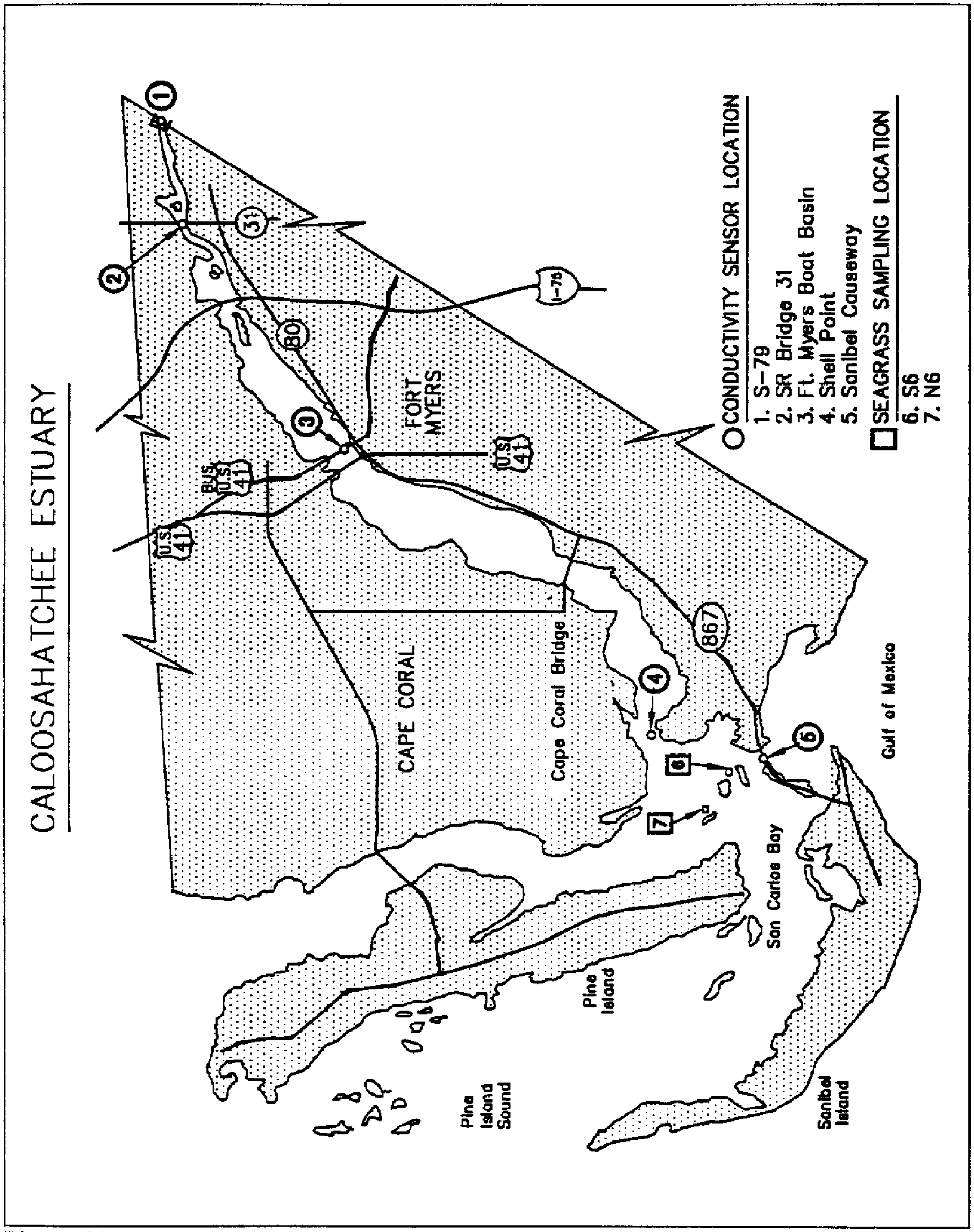


Figure 30. Salinity sensors and seagrass sampling stations in the Caloosahatchee Estuary.

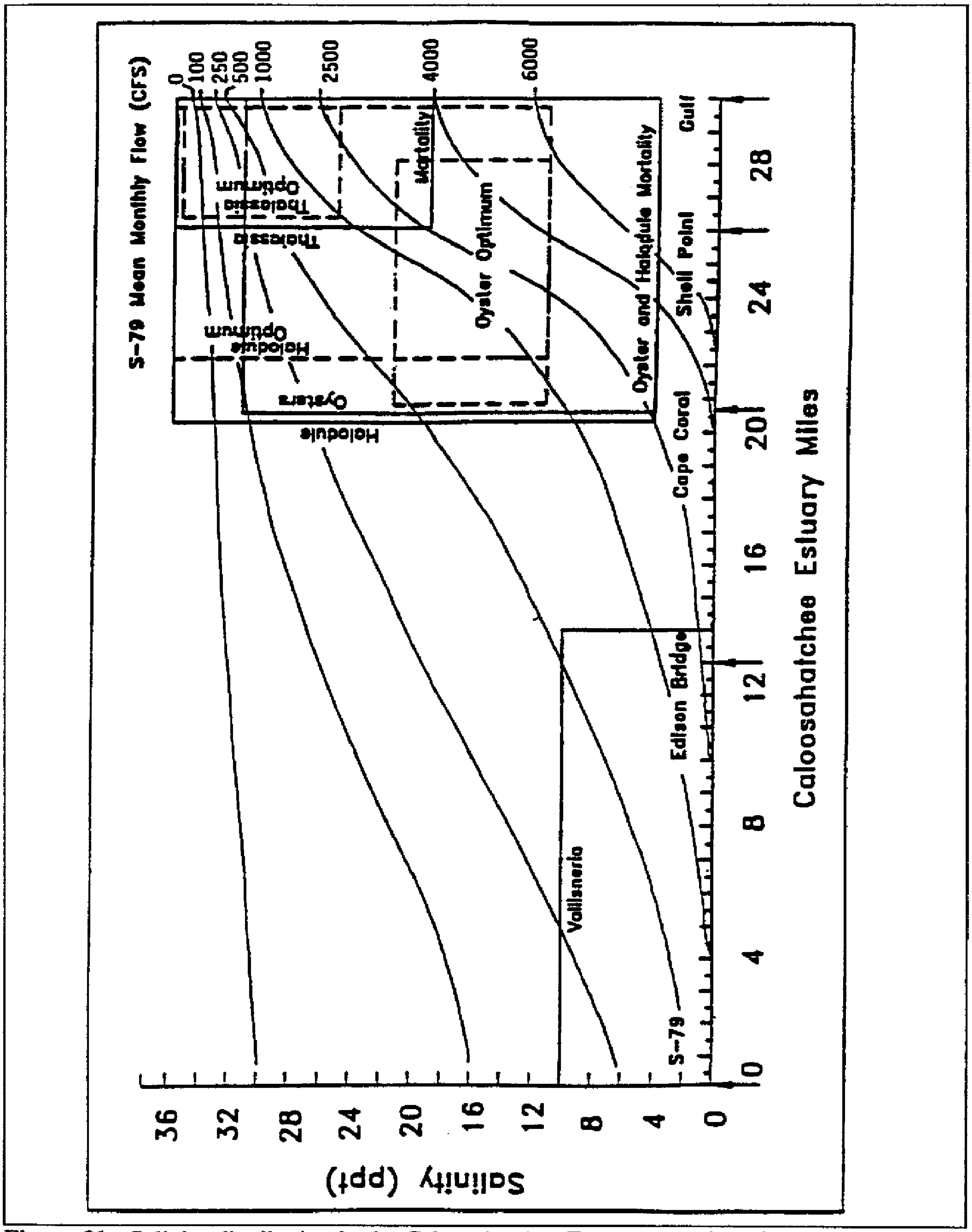


Figure 31. Salinity distribution in the Caloosahatchee Estuary at various freshwater inflows.

Comparison with a long-term record of flow at S-79 places the 1994 discharges to the Estuary in an historical perspective. Figure 32 shows the frequency of mean monthly discharges for the May-December period from 1963-1990 (top panel) and 1994 (bottom panel). Both total measured flow and flow calculated without contribution from the Lake (discharge at S-79 - discharge at S-77) are given. The May-December period of 1994 was clearly anomalous. The long-term mean monthly discharge at S-79 for the entire eight month period is about 1200 cfs with discharges over 4000 cfs relatively rare (Figure 31). The mean monthly discharge, averaged over the May-December 1994 period, was about 2.5 times higher than the long-term mean and discharges over 4000 cfs occurred for four of the eight months.

At S-79 the high mean monthly discharges in 1994 were caused primarily by discharge from the Lake rather than runoff from the C-43 basin. In the long-term, mean monthly total discharge at S-79 and mean discharge calculated without contribution from the Lake are similar. Most of the water entering the Estuary derives from basin runoff and discharge from the Lake comprises only about 20 percent of the total. In 1994, discharge from the Lake accounted for about 50 percent of the total. S-79 discharge in 1994 was nearly 2000 cfs higher than the long-term mean. Of this increase only 35 percent was due to enhanced basin runoff, while 65 % was due to discharge from Lake Okeechobee.

Salinity Distribution Within the Estuary

The effects of the 1994 discharges on the longitudinal distribution of salinity were calculated from a steady state model formulated by Bierman (1993). For any given freshwater discharge, the model predicts average water column salinity as a function of distance between the head of the Estuary at S-79 and its mouth at Shell Point. The model uses monthly average freshwater discharge as an input and has been verified using data collected from five continuous salinity recorders located throughout the reach of the Estuary (Figure 30). During normal inflow conditions, the residence time of freshwater in the system averages about one month (Haunert and Chamberlain, 1994). Thus, monthly mean freshwater inflow is an appropriate input to the model and the predicted salinities may be considered to represent overall conditions in the Estuary.

The high average freshwater discharge for the period May-December 1994 produced a salinity distribution markedly different from the log-term mean condition (Figure 33). At the long-term mean discharge of about 1000 cfs, freshwater extends only 8 km downstream of S-79. At the May-December 1994 mean monthly flow of about 3000 cfs, freshwater extends nearly 30 km downstream. While the long-term mean salinity distribution in the Estuary fall within the range of salinities implied by the recommended minimum and maximum discharge limits for the Estuary (500-2500 cfs), the average distribution for the May-December 1994 period fell below this envelope. Reference to Figure 31 suggests that salinity was reduced below optimum levels for both oysters and the seagrass, *Halodule*, throughout much of their lower estuarine range (Cape Coral to Shell Point).

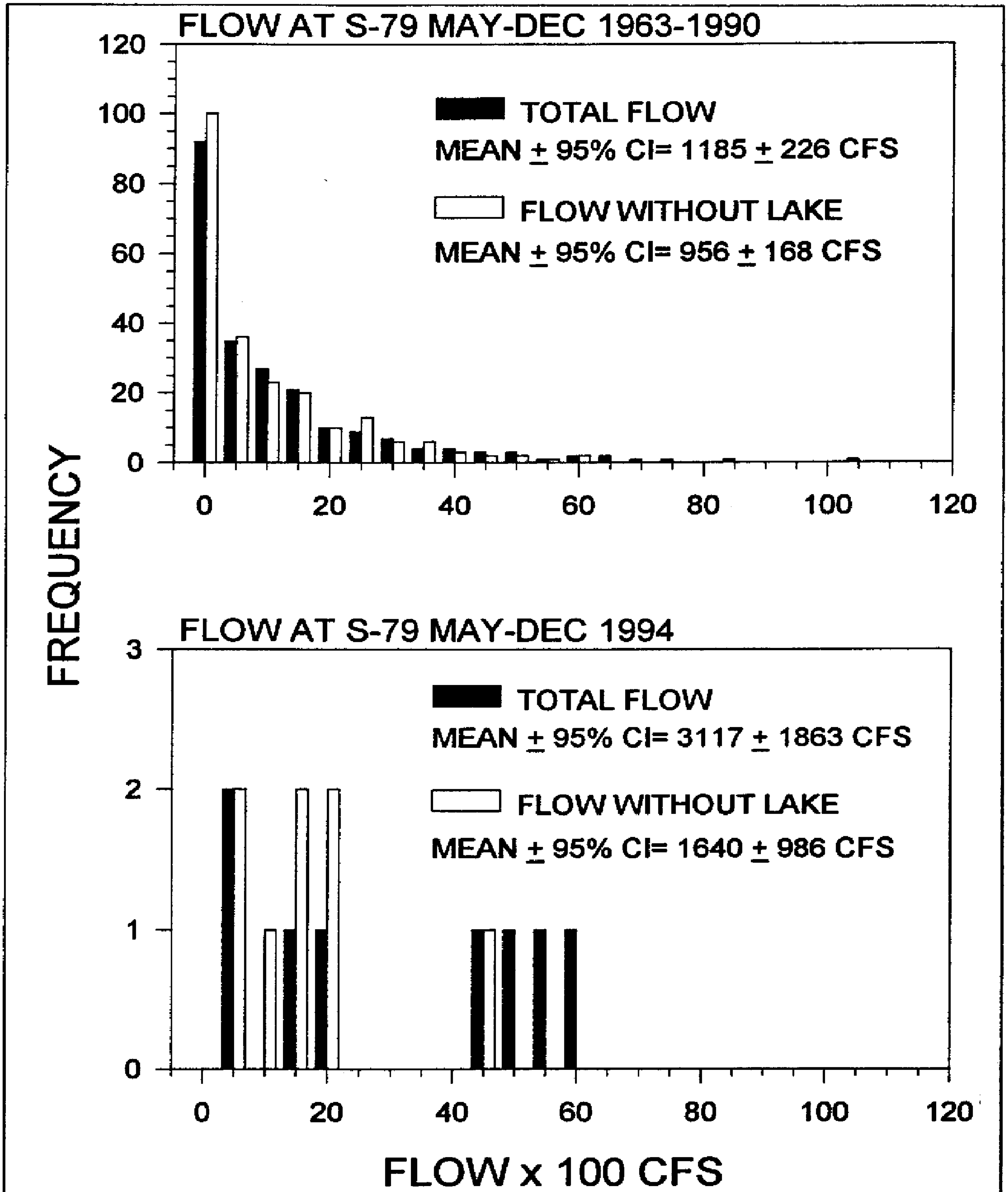


Figure 32. Frequency distributions of mean monthly discharges at S-79 (May-Dec. 1994).

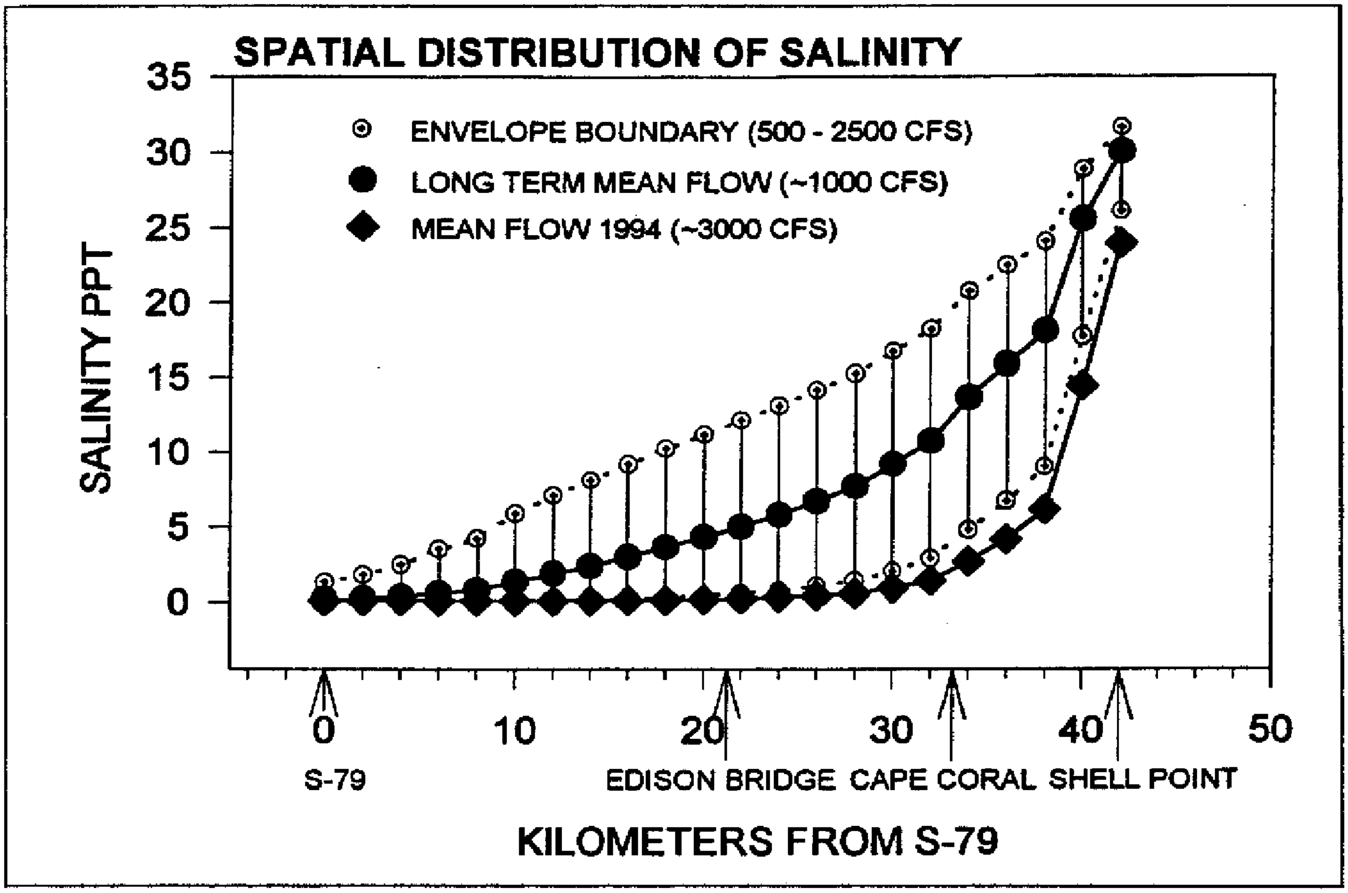


Figure 33. Distribution of salinity in the Caloosahatchee Estuary.

Examining predicted salinity distributions for each month between May and December 1994 (Figure 34) reveals that salinities were not reduced below ecologically reasonable levels until September. From May through August, total freshwater discharge at S-79 fell with the limits established by Haunert and Chamberlain (1994). The contribution of discharge from Lake Okeechobee to the total discharge was nonexistent and the salinity distribution within the Estuary was not seriously altered. As total discharge increased in September, freshwater extended 30 km downstream, nearly to the Cape Coral Bridge. Freshwater discharge exceeded recommended limits resulting in depressed salinity throughout the entire Estuary.

Comparison of distributions calculated with and without the contribution of discharge from Lake Okeechobee suggest that basin runoff alone was sufficient to cause reduced salinities in the Estuary. From October through December, depressed salinities in the Estuary resulted entirely from Lake Okeechobee discharge. During this period, total discharge at S-79 continued to exceed recommended limits. However, the contribution of Lake Okeechobee to the total discharge at S-79 increased while the contribution of basin runoff declined. Basin discharge, calculated without contribution from the Lake would have produced salinities within the recommended range (Figure 34).

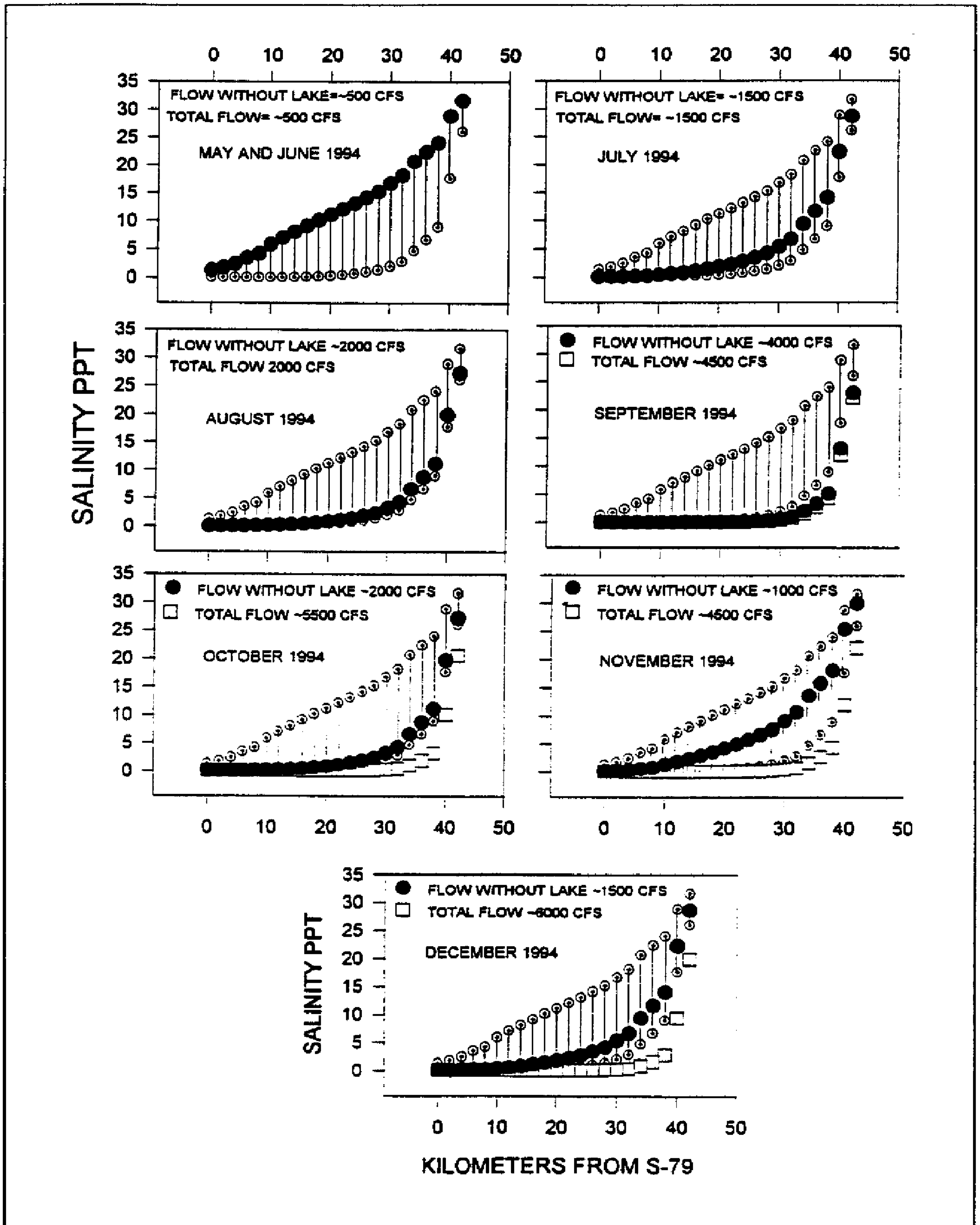


Figure 34. Distribution of salinity in the Caloosahatchee Estuary (May-Dec. 1994).

The depression of salinity in the Caloosahatchee Estuary by discharge from Lake Okeechobee must be viewed within the context of drainage throughout much of south Florida. In essence, salinity was lowered in the Estuary by rain which fell outside the Caloosahatchee Basin. While 1994 was a wet year for most of south Florida, rainfall in the Caloosahatchee Basin was normal (see Meteorological Description section of this report). Figure 33 suggests that if regulatory discharge from Lake Okeechobee had not occurred, basin runoff would have depressed salinity only in September.

Seagrasses

In November and Dec.ember of 1994, average blade length and density of two seagrass species were measured at two shallow stations (0.4 m) located in San Carlos Bay. These data are compared with data obtained in previous years by Mr. R. Chamberlain (Figure 35). Since freshwater discharge was "normal" during these years (1986-1988), such a comparison is designed to reveal effects of the high freshwater discharges experienced in 1994. Aside from a somewhat reduced blade density and blade length of *Halodule* at station S-6, seagrasses do not yet appear adversely affected by increased freshwater discharge. Since Zone C discharges are continuing, it is far too early to reach a firm conclusion. The stations in San Carlos Bay, are quite some distance from S-79 and effects of increased discharge may be slow to appear.

Conclusions

1) For the entire eight month period May through December 1994, mean monthly freshwater discharge (about 3200 cfs) to the Caloosahatchee River Estuary was higher than the long-term historical mean for this period (about 1200 cfs).

2) However, greater than normal mean monthly discharges, actually began in September, 1994 and continued through December.

3) In September, increased basin runoff caused anomalously high discharge at S-79. From October through December, higher than normal discharges were caused by releases from Lake Okeechobee.

4) As a result of the high freshwater input from September through December, salinities were depressed in the Estuary during this period. Since Zone C discharges from Lake Okeechobee are continuing into 1995, salinities will likely remain depressed until releases cease.

5) To date there is no conclusive evidence of damage to seagrass communities in San Carlos Bay. This area is quite some distance from S-79 and effects of increased freshwater discharge may be slow to appear.

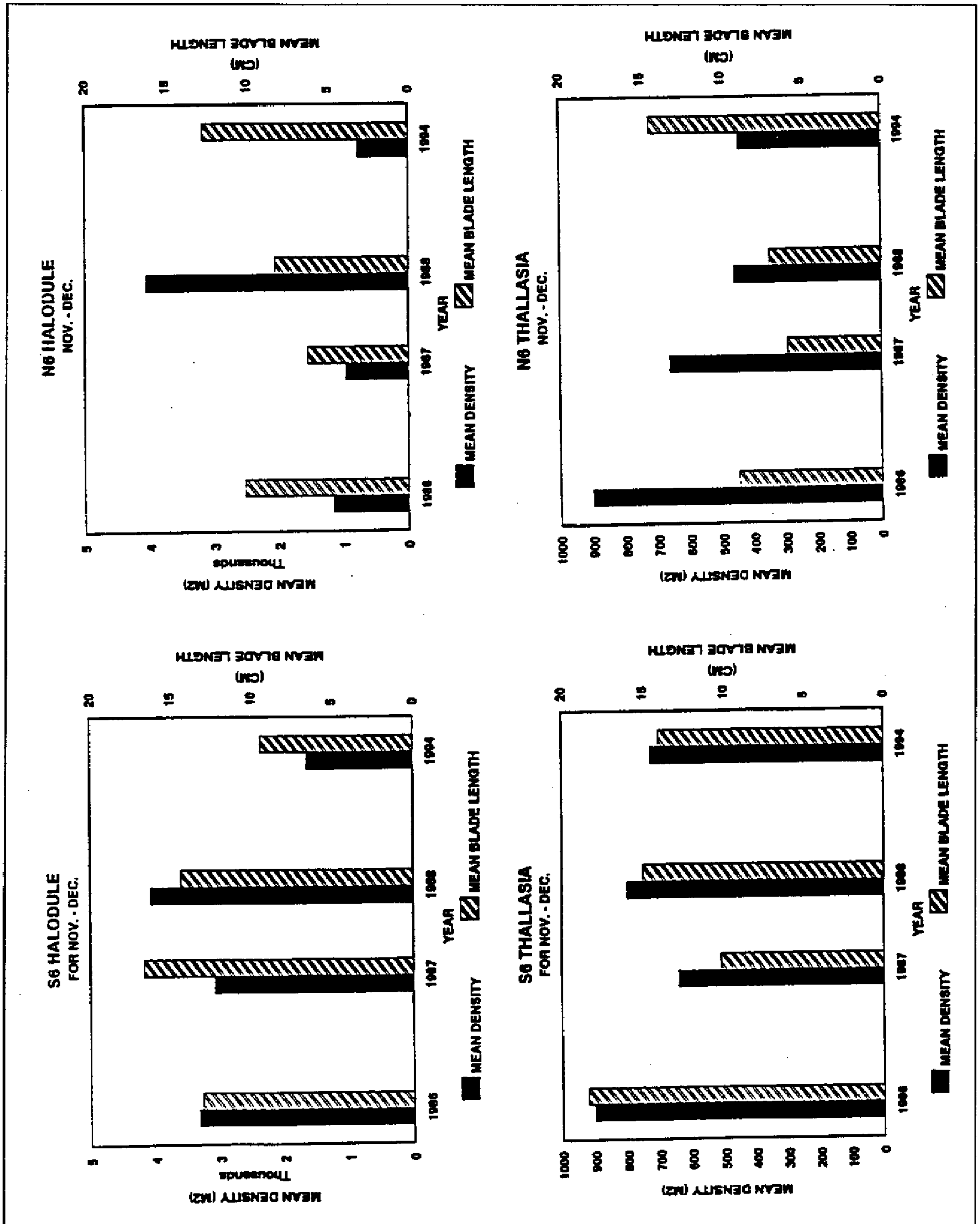


Figure 35. Mean blade density and blade length of seagrasses in San Carlos Bay.

This page intentionally left blank.

IMPACTS TO THE ST. LUCIE ESTUARY DURING THE 1994 WET SEASON

St. Lucie Estuary Watershed

The St. Lucie Estuary (SLE) is located on the southeast coast of Florida, encompassing portions of both Martin and St. Lucie counties within the watershed. The two forks, the North Fork and South Fork, flow together at the Roosevelt Bridge near the City of Stuart, and then flow eastward approximately six miles to the Indian River Lagoon and Atlantic Ocean at the St. Lucie Inlet (Figure 36). Tidal influences in the North Fork reach 15 miles north of Stuart in Five-Mile Creek, and to a water control structure on Ten-Mile Creek just west of the Florida Turnpike. Tidal influences in the South Fork extend about eight miles south of Stuart to the St. Lucie Lock and Dam (S-80) on the St. Lucie canal and into the extremes of the Old South Fork tributary.

The SLE is divided into three major areas: the inner estuary, comprised of the North and South Forks; the mid-estuary, consisting of the area from the juncture of the North and South Forks to Hell Gate; and the outer estuary extending past Hell Gate into the Intracoastal Waterway and St. Lucie Inlet. The main body of the North Fork is about four miles long, with a surface area of approximately 4.5 square miles. The South Fork is approximately half the size of the North Fork with a surface area of about 1.9 square miles. The mid-estuary extends approximately five miles from the Roosevelt Bridge to Hell Gate and has an area similar to the North Fork (4.7 square miles).

While the SLE encompasses about 8 square miles, the watershed covers an area of almost 775 square miles. The watershed is divided into eight basins (Figure 36); five major basins and three minor ones. Three of these major basins, the C-23, C-24, and C-44, represent basins now draining to the estuary through primary canals. In addition to drainage from within the C-44 basin, the C-44 canal (St. Lucie Canal) also conveys flood control discharges from Lake Okeechobee to the SLE. The other two major basins, the North Fork, and Tidal Basin, include numerous drainage connections to the SLE.

Numerous physical drainage modifications have been made within the St. Lucie Estuary watershed. Since the early 1900s, canals and water control facilities were constructed. The St. Lucie Canal (C-44) was constructed between 1916 and 1924 to provide an improved outlet for Lake Okeechobee floodwaters. In 1918 the North St. Lucie River Drainage District, now the North St. Lucie Water Control District (NSLWCD), was formed. A system of canals and control structures was designed to provide flood control for about 75,000 acres in the North Fork Basin. As part of this project, Five and Ten-Mile Creeks were channelized to increase drainage. The C-24 canal was constructed to provide drainage west of the NSLWCD. The C-23 provided drainage to the SLE for the Allapattah Flats Marsh.

Following severe flooding in 1947, the U.S. Congress authorized the design and construction of the Central and South Florida Flood Control (C&SF) Project. The C-23, C-24, and C-44 canals were improved under the C&SF Project.

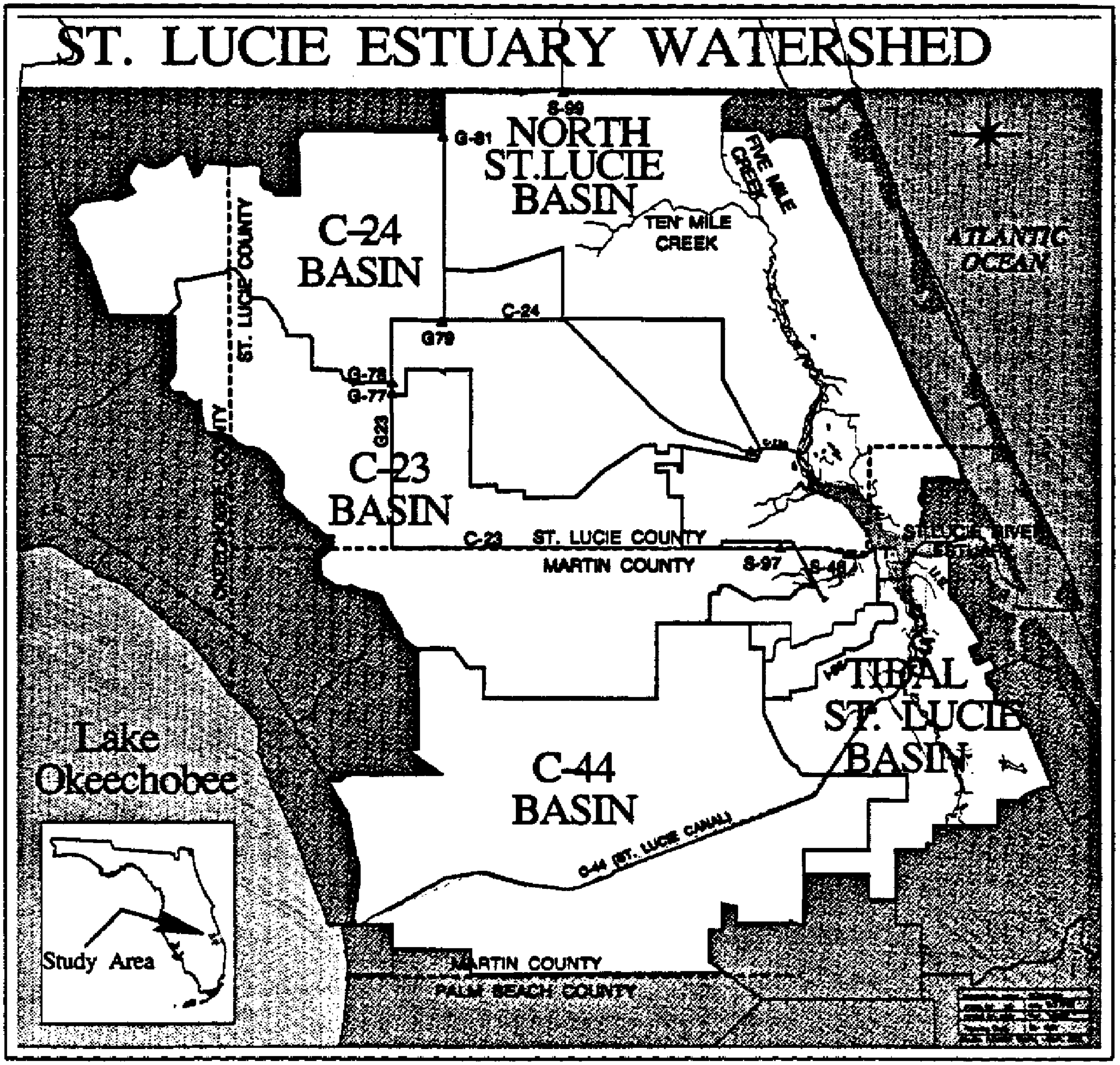


Figure 36. St. Lucie Estuary Watershed.

Environmental Issues: St. Lucie Estuary and Indian River Lagoon

Major environmental issues are:

- Adverse salinity fluctuations,
- Degraded water quality associated with urban and agricultural activities within the watershed and from the Lake,
- Loss of seagrass and shellfish, and
- Accumulation of sediments.

The estuarine environment is sensitive to freshwater inflows, and modification of the quality, quantity and timing of these inflows can cause severe stress upon the entire ecosystem. The entire watershed of the SLE has been extensively modified and increased in size due to agricultural and residential development. Major effects of these man-made alterations are increased drainage, manifested by a lowered groundwater table and dramatic changes in stormwater runoff characteristics. Typically, when a watershed is well drained like the SLE watershed, all three freshwater runoff factors (quality, quantity and timing) are negatively affected. From an annual cycle perspective, the quantity of water drained to the Estuary is increased, the water quality is degraded and the seasonal distribution of runoff is altered such that dry season flows are of less magnitude and frequency and wet season flows are greater in magnitude and more frequent. From a short-term perspective, these three factors are also all negatively affected due to the accelerated rate of runoff from the watershed. The vast majority of runoff occurs within the first three days instead of over an extended period of time. Water quality is degraded, especially by increased amounts of nutrients and suspended solids. The increased nutrients in the SLE have increased primary productivity within the system during the wet season resulting in unhealthy levels of dissolved oxygen to occur on a regular basis in the inner estuary.

The dramatic increase in sediment load has contributed significantly to the build-up of muck throughout the system. As a result, the benthic environment of the SLE has become a favorable habitat for mostly pollution tolerant organisms. In addition, the rapid introduction of freshwater from the watershed and Lake Okeechobee causes salinity fluctuations that are not conducive to developing or maintaining healthy estuarine plant and animal communities. The SLE has suffered the loss of seagrasses and oysters which provided vital habitats for many estuarine dependent organisms and therefore an overall degradation of the ecosystem has occurred.

Salinity Envelope for the St. Lucie Estuary

To determine appropriate water quantity inflows to the estuary, reasonable biological indicators with definable salinity preferences must be chosen along with its desired range within the Estuary. Highly dynamic conditions within systems such as the SLE, discourage the use of transient, adaptable indicators such as fishes which can be readily influenced by short-term edaphic conditions. However, fishes and other biota would be considered in a final evaluation. Within northern portions of the IRL, the distribution and abundance of clams has provided a basis for evaluating the biological health of the system; the long-term salinity regime within the SLE can be assessed based upon oyster and shoalgrass distribution and viability.

Oyster populations are most abundant in salinities over a range from 5 to 18 ppt and the lowest salinity that can be tolerated by shoalgrass is about 3 ppt (Figure 37). To maintain viable oyster and shoalgrass populations within the SLE, flows from contributing basins must be managed such that the aggregate flow maintains salinities within the appropriate salinity range over the appropriate geographic area of the Estuary.

An inflow/salinity model was used to generate SLE inflow/salinity curves for the inner and middle estuary. Historical oyster and shoalgrass distributions within the estuary have been compared to the inflow/salinity curves to develop a preliminary "salinity envelope" for the SLE which is 350 to 1500 cfs (Figure 37).

Freshwater Input

Historical Wet Season Flows

Since a salinity envelope has been established for the Estuary, the distribution of historical wet season flows can be assessed in relation to desired levels of flow that would allow oysters and shoalgrass to populate the Estuary. Figure 38A shows that flows greater than 1500 cfs have occurred numerous times during the period of record (May through December, 1965 through 1990). Flows shown with Lake releases are what actually occurred whereas flows without Lake releases depict what would have occurred if only watershed stormwater runoff was introduced to the estuary. Clearly, from an historical perspective, the salinity envelope is violated frequently enough from watershed runoff alone to nearly exclude oyster and shoalgrass populations from developing in the inner estuary. Figures 39A and B reveal the mean flow and salinity gradient for both historical situations in relation to the salinity envelope. To obtain an understanding of the variation of flows around the mean flow, the hatched areas demonstrate where about three fourths of the flows occur for each situation.

1994 Wet Season Flows

St. Lucie Estuary. To evaluate the flows that occurred during the wet season of 1994 (Table 19), Figure 38B is compared to the historical flows shown in Figure 38A. All of the flows, with the exception of May 1994, violated the salinity envelope (Figure 40) and many fell within the upper range of historical flows. Watershed runoff alone occurred from May to September and then was augmented with flows from the Lake beginning in October. Pulse releases from the Lake actually began in mid-September to the Caloosahatchee Estuary, however, the local runoff from the C-44 basin was so great that it exceeded the Level I pulse release criteria for discharges at the St. Lucie Lock and Dam and therefore could not be implemented until October when C-44 basin runoff subsided. Continued Level III pulse releases until mid-November where not sufficient to control the rising stage in the Lake. Lake stage in mid-November reached Zone C of the "Run 25" Lake Regulation Schedule and

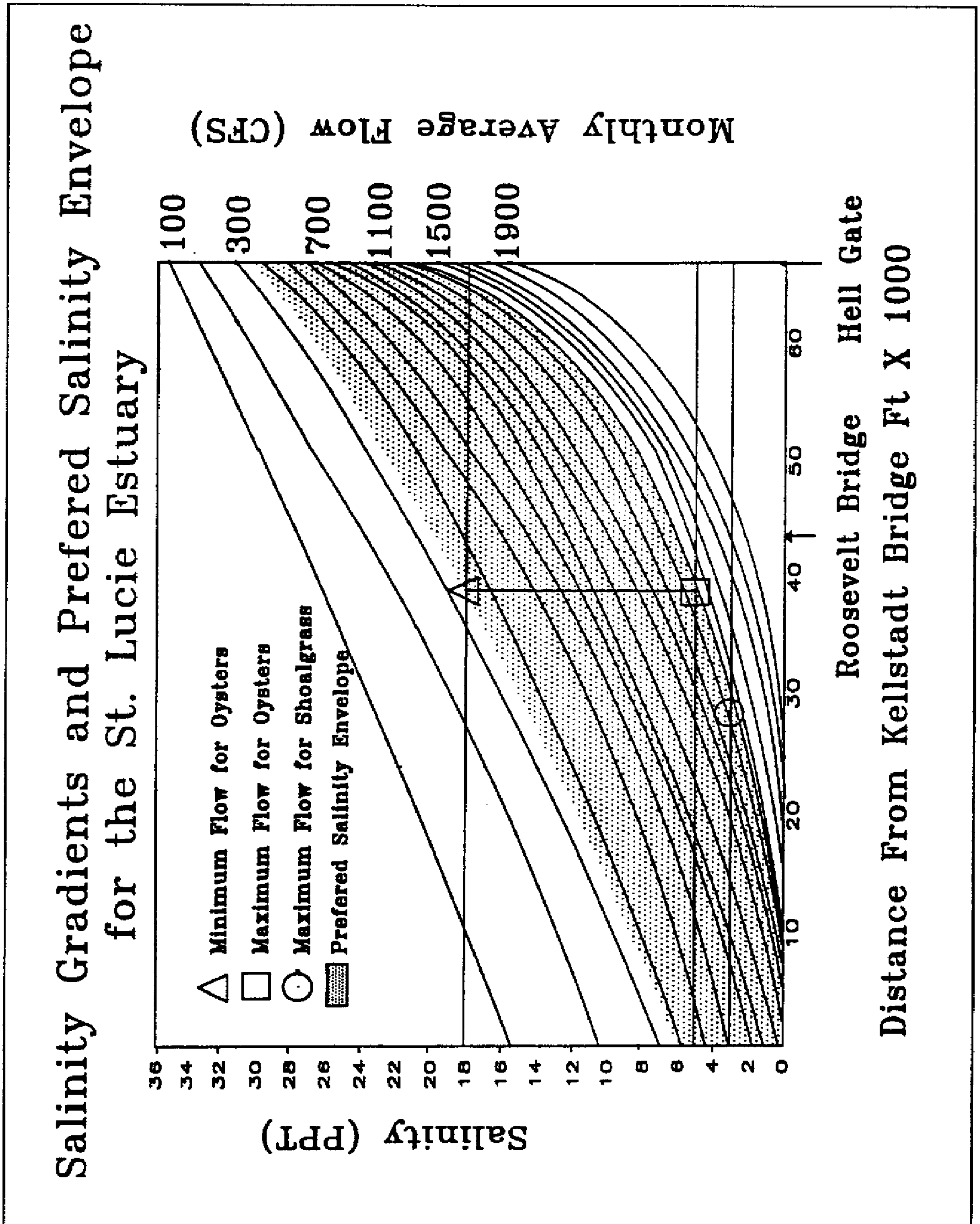


Figure 37. Salinity gradients and preferred salinity envelope for the St. Lucie Estuary.

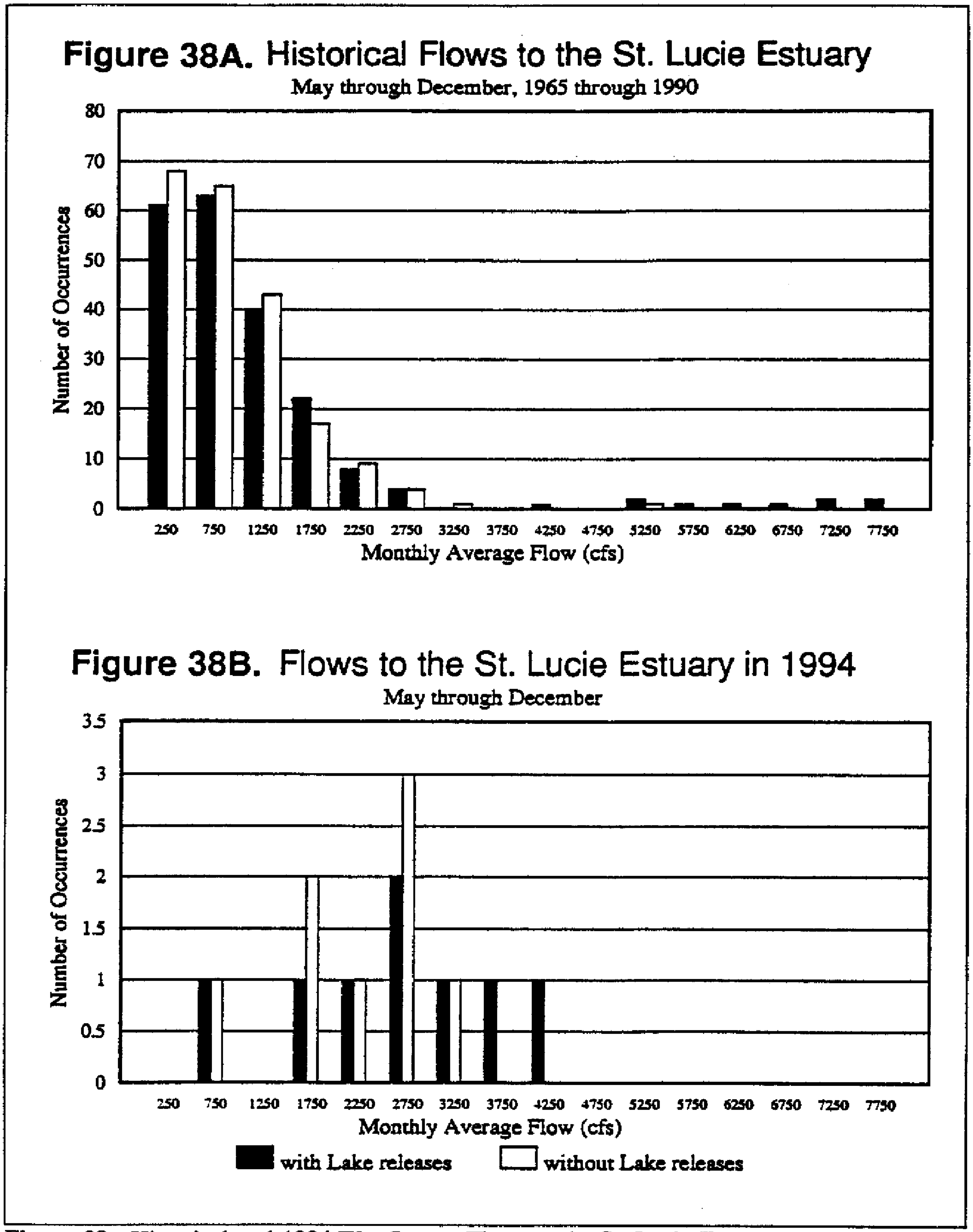


Figure 38. Historical and 1994 Wet Season Flows to the St. Lucie Estuary.

Figure 39A. St. Lucie Historical Salinity Gradient With Lake Okeechobee Flows

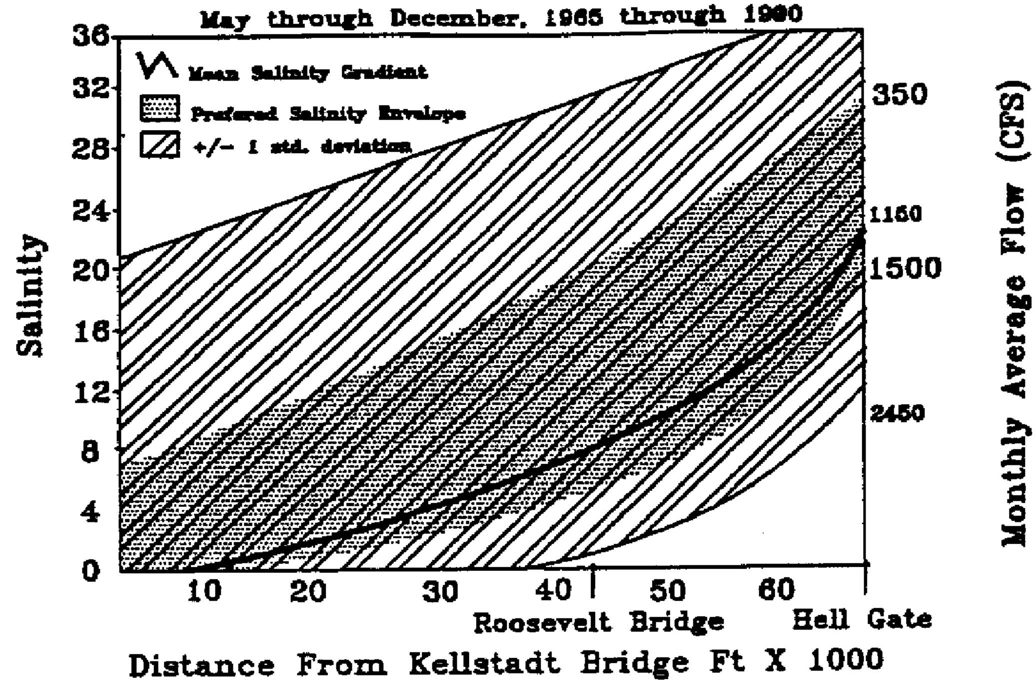


Figure 39B. St. Lucie Historical Salinity Gradient Without Lake Okeechobee Flows

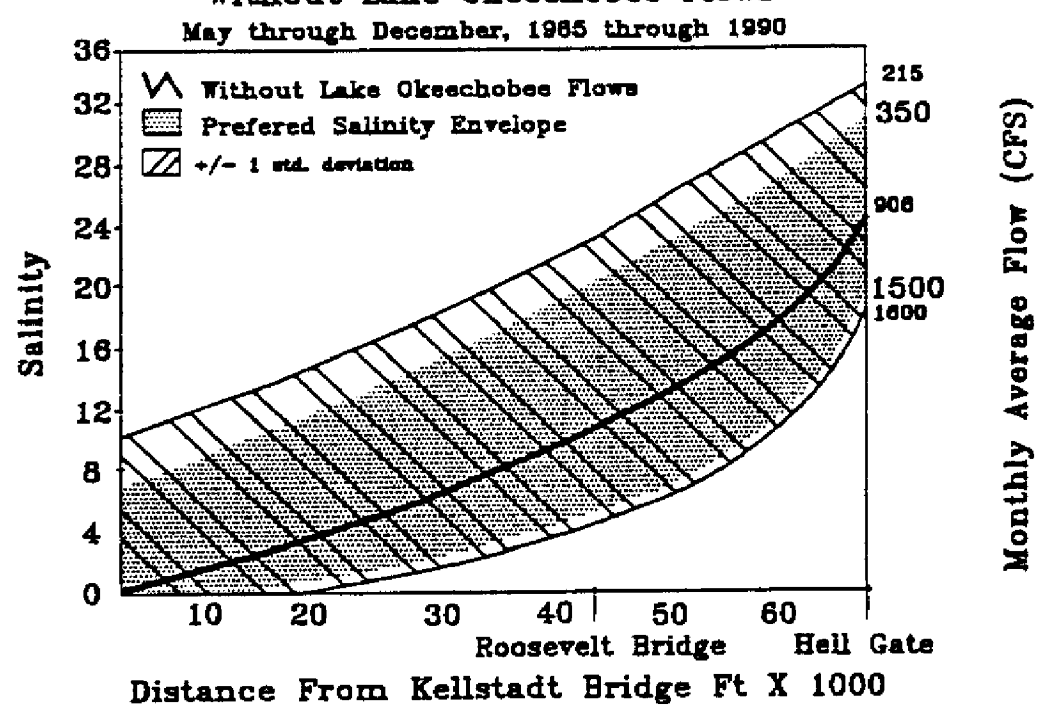


Figure 39. Historical and 1994 Wet Season Salinity Gradients for the St. Lucie Estuary.

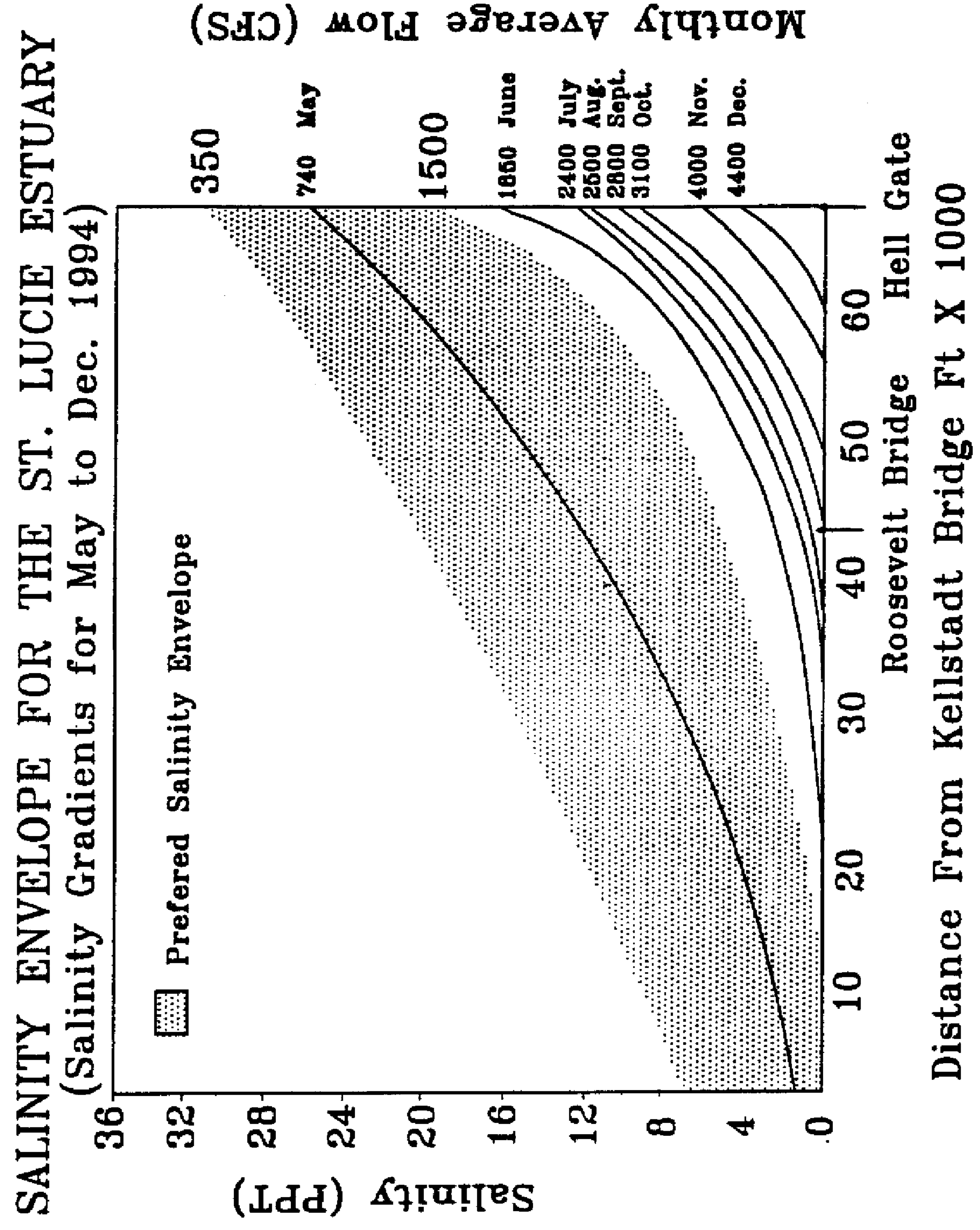


Figure 40. Salinity Envelope for the St. Lucie Estuary (May-Dec. 1994).

therefore regulatory releases (2500 cfs) began at that time. Figure 41 reveals the affect of adding regulatory releases to the watershed runoff from October to December 1994.

Table 19. Wet Season 1994 Flows to the St. Lucie Estuary

Month	S-80	S-97	S-49	South Fork	North Fork	Total Flow with L.O.	Total Flow without L.O.
May	0	293	192	63	192	740	740
June	0	748	754	248	754	2504	2504
July	518	332	248	81	248	2834	2834
August	537	326	429	141	429	1862	1862
September	989	603	662	218	662	3134	3134
October	1270	334	344	113	344	2405	1772
November	1763	579	663	217	663	3985	2984
December	2519	360	657	219	657	4412	2430

Indian River Lagoon. From field observations of the SLE and adjacent Indian River Lagoon, it has been noted that if total flows to the Estuary are under about 2000 cfs there is minimal exchange of estuarine waters with Indian River Lagoon (IRL) waters north and south of the St. Lucie Inlet. However, when flows exceed about 2000 cfs for more than a month, water exchange begins to become apparent. As flows increase above 2000 cfs, salinity in the Lagoon decreases more rapidly. In addition, if a north winds occur while flows are greater than approximately 2500 cfs, additional estuarine waters are driven south in the Intracoastal Waterway towards Jupiter Inlet. Table 19 shows that flows greater than 2000 cfs occurred frequently between June and December 1994 with flows reaching near 4000 cfs in November and December.

Salinity in the IRL between Ft. Pierce Inlet and the Jupiter Inlet rarely are less than 25 ppt. Exceptions to this are most often related to extremely wet, wet seasons and regulatory discharges from the Lake. Figures 42 through 47 demonstrate how the 1994 wet season flows have affected the salinity (Figures 42 to 44) and color (Figures 45 to 47) of the IRL during this wet season. The salinity distribution has been partitioned into three categories. The first category is 26 to 35 ppt (Green) representing salinities most favorable to marine organisms that utilize the IRL between Jupiter and Ft. Pierce. The second category (19 to 25 ppt) is yellow or caution areas where salinities have decreased and may become low enough to be represented in the third or red category (0 to 18 ppt) if discharges greater than 2000 cfs from the SLE continue. Once the salinity reaches about 18 ppt and continues to decline, marine organisms that have limited mobility (e.g. marine snails and clams) will be severely stressed and may perish. Figure 42 on July 12, 1994 reveals a limited area of concern, however, by October 10, 1994 (Figure 43) much of the study area is within the caution zone. Since flows remained high, especially in November and December, the red zone as of January 9, 1994 has moved north past the first causeway and about two thirds the distance to the Jupiter Inlet (Figure 44).

As the amount of color in the water increases, the depth of appropriate light penetration to support photosynthesis of submerged aquatic vegetation (SAV) decreases rapidly. Therefore the introduction of colored water to the IRL can have severe impacts on the health of SAV, especially those located in the deeper areas. Color in the IRL depicted area is usually below 15 to 20 units. Figure 45 represents the color conditions in the IRL on July 12, 1994 and shows that a month of flows greater than about 2000 cfs from the watershed of SLE does introduced limited amounts of color to the IRL. However, due to a dramatic increase in flows from the watershed during September 1994 when tropical storm Gordon passed through the area, color increased to high levels on October 10, 1994 (Figure 46). This level of color stressed thousands of acres of seagrasses. Fortunately, from a color perspective, as more Lake water of lower color than watershed runoff was added to the discharge to the IRL, color conditions improved by January 9, 1995 (Figure 47).

Although the density of SAV is naturally low during the winter months, some vegetation is usually present. Field observations on January 10, 1995 in the area immediately north and south of the St. Lucie inlet revealed that this area which usually has about 1050 acres of seagrasses (in yellow) had very limited presence of SAV. It appears that complete defoliation of this area may have occurred as a result of stresses resulting from the wet season discharges. The rhizomes of the SAV are still present, however, it is unknown how long they can remain viable without photosynthesis to support them.

Conclusions

1. The wet season of 1994 resulted in flows that are infrequently experienced in the St. Lucie estuary. However, even though the flows were high, more frequent stormwater runoff from the watershed frequently violates the salinity envelope established for the estuary. Stormwater management within the watershed is necessary to rehabilitate the Estuary. The Indian River Lagoon SWIM Plan outlines the problems, potential solutions and level of District efforts to address the stormwater runoff problem.

2. Lake Okeechobee regulatory releases not only aggravate the watershed runoff problem for the estuary but also significantly add to the potential of biological destruction in the Indian River Lagoon. Continued regulatory releases will increase the area in the IRL that is negatively affected. All efforts should be undertaken to stop all regulatory releases from the Lake in the future if rehabilitation of the estuary is to be accomplished.

Short-Term Management Suggestion

Since the salinity envelope for the estuary has been violated since June 1994 and no relief is insight in the near future to affect this problem, management should be focused on trying to reduce the negative impact to the Indian River Lagoon. Once the Lake stage declines into Zone D (the pulse zone), management should allow time (3 to 5 days) between pulse releases to enable the IRL time to rebound or at least slow the progression of low salinity water in the Lagoon.

Figure 41A.

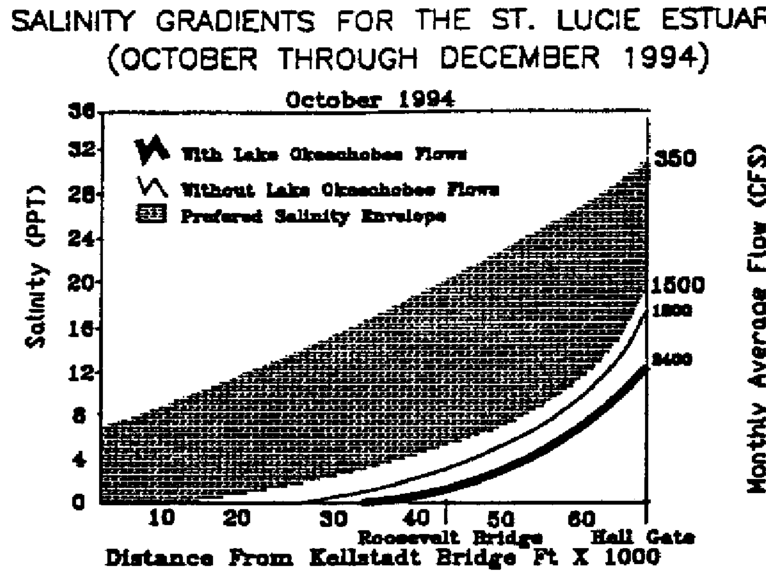


Figure 41B.

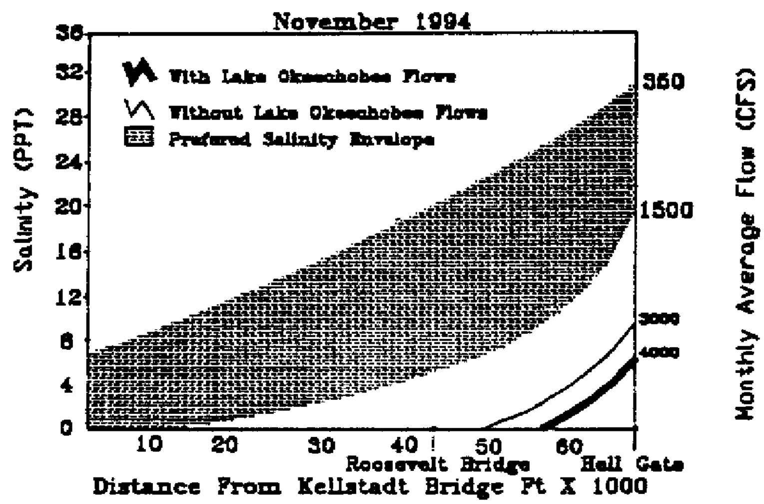


Figure 41C .

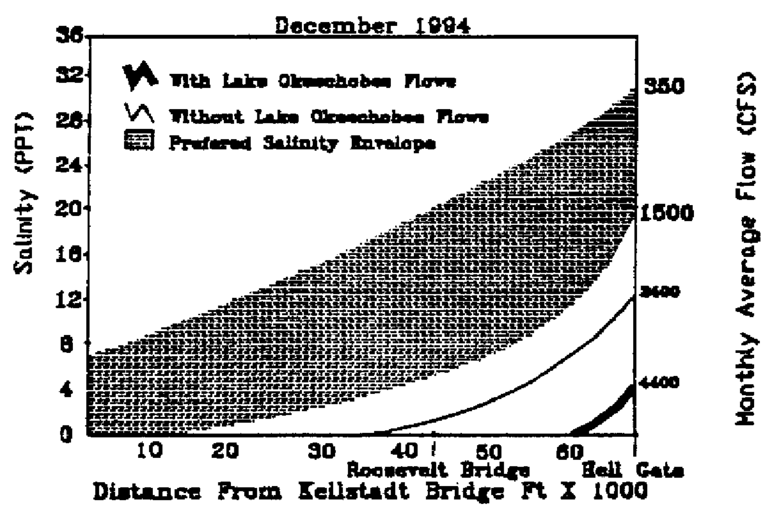


Figure 41. Salinity Gradients for the St. Lucie Estuary (Oct.-Dec. 1994).

This page intentionally left blank

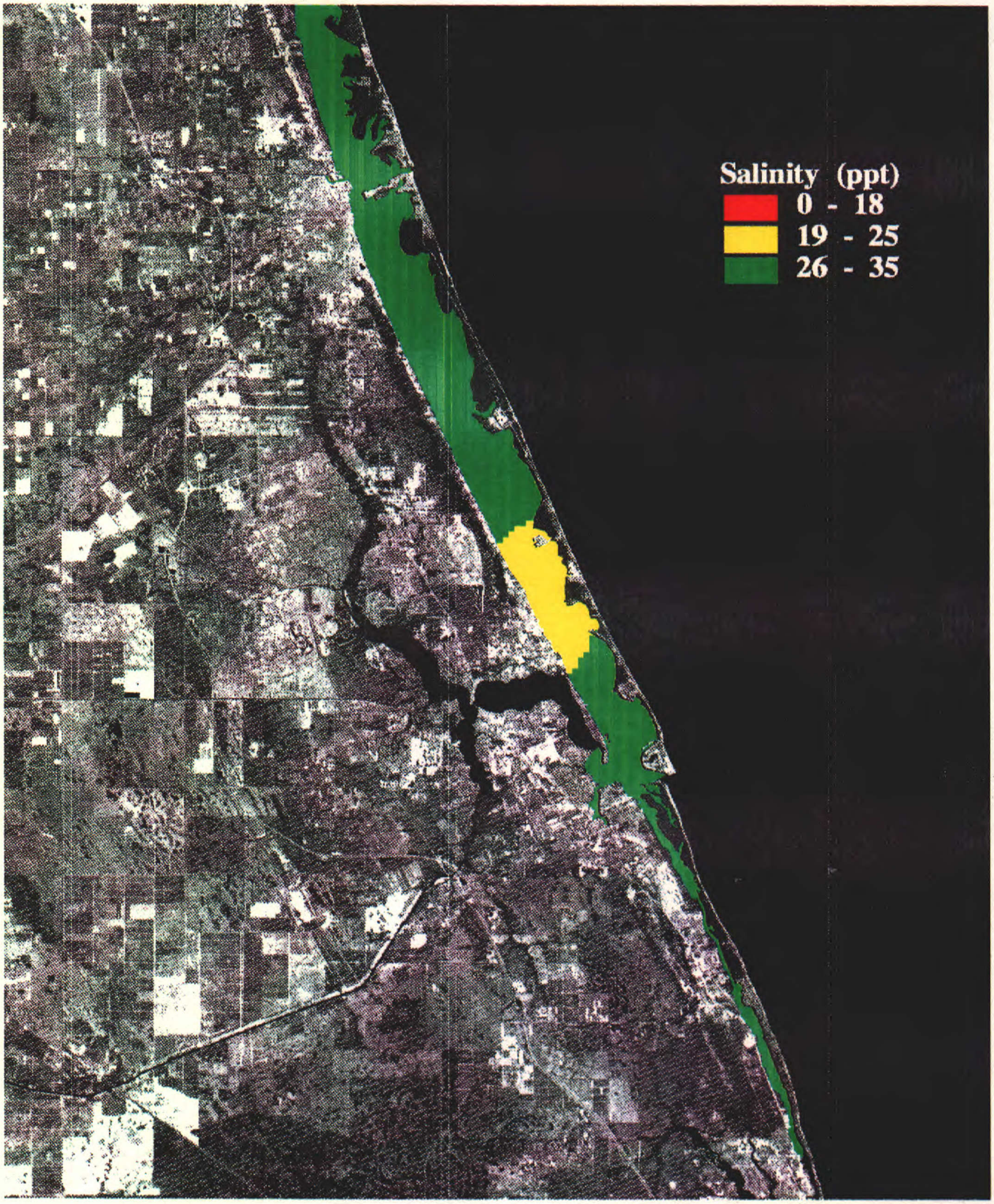


Figure 42. Salinity Distribution in the Indian River Lagoon (July 12, 1994).

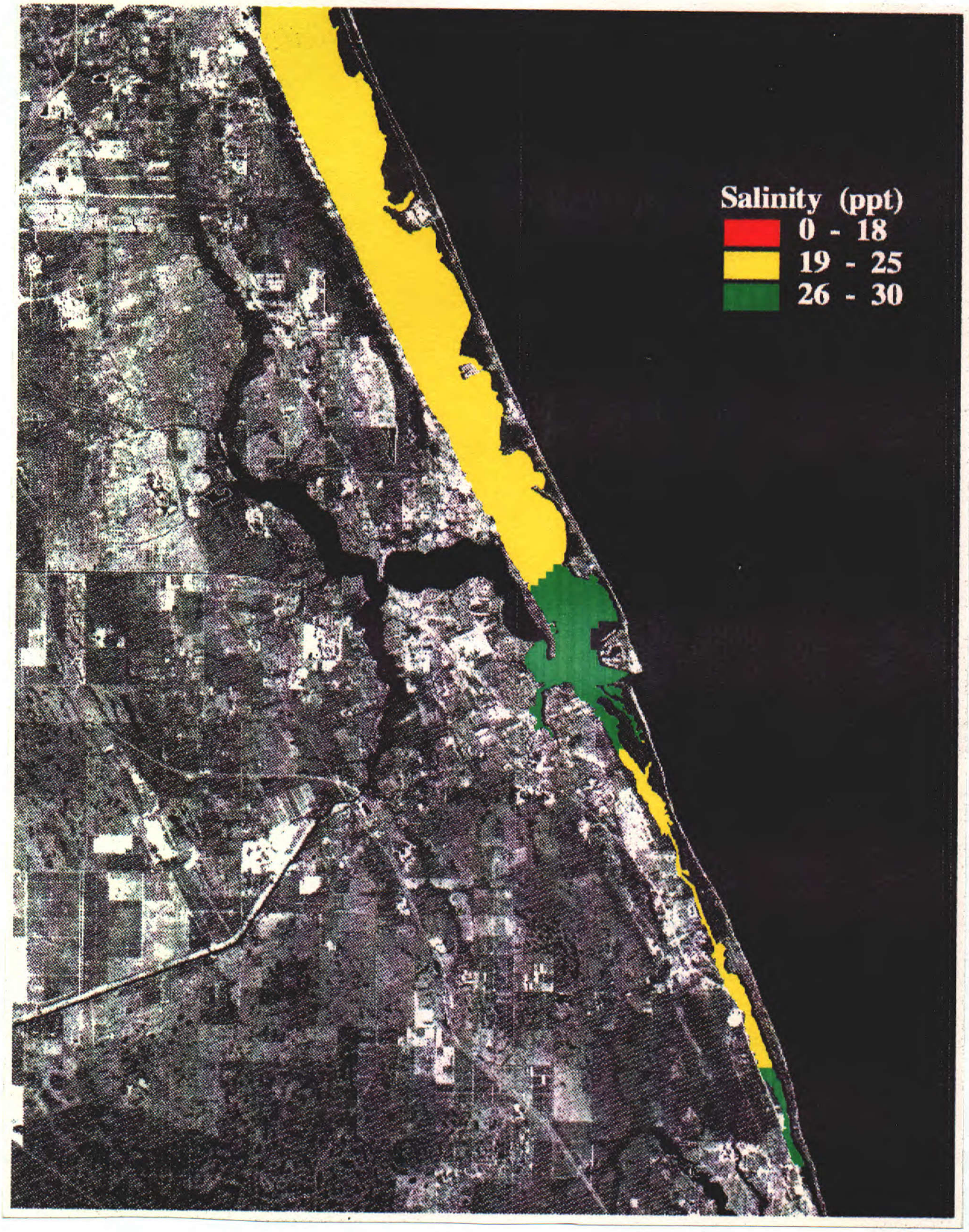


Figure 43. Salinity Distribution in the Indian River Lagoon (Oct. 10, 1994).

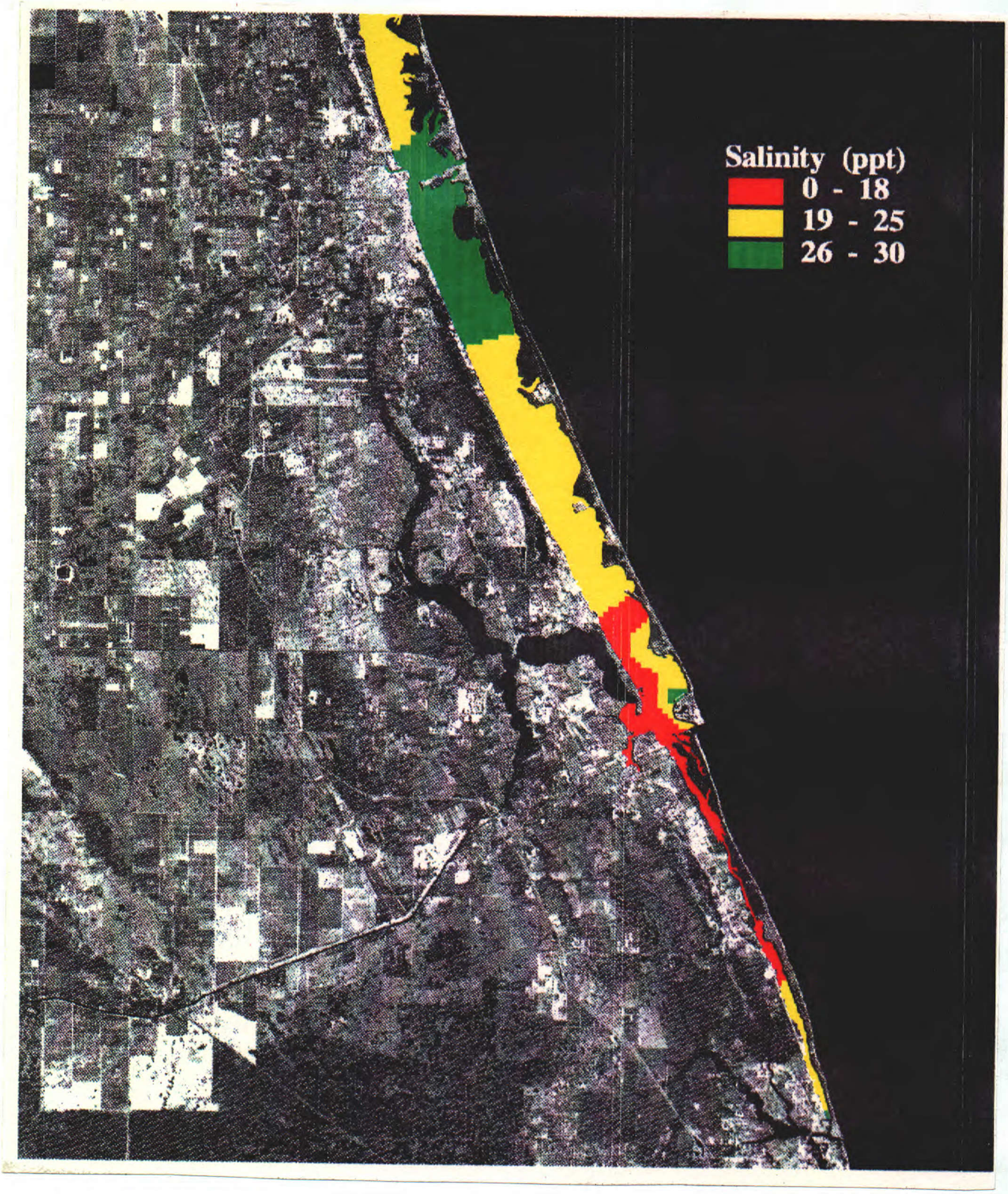


Figure 44. Salinity Distribution in the Indian River Lagoon (Jan. 9, 1995).

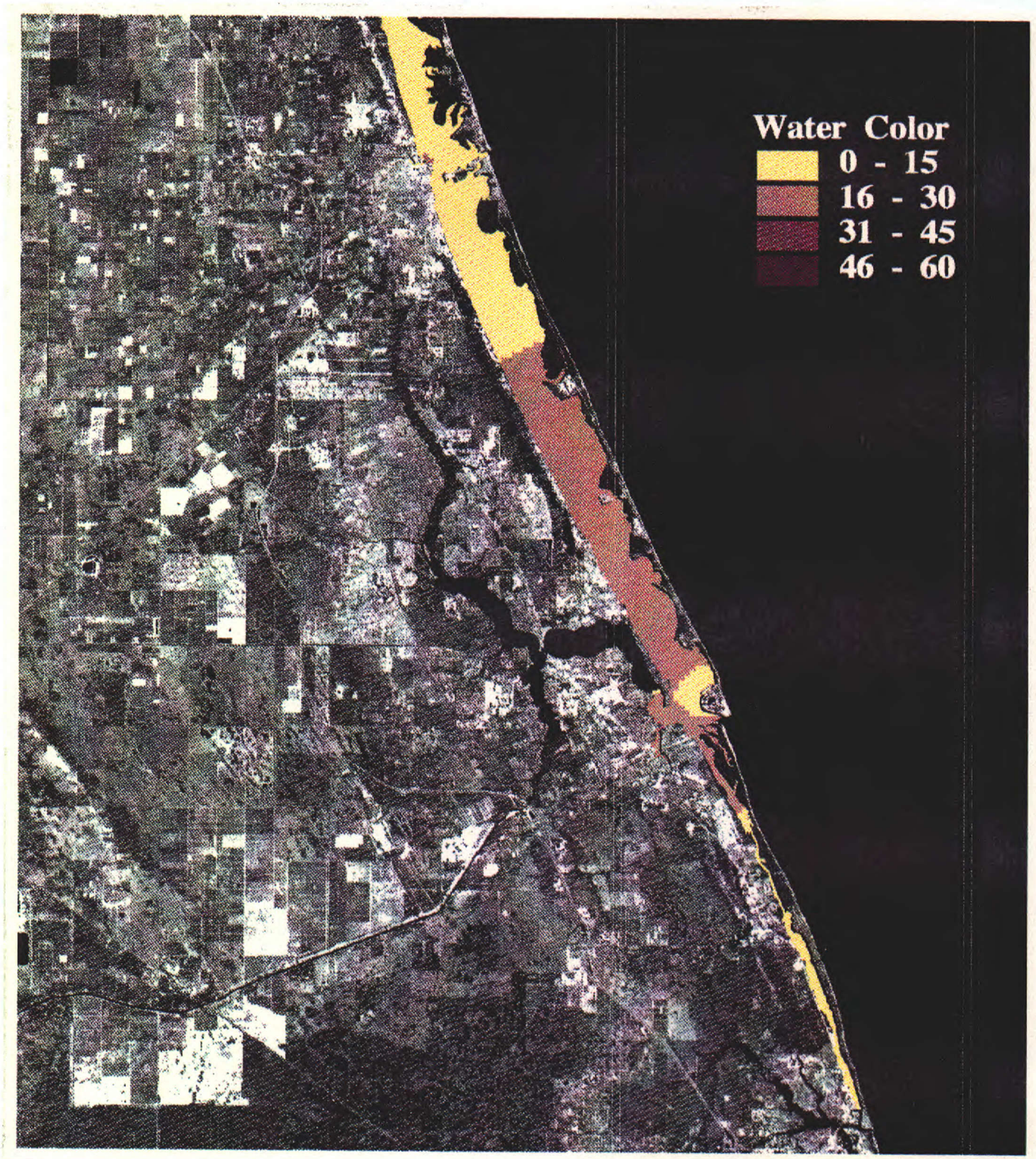


Figure 45. Water Color in the Indian River Lagoon (July 12, 1994).

Figure 46. Water Color in the Indian River Lagoon (Oct. 10, 1994).

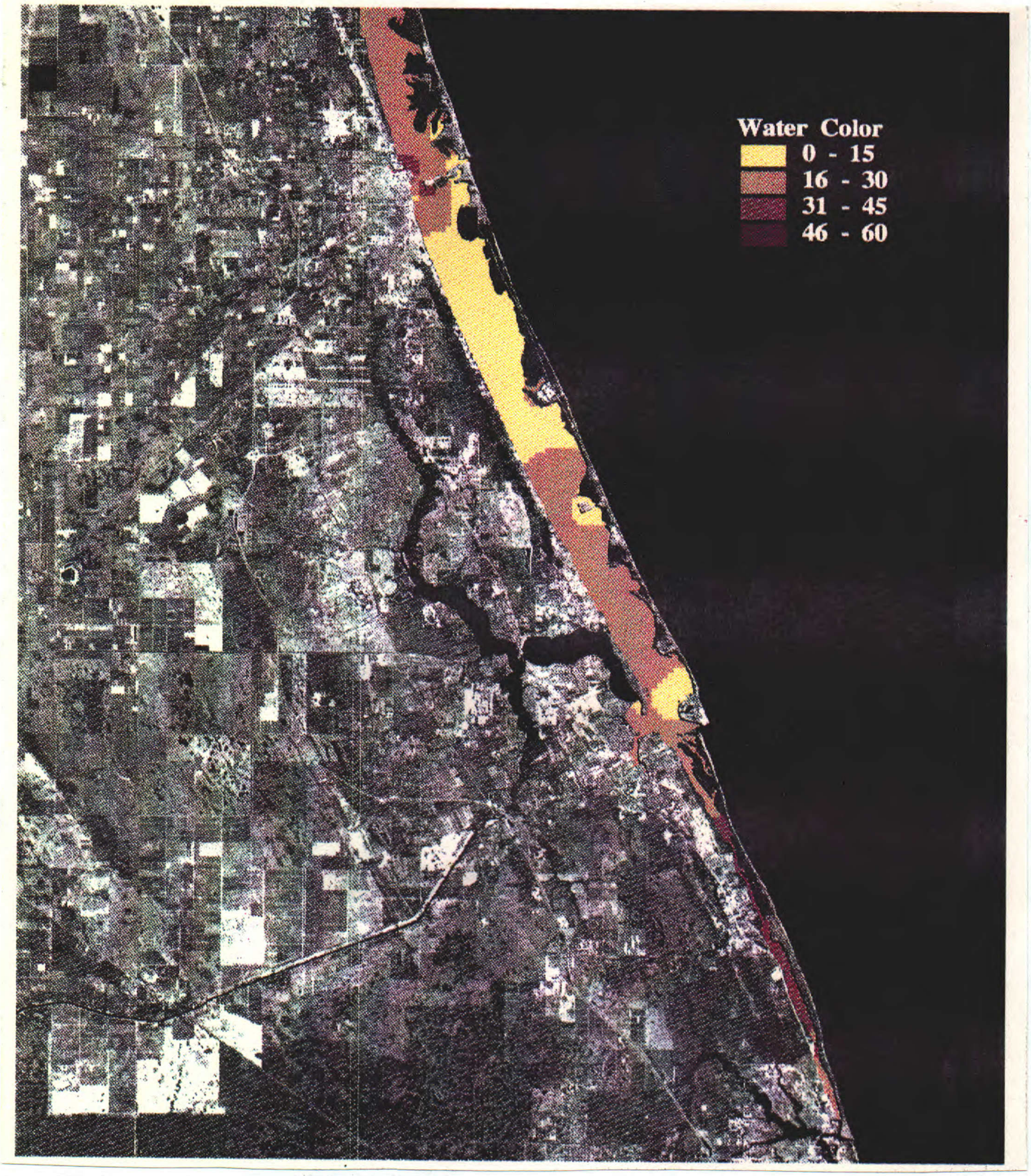


Figure 47. Water Color in the Indian River Lagoon (Jan. 9, 1995).

CONDITIONS IN FLORIDA BAY DURING THE 1994 WET SEASON

Summary

The 1994 wet season in Florida Bay had two dramatically different portions. May through July was a time of relatively low rainfall and low surface water flow rates into the wetlands north of Florida Bay. The District is currently unable to directly measure the quantity of freshwater runoff into the Bay (such measurements are an important component of future research), but it is likely that the amount of freshwater reaching the Bay from Taylor Slough and C-111 gaps was far less than the 22,000 acre feet that flowed past Taylor River Bridge and S18c from May through July. Coincident with low freshwater inputs, salinity in Florida Bay increased during the early wet season such that by August, salinity was unusually high throughout the Bay; values were near levels that occurred following the 1989-1990 drought.

In contrast, the second portion of the 1994 wet season, August through October, plus November and December, was a time of high rainfall and surface water flow. Almost 200,000 acre feet of freshwater flowed into the wetlands north of the Bay. Consequently, salinity decreased dramatically in the Bay, initially decreasing along the northern coast and by December decreasing through most the Bay, with salinities below 30 ppt. In addition to runoff from the Everglades, water was discharged from C-111 through S-197 into Manatee Bay on three occasions in September, October, and November. Total discharge was about 30,000 acre feet, but this discharge was spread out over time such that salinity in Manatee Bay decreased far less than in June 1992, when a similar total discharge from S-197 occurred.

The biological effects of drastically changing freshwater inputs to Florida Bay and salinity in the Bay during a single wet season are not known at this time. Preliminary visual observations in northeastern Florida Bay and Manatee Bay indicate that no obvious detrimental effects occurred; no mass mortality of plants, invertebrates or fish was observed. More subtle effects may have occurred and future data on plant abundance and biomass may reveal such effects.

Rainfall

Rainfall patterns near Florida Bay during the 1994 wet season were similar to the general patterns in south Florida that have been described in earlier sections. Rainfall at one site, S18c, is presented in Figure 48 to illustrate two points regarding freshwater sources near Florida Bay. First, the first half of the 1994 wet season (May through July) was the driest of the past four years, with rain quantities similar to that of the drought years of 1989 and 1990. During this period, July 1994 was exceptionally dry, particularly within Florida Bay. Rainfall during the wet season is usually lower over the Bay than over the Everglades, and Joe Bay (in northeastern Florida Bay) had only 0.74 inches of rain in July.

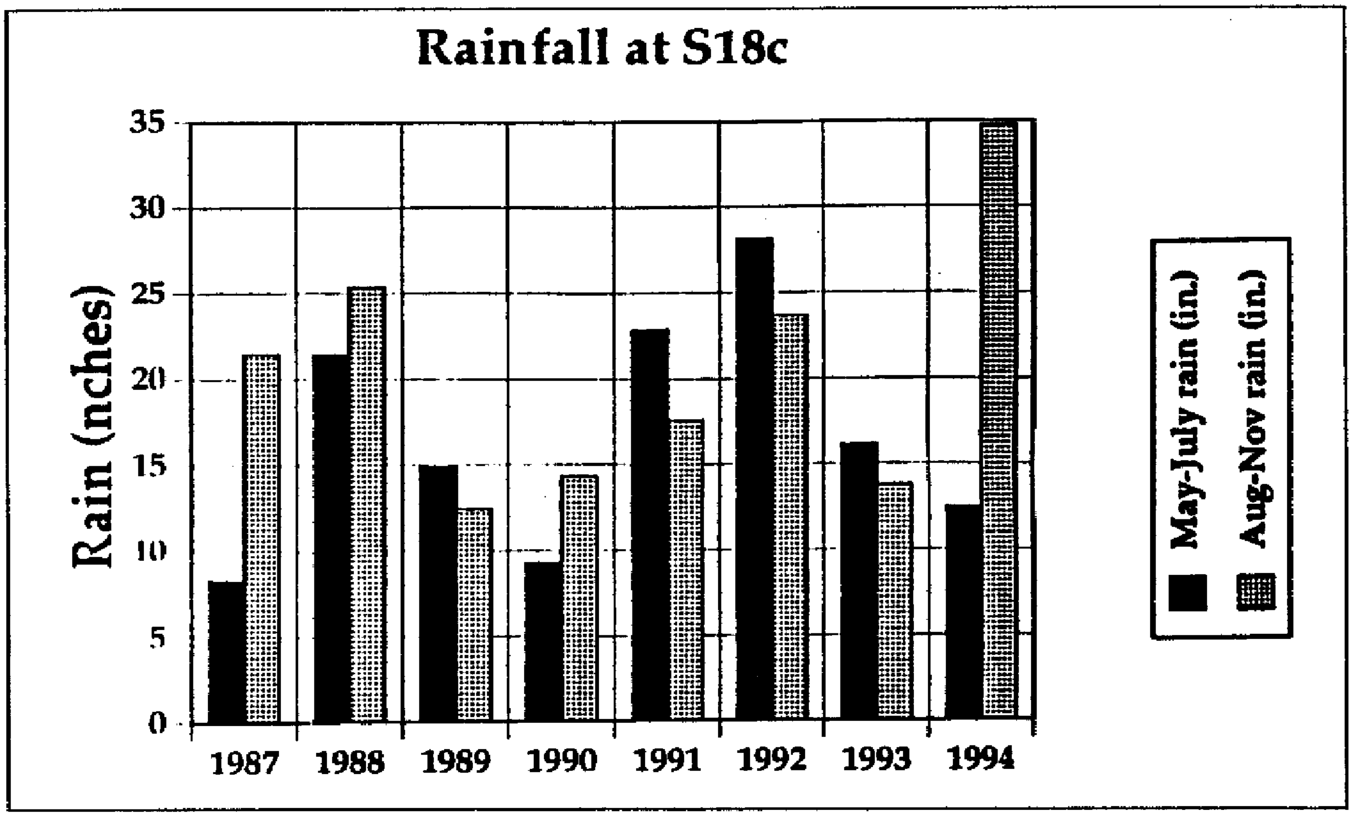


Figure 48. Rainfall at S18c (1987-1994).

The second point illustrated in Figure 48 is that the second half of the wet season (August through October) plus November was dramatically wetter than the first half of the wet season, with rain quantities greatly exceeding values found in recent years. Thus, more fresh water thatpotentially mixed into Florida Bay during the late 1994 wet season than during previous years (particularly since 1991, when a water quality monitoring network was established in the Bay).

Fresh Water Discharge

Freshwater discharge to the southern Everglades followed the same temporal pattern as rainfall, with the occurrence of low flows during the early wet season and extremely high flows during the late wet season and November and December (Figure 49). The values given in Figure 49 are derived from flow estimates at Taylor Slough Bridge, S18c, and S197. The values given for flow southward through the C-111 gaps are estimated as the difference between S18c flows and S197 flows. Also note that flows presented in this figure are not equivalent to flows into the Bay. Water can be lost from the Taylor Slough and ENP panhandle wetlands (south of the C-111 gaps) via evaporation or downward seepage into ground water and water can be gained in this region via local rainfall and upward ground water seepage. Thus, an unknown proportion of the water flowing past the Taylor Slough Bridge and the C-111 gaps actually flows into Florida Bay.

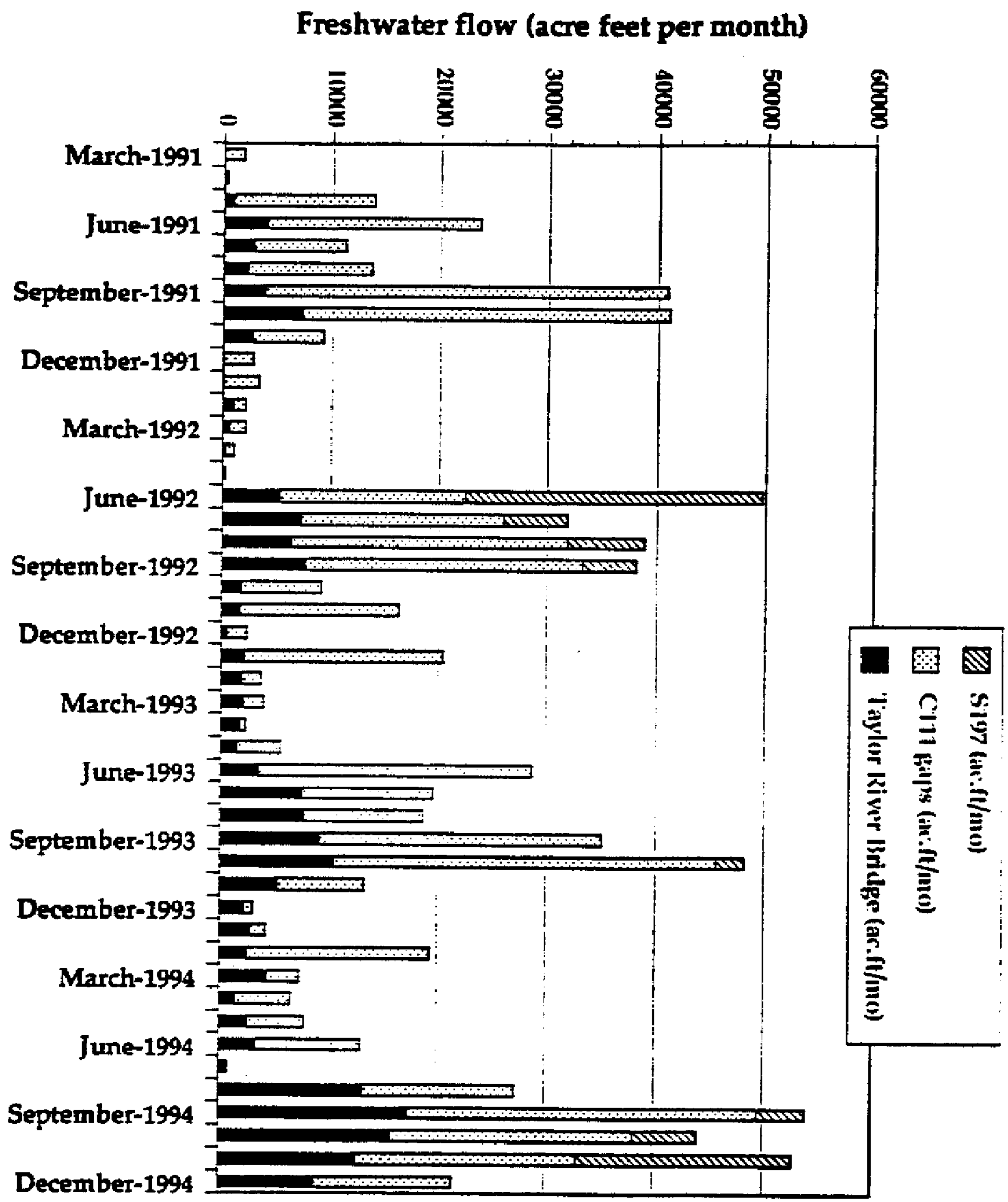


Figure 49. Freshwater flow to the southern Everglades.

Flow quantities were quite low during June and July, compared to the past three years. Almost no water flowed during July. Total flow during the early 1994 wet season was about 22,000 acre feet through S18c plus Taylor Slough Bridge. As has been common since the construction of the C-111 canal, flows toward Florida Bay via the C-111 basin exceeded flows entering Taylor Slough. After July, this pattern changed, with very high flow rates, totalling 199,000 acre feet through S18c plus Taylor Slough Bridge from August through December. In addition to increased water quantity, the distribution of flow during this wet period changed, with relatively more water flowing into Taylor Slough than during similarly wet months of 1991-1993. This change in distribution is probably the result of the timing of rainfall and water management operations.

In addition to discharges that flow towards Florida Bay and the Long Sound to Blackwater Sound corridor, water was discharged into Manatee Bay through S-197 culverts on three occasions in September, October, and November 1994 (Figures 50 and 51). While the total of these discharges was similar to discharges that occurred in June 1992 (about 30,000 acre feet), 1994 discharges were spread out over a longer period of time than in 1992. Both of these discharges were far less than the 72,000 acre feet that was discharged from S197 in August 1988.

Salinity

Manatee Bay Salinity

Because the S197 freshwater discharges into Manatee Bay were more gradual during the Fall of 1994 than during June 1992, the former discharges had more time to mix with seawater from Biscayne Bay and Barnes Sound. This resulted in less of a "freshening" of Manatee Bay water in 1994 than in 1992 (Figures 52 to 56). In June 1992, salinity throughout Manatee Bay was below 5 ppt (Figure 56). In contrast, Manatee Bay salinity during September and October 1994 remained above 10 ppt with the exception of stations next to the C-111 mouth (Figures 52 and 53). Following Tropical Storm Gordon, salinity in most of Manatee Bay ranged from 8 ppt to 15 ppt.

Long Sound Salinity

Salinity in the Long Sound and Little Blackwater Sound is also shown in Figures 52 to 56. Freshwater inputs to these bays predominantly comes from the C-111 gaps via many small creeks that flow toward the northern coast of Long Sound. During the early half of the 1994 wet season, which was relatively dry, salinity in Long Sound ranged from 20 ppt in May to 26 ppt in early August (Figure 57). This August salinity was high compared to August salinities of the previous three years. With the subsequent heavy rains of the second half of the 1994 wet season, Long Sound salinity dropped to about 5 ppt in September and near 1 ppt in October (Figures 52, 53, and 57). Extremely low salinity values occurred in Long Sound because water exchange between Long Sound and Biscayne Bay and between Long Sound and Florida Bay is restricted by land.

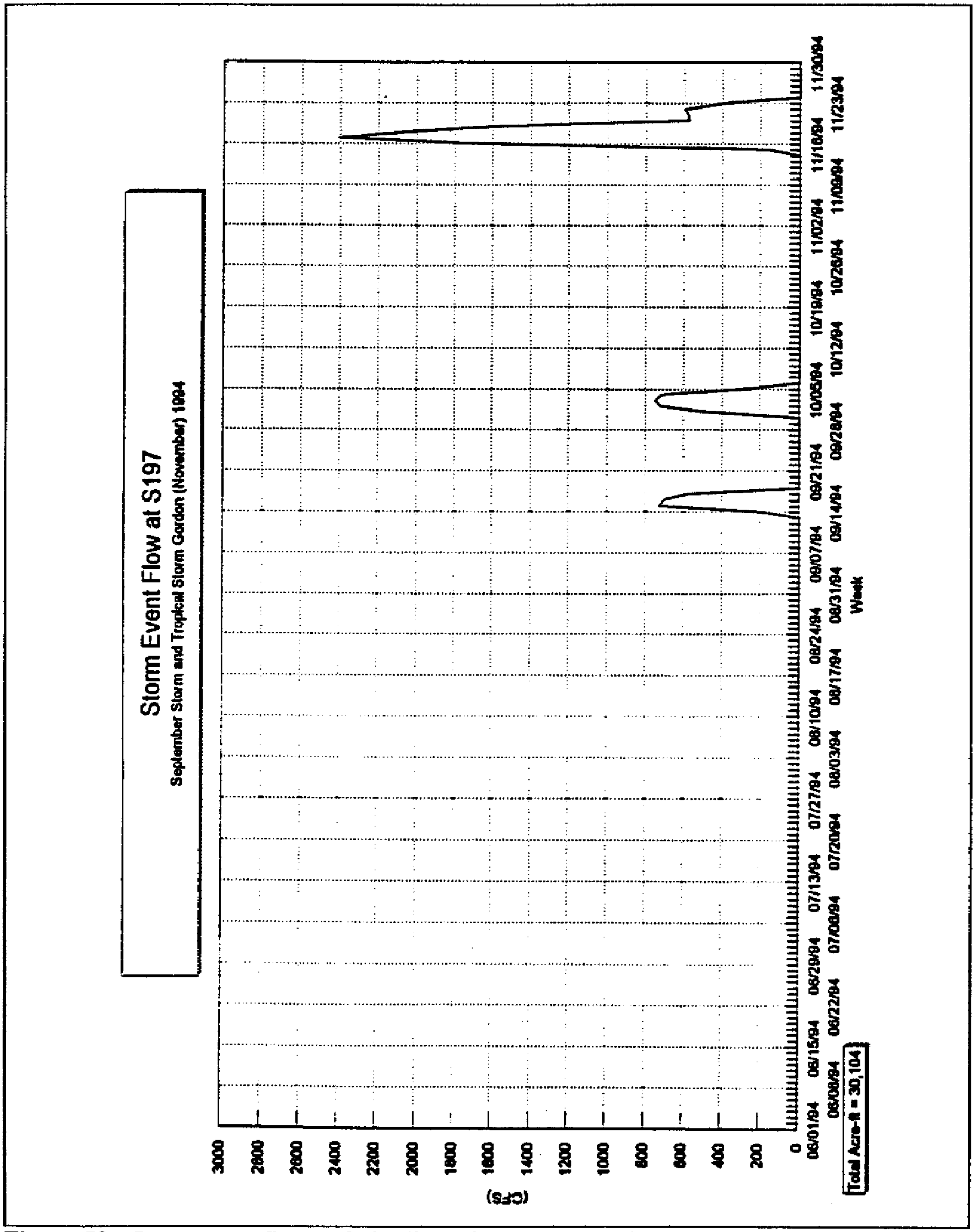


Figure 50. Storm event flow at S197 (Sept. Storm and Tropical Storm Gordon).

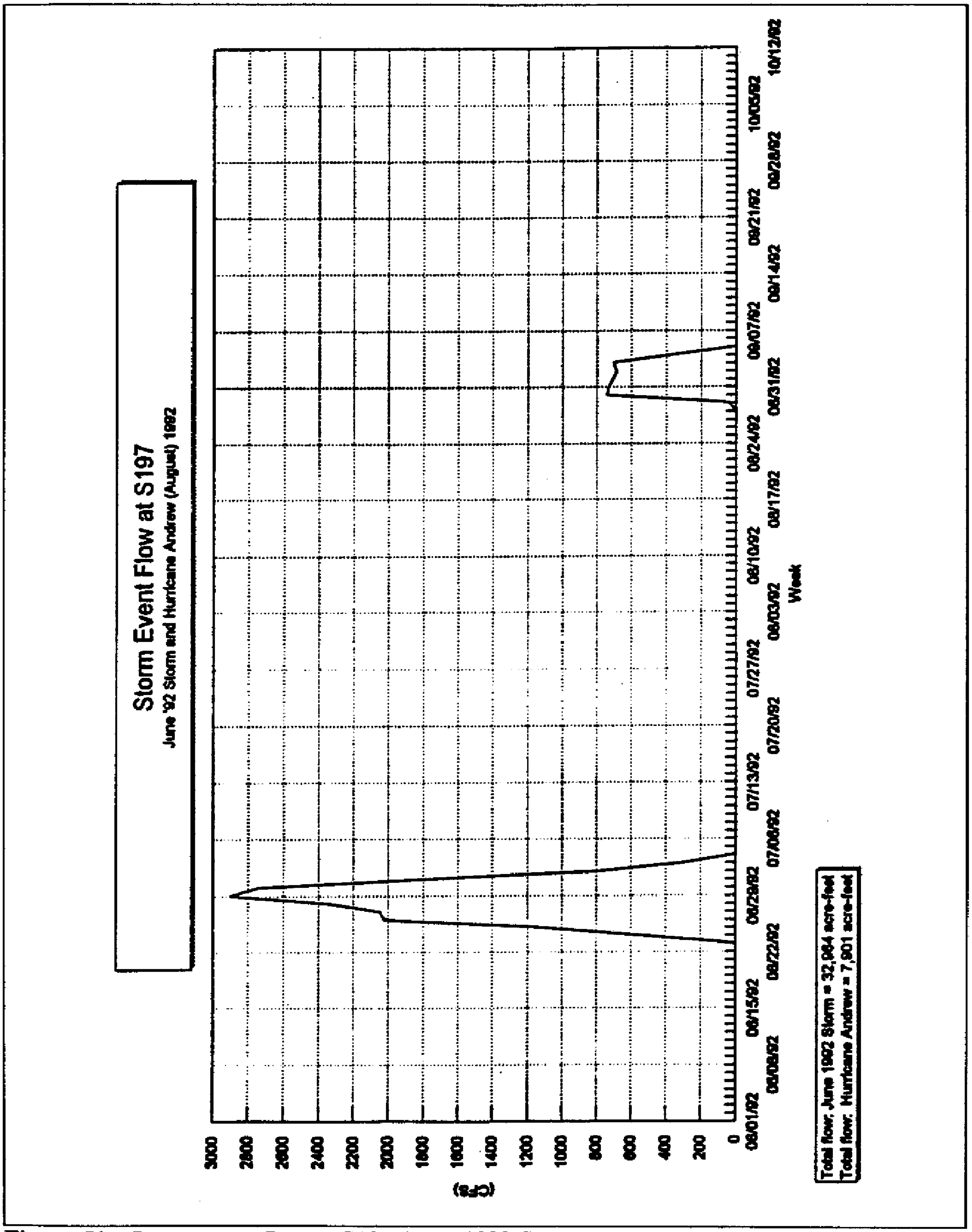


Figure 51. Storm event flow at S197 (June 1992 Storm and Hurricane Andrew, Aug. 1992).

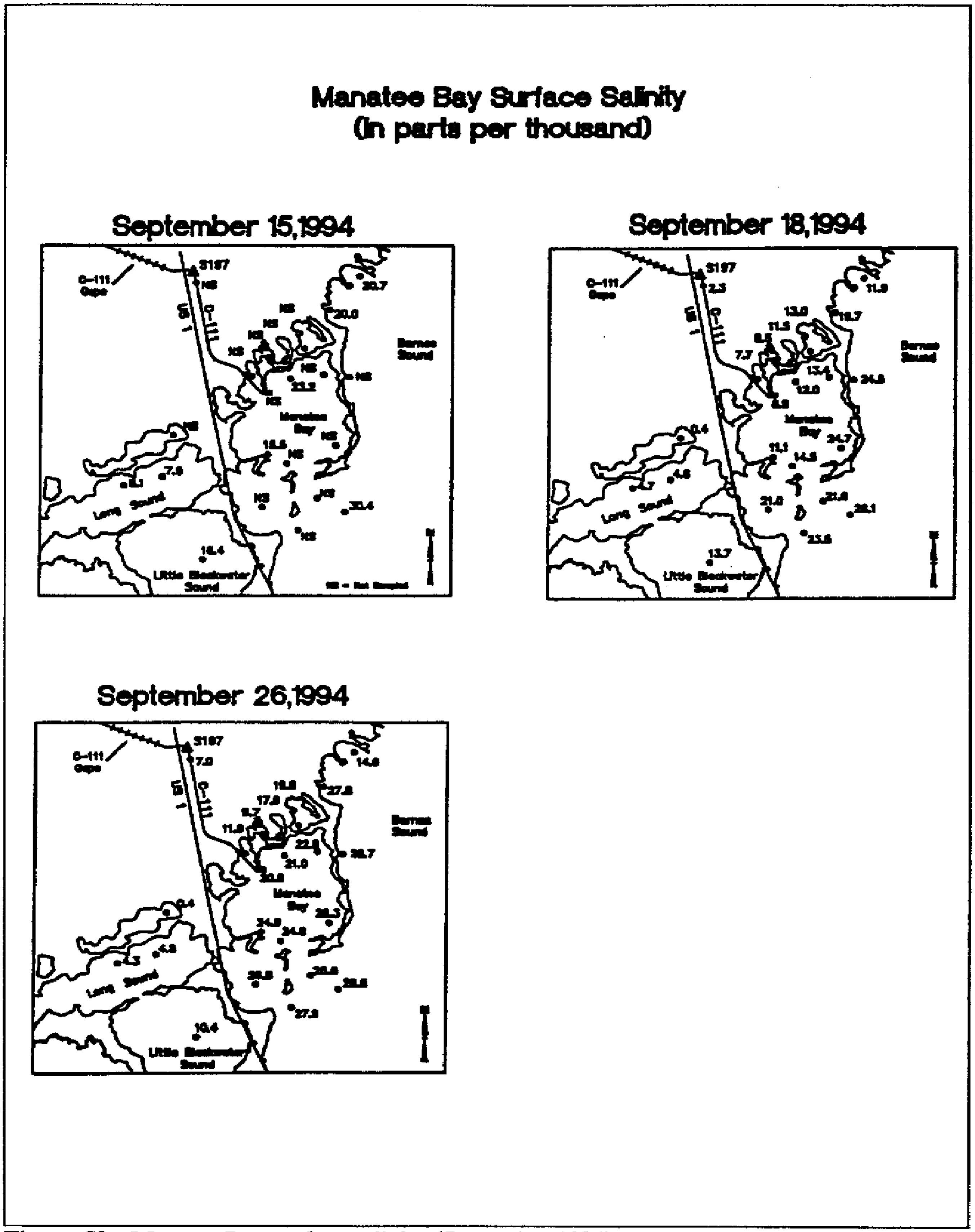


Figure 52. Manatee Bay surface salinity (September 1994).

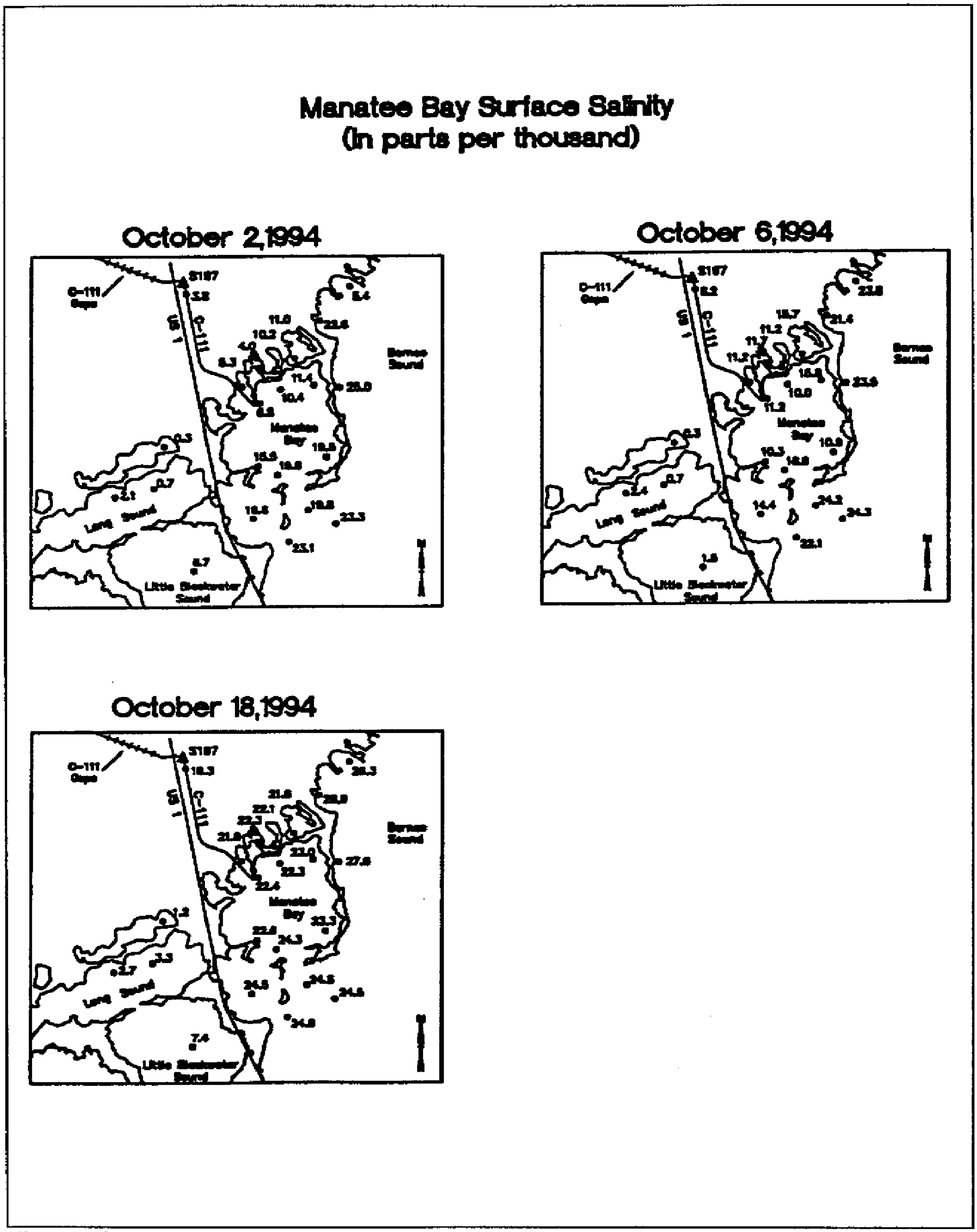


Figure 53. Manatee Bay surface salinity (October 1994).

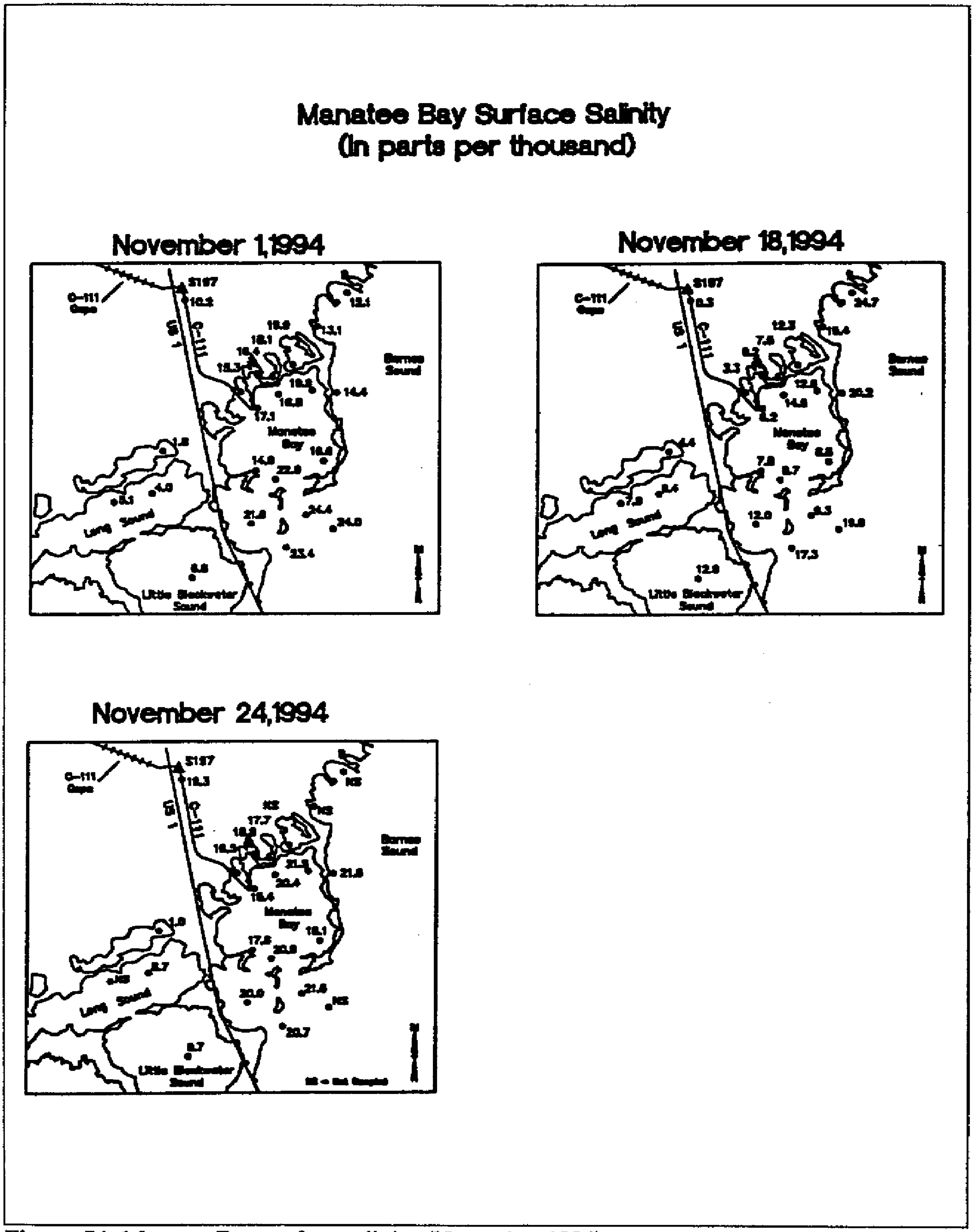


Figure 54. Manatee Bay surface salinity (November 1994).

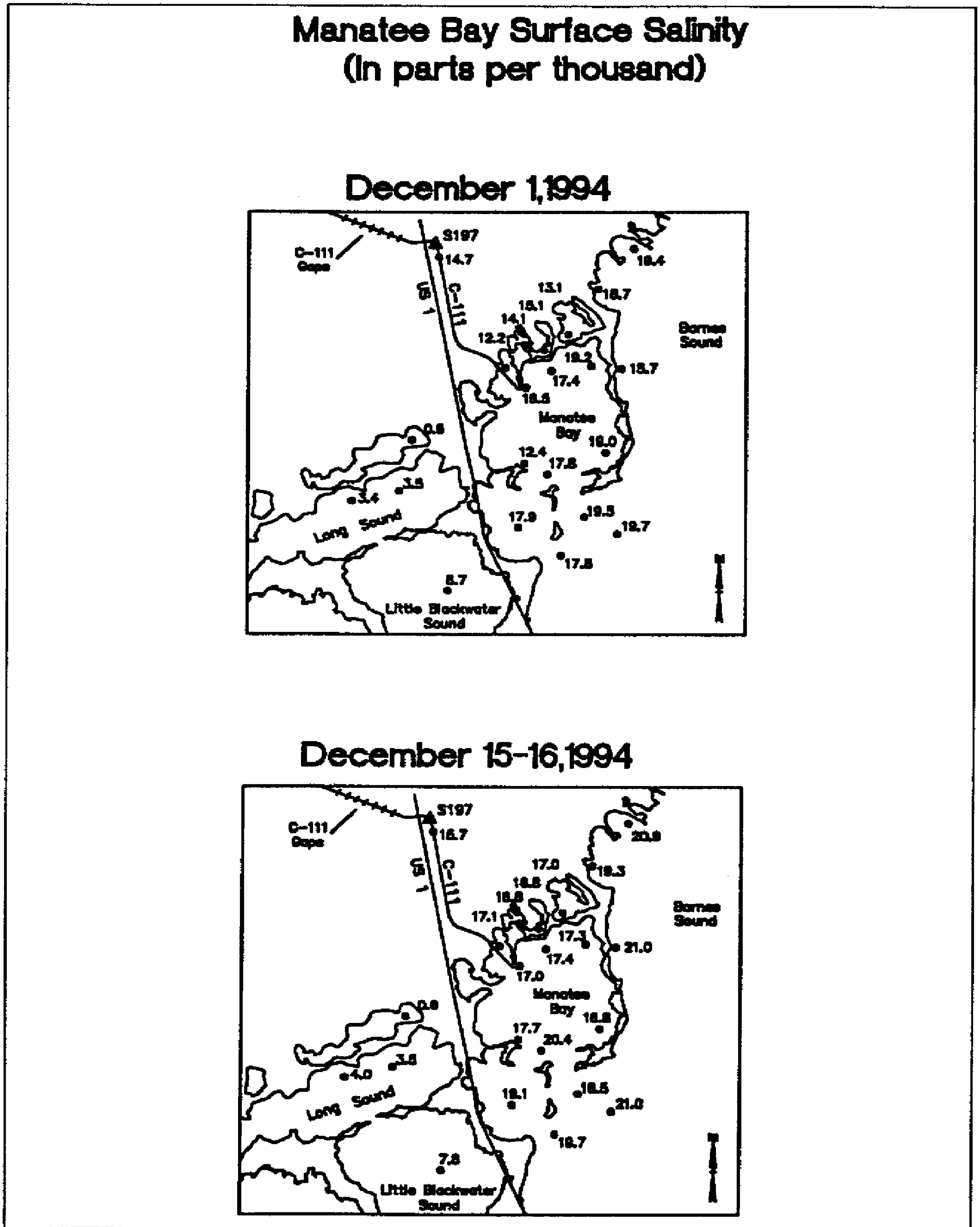


Figure 55. Manatee Bay surface salinity (December 1994).

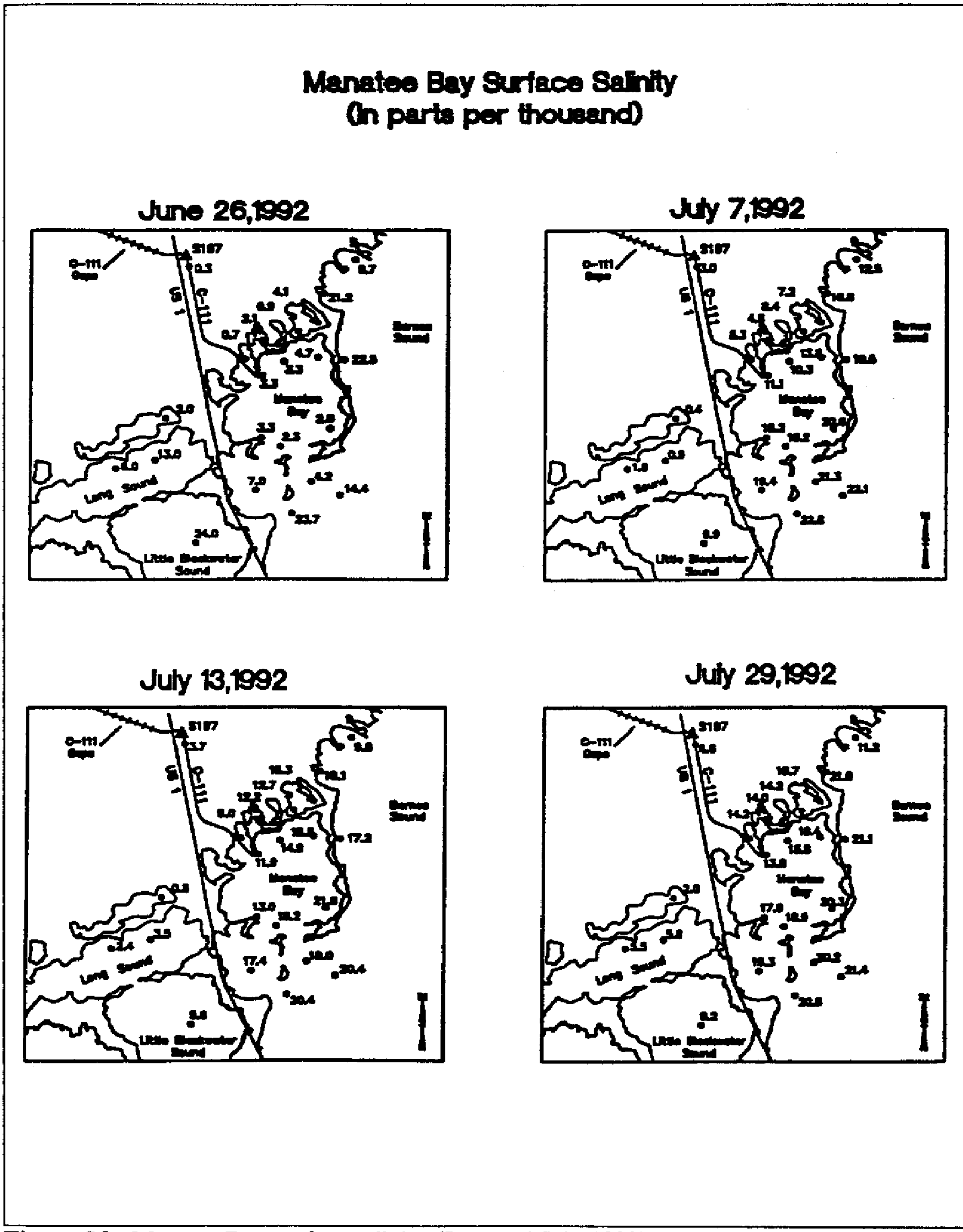


Figure 56. Manatee Bay surface salinity (June and July 1992).

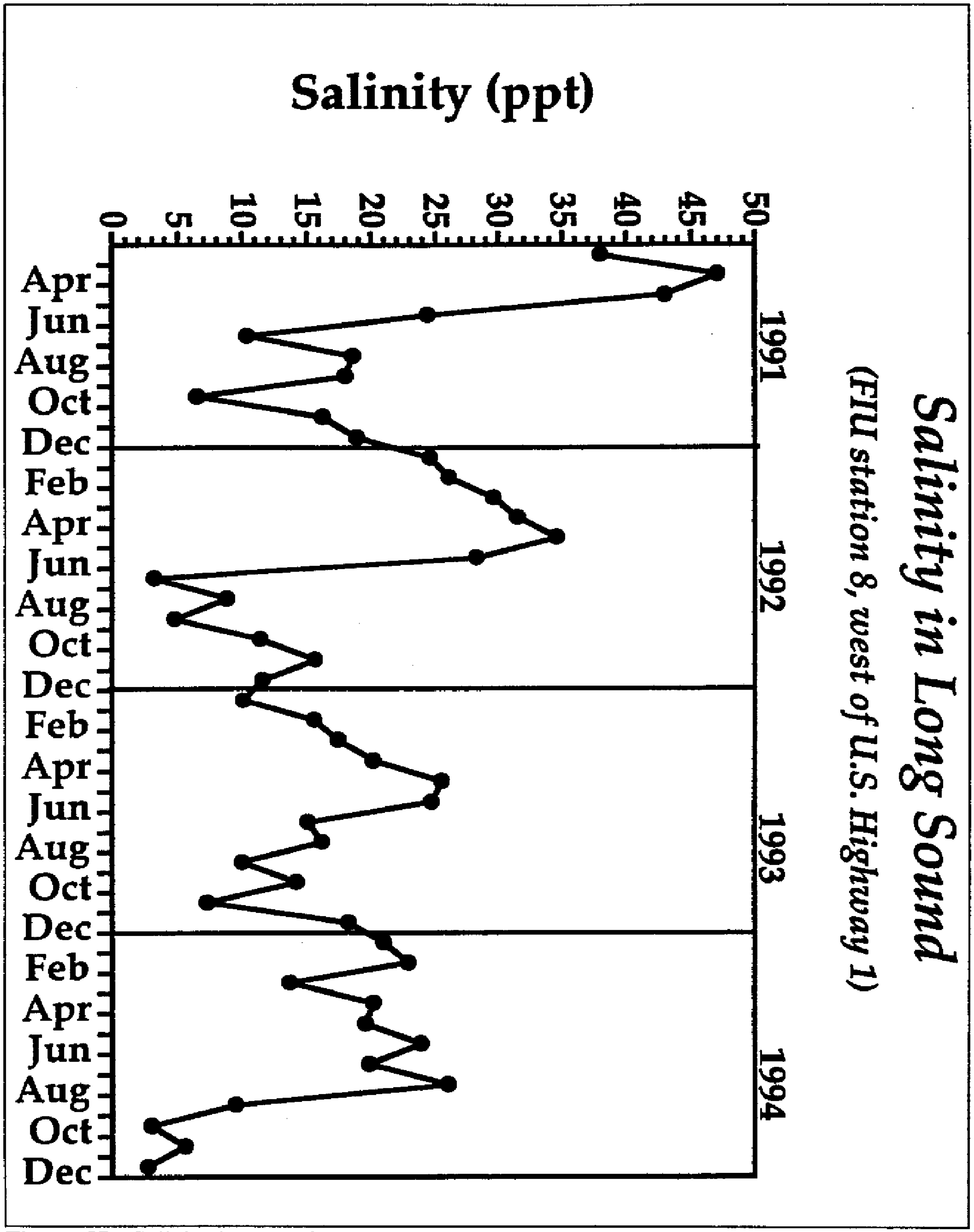


Figure 57. Salinity in Long Sound.

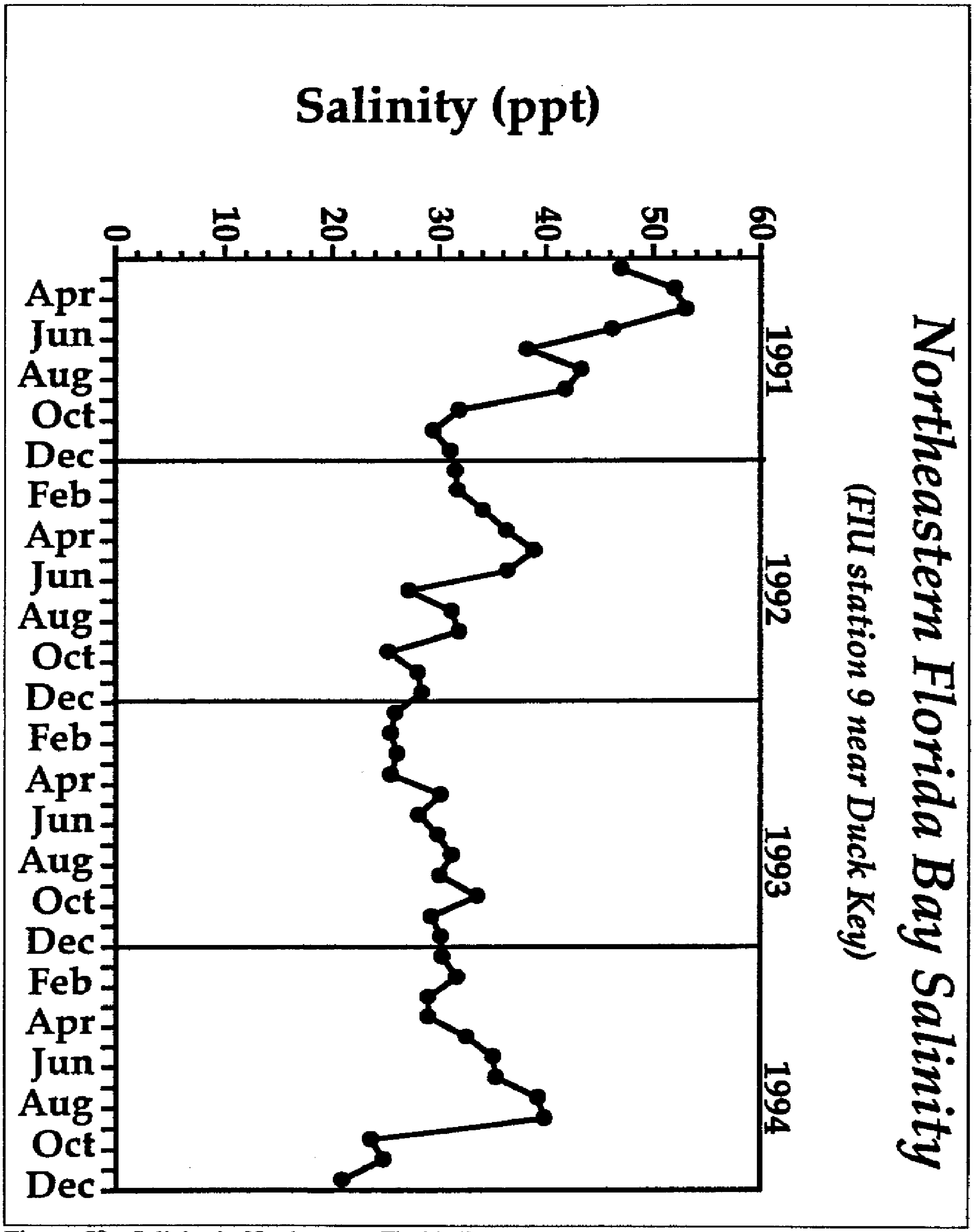


Figure 58. Salinity in Northeastern Florida Bay.

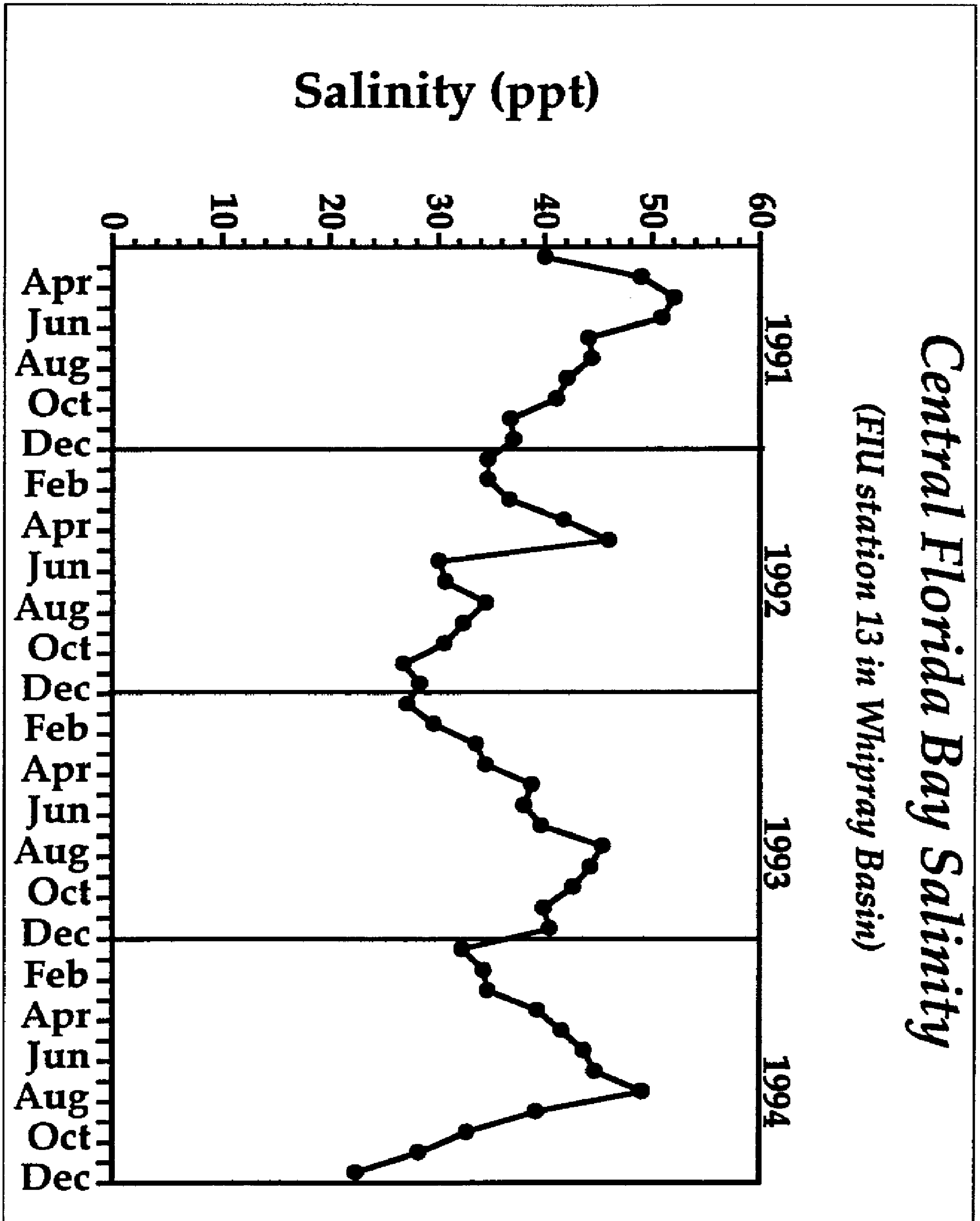


Figure 59. Salinity in Central Florida Bay.

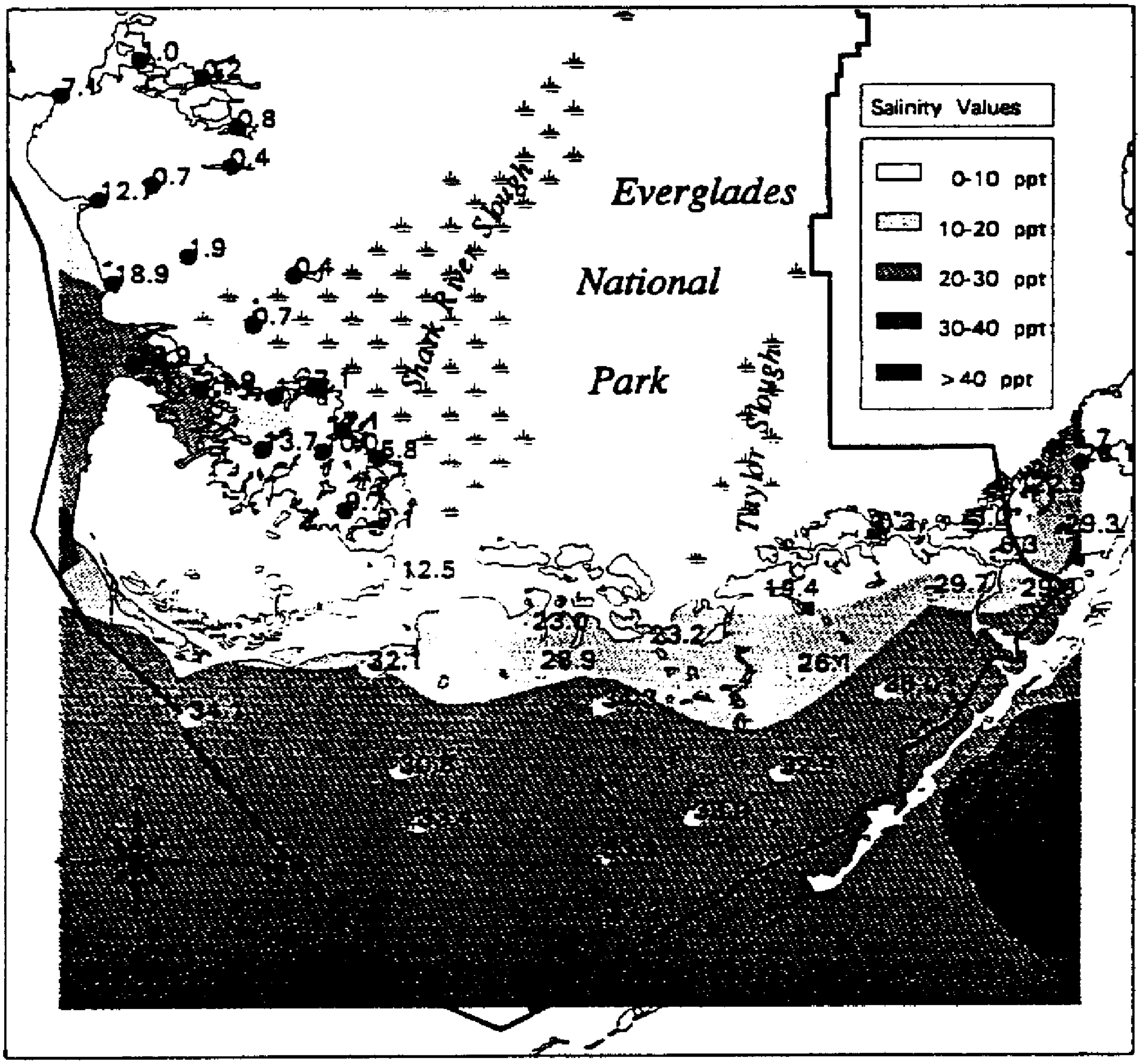


Figure 60. Florida Bay salinity values for October 1994.

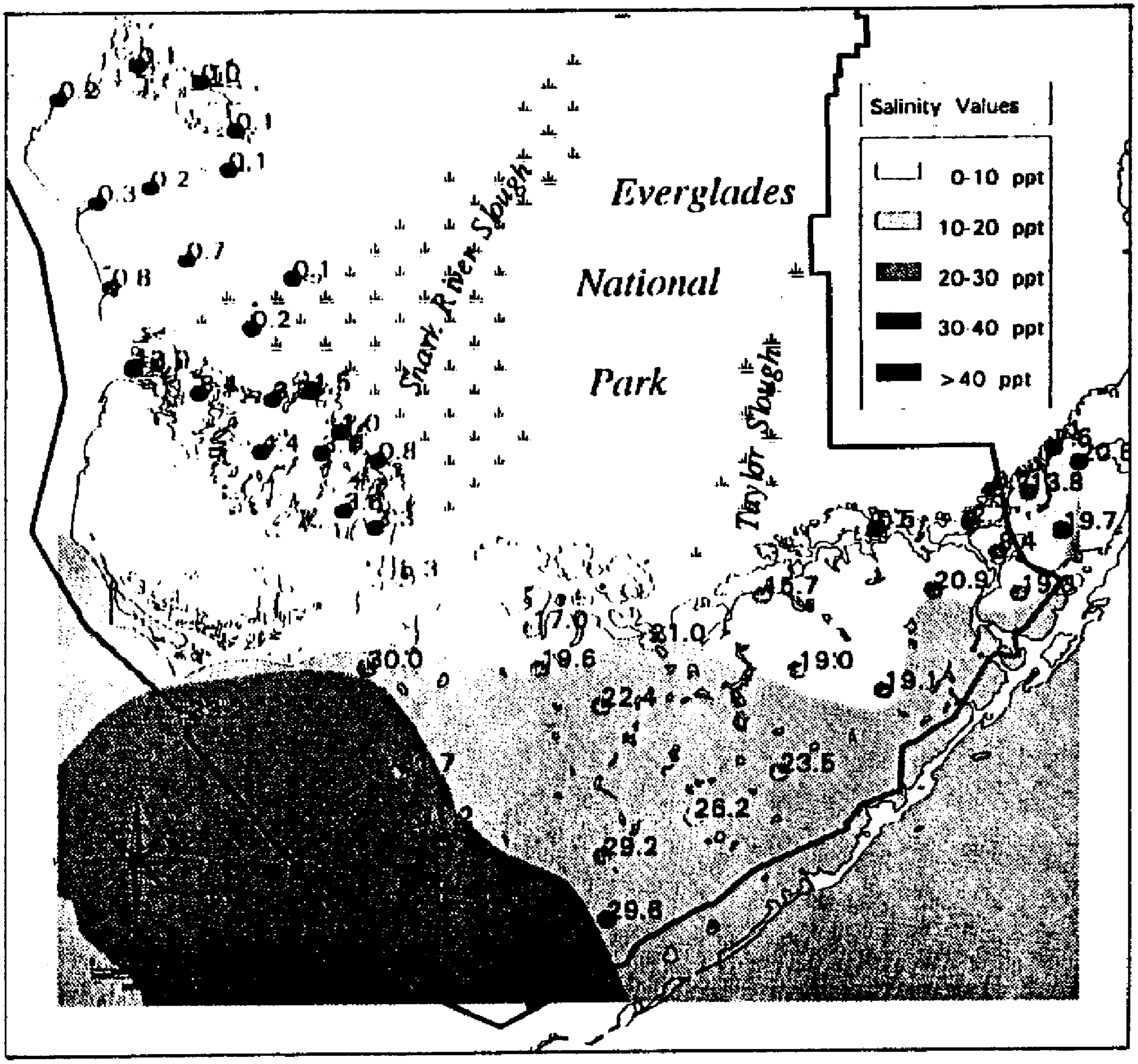


Figure 61. Florida Bay salinity values for December 1994.

Florida Bay Salinity

Changing patterns of salinity in Florida Bay reflected the large increase in rainfall and freshwater runoff that occurred between the first and second half of the 1994 wet season (Figures 48 and 49). At the beginning of the wet season (May 1994), almost all of the Bay's water had salinity values between 30 ppt and 40 ppt. This is similar to the salinity of seawater entering the Bay from the Gulf of Mexico or the Florida Straits, which both have salinities near 35 ppt. Thus, once this seawater entered the Bay, loss of freshwater via evaporation was generally balanced by freshwater inputs via rain and runoff. Only in the restricted bays, such as Long Sound and Joe Bay, were salinities below this range.

Time series of salinity at two stations that are representative of northeastern and central Florida Bay waters are presented in Figures 58 and 59. Early in the 1994 wet season, salinity in the northeastern Bay (Figure 58) increased from about 32 ppt to nearly 40 ppt in August. This exceeded recent August salinities at this station, except in 1991, when salinities were elevated because of the 1989-1990 drought. With increased freshwater inputs after early August 1994, salinity rapidly dropped to near 20 ppt. Based on a compilation of historical values by Dr. M. Robblee, 20 ppt equals the minimum values recorded in the northeastern Bay since occasional measurements began in the late 1950s (only after Hurricane Donna in 1960 was salinity lower, with 15 ppt).

A similar time series pattern occurred in central Florida Bay (Figure 59), with salinities rising through the early wet season and then rapidly falling in September. While August salinity was nearly 50 ppt, by December salinity was about 23 ppt. This value is near the minimum value recorded in central Florida Bay since the 1950s (personal communication, M. Robblee).

The geographic pattern of salinity change that occurred during the late wet season and the influence of freshwater runoff from the Everglades and C-111 basin is clearly seen in Figures 60 and 61. In October, the northeast margin of Florida Bay near C-111 and Taylor Slough had salinities less than 20 ppt, and the northern edge of the Bay had salinities below 30 ppt. The main body of Bay waters, however, had salinity values that were near that of seawater (35 ppt). In contrast, by December, following Tropical Storm Gordon, the main body of Bay waters had salinity values below 30 ppt.

Water Quality

An assessment of changes in water quality in Florida Bay, the Long Sound - Blackwater Sound corridor, Manatee Bay and Barnes Sound is not possible at this time because analysis of autumn samples by Florida International University (FIU) is not complete at this time. However, preliminary data on dissolved oxygen (DO) concentrations are currently available and indicate that severe problems oxygen depletion during the 1994 wet season did not at the 28 Florida Bay stations that are monitored monthly by FIU. The lowest value measured was 3.5 mg O_2/L in bottom waters of Long Sound in November. This is 46 percent of the saturation DO concentration and is unlikely to have been lethal of plants, invertebrates, or fish. Throughout most of the Bay, DO remained near saturation.

Biological Effects

Changing freshwater input to Florida Bay is most likely to affect biota in the Bay via two mechanisms. First, salinity changes caused by changing freshwater inputs directly affect the physiological state of all organisms. Second, nutrient availability may be altered by nutrient inputs associated with freshwater runoff and salinity changes may secondarily cause changes in the biogeochemical cycling of nutrients.

The direct effect of salinity change and magnitude upon the growth, reproduction, and mortality of organisms is highly variable among individuals and species. At this time, no evidence is available that indicates a strong negative effect of the salinity decrease that occurred during the 1994 wet season. This effect would be expected to be most evident in Manatee Bay and other embayments along the northeastern Florida Bay coast that received rapid pulses of freshwater. Monthly visual surveys by the Dade County Department of Environmental Resources Management (DERM) and SFWMD staff during the wet season indicated that submersed macrophytes were not greatly stressed by freshwater inputs in 1994. Unlike June 1992, when seagrasses and macroalge displayed marked pigment changes coincident with S-197 discharges, no pigment changes were noted with discharges in 1994. Furthermore, no widespread mortality of plants, invertebrates of fish was observed. Such mortality was seen following large S-197 discharges in August 1988. Thus, it seems that the detrimental effects of water releases from C-111 have been decreased by construction of S-197 culverts and operational changes since 1988.

CHAPTER 6

WATER QUALITY CONDITIONS

KISSIMMEE RIVER WATER QUALITY STATUS

S65

At the outlet of Lake Kissimmee, S65 is the first major structure along the Upper Kissimmee River controlling flow from the chain of lakes. This is a headwater area of the District. Figure 62A shows monthly historical flow through the structure. The total flow volume in 1994 is the largest in recent years. Using total phosphorus (TP) as an indicator, Figure 62B depicts the material carried by the flow. The load is calculated by the flow volume multiplied by the material concentration in that volume. The monthly concentration is a flow weighted concentration, i.e., the value of a total monthly load divided by the flow volume of the month. High material loads in 1994 can be directly attributed to the flow volumes; material concentrations stay about the average.

S65C

The S65C structure is located in the middle section of Kissimmee River valley and collects additional water from surrounding improved pastures. Figure 63A is a plot of historical monthly flow volumes at S65C. Due to a larger drainage area, there are less no-flow periods, making the entire reach of the stream a reliable source of drinking water for cattle. Figure 63B shows the total phosphorus loads and concentrations at S65C. Compared with the upstream structure, the increases in flow, loads and concentrations in 1994 at S65C were proportional to historical records. Most of the water and the material passing through the structure will eventually flow into Lake Okeechobee.

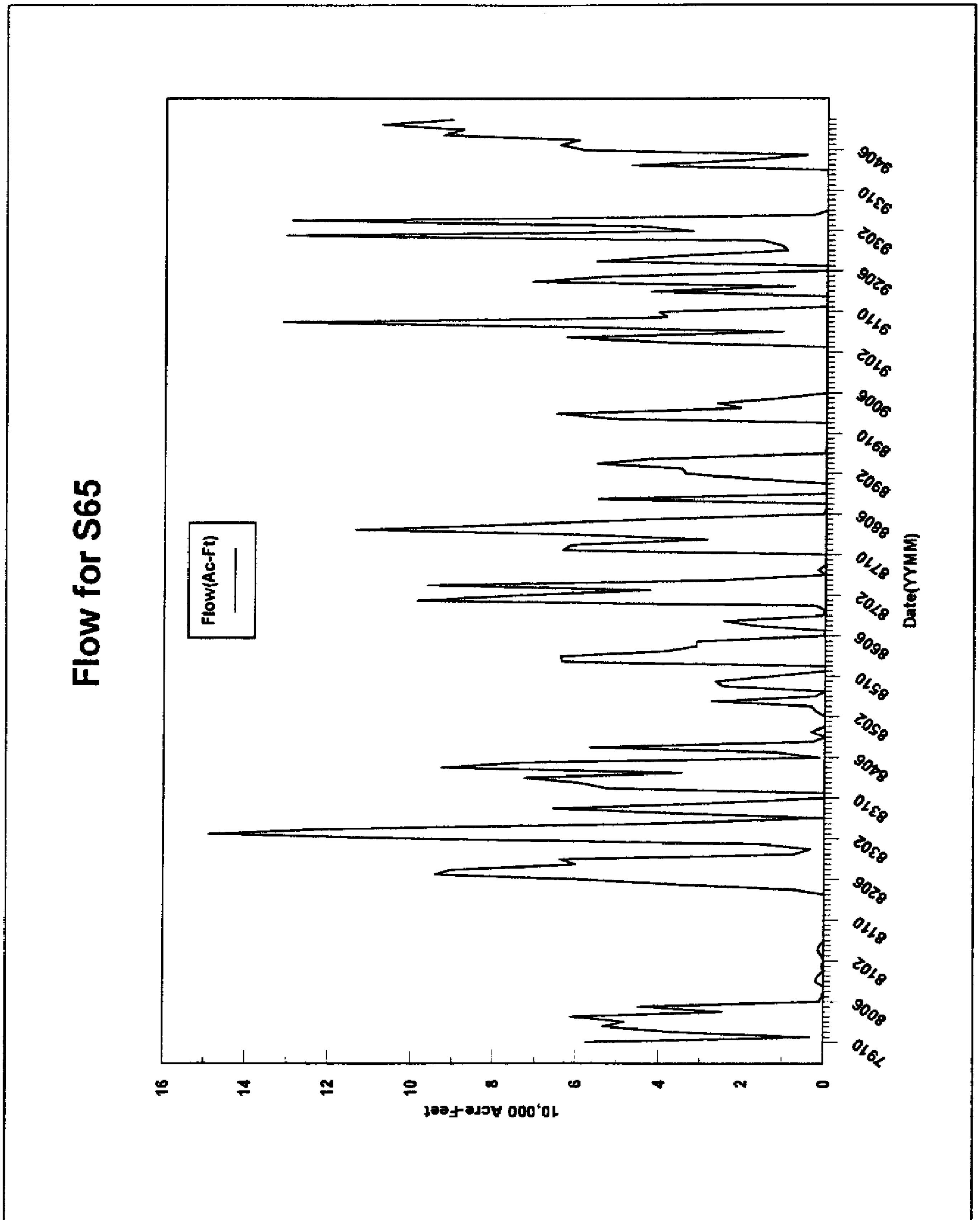


Figure 62A. Flow for S65.

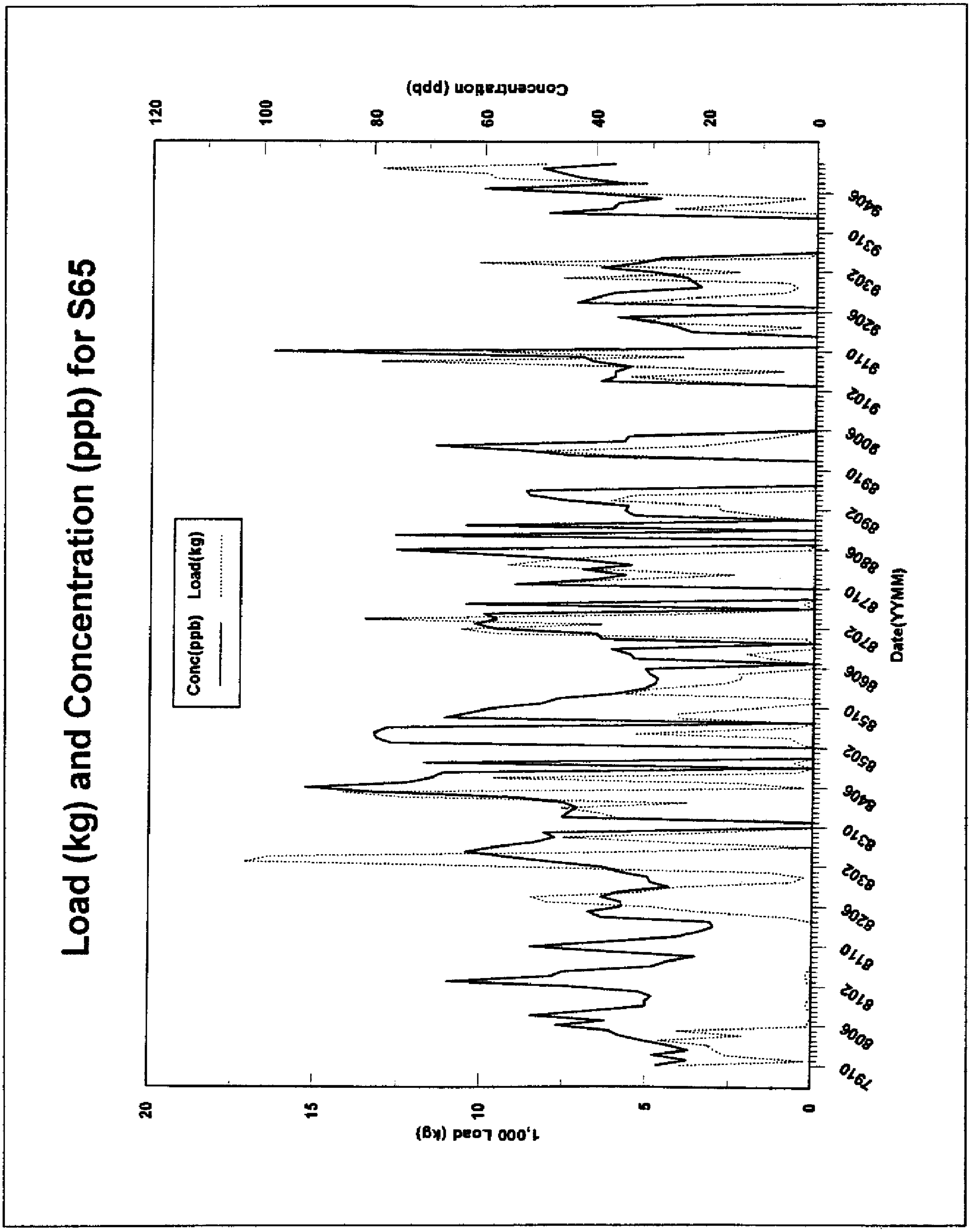


Figure 62B. Historical monthly total phosphorus load and concentration for S65.

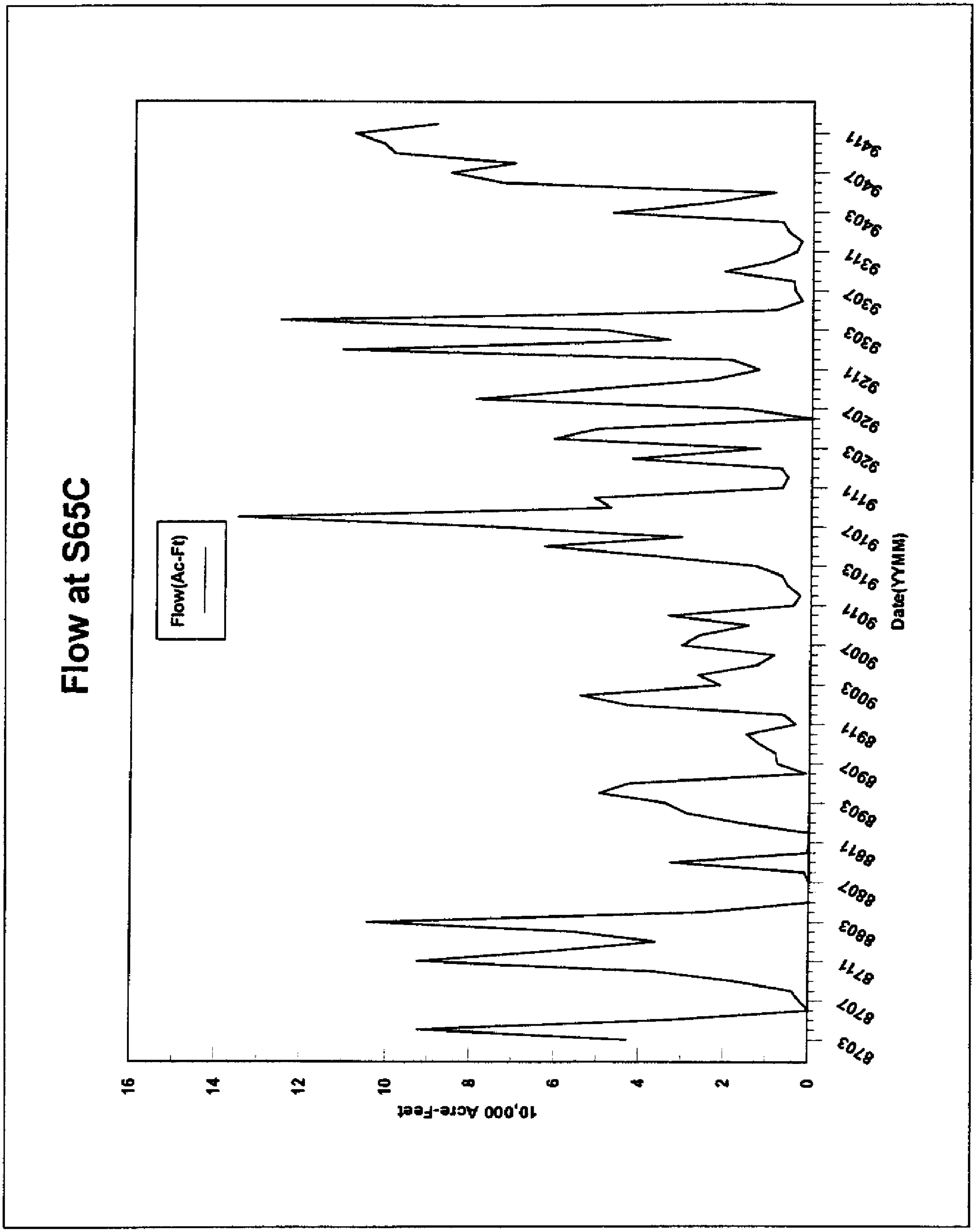


Figure 63A. Historical monthly flow for S65.

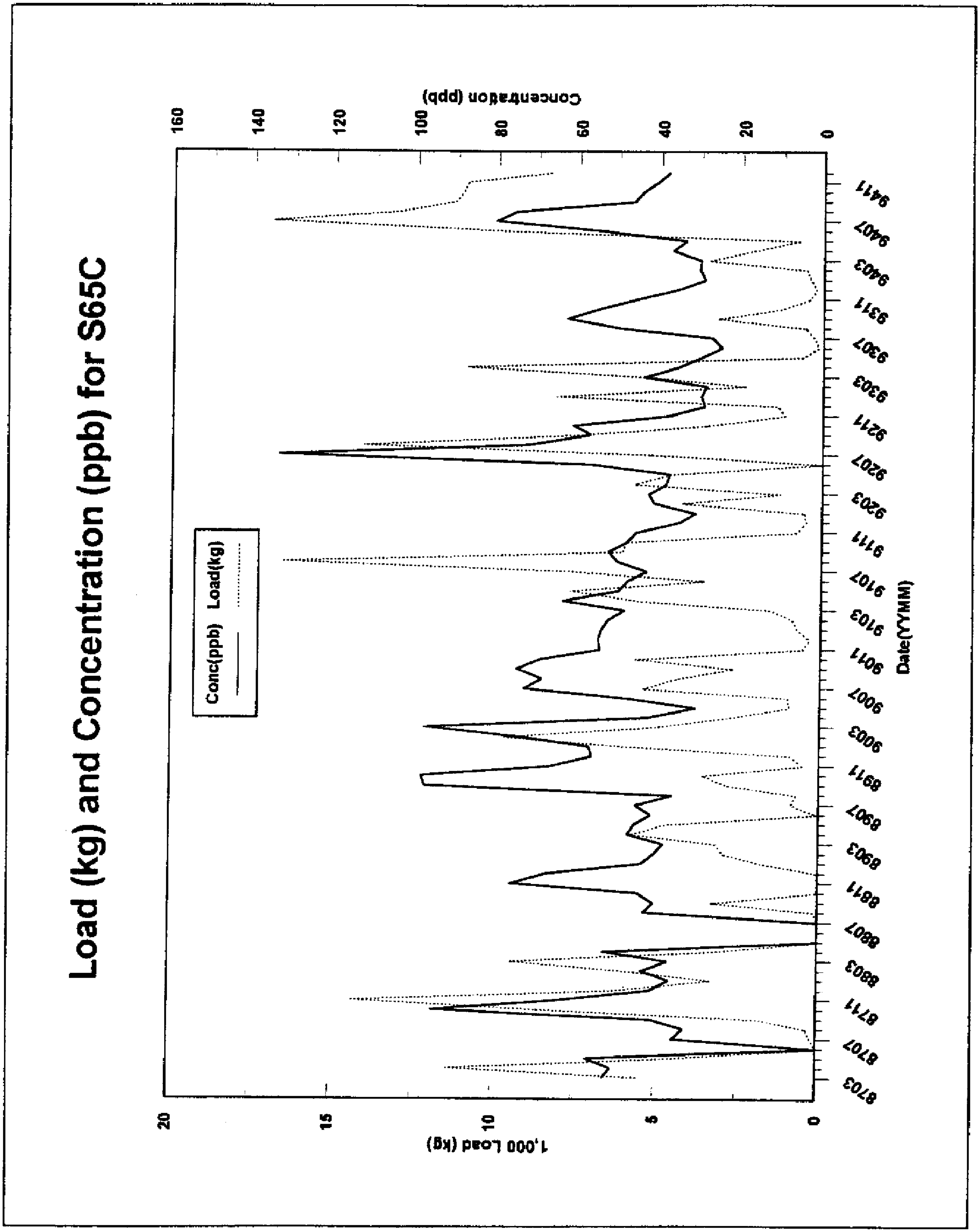


Figure 63B. Flow for S65c.

LAKE OKEECHOBEE WATER QUALITY STATUS

Many figures in this section are routinely reported every three months. The last quarterly report included data up to the end of September 1994. In many cases, provisional data are used to update the data to the end of December 1994.

Loading Trends

The 1987 SWIM Act directed the District to design and implement a program to protect the water quality of Lake Okeechobee. The Act stated that this program "shall be designed to result, by July 1, 1992, in reduction of phosphorus loadings to the lake by the amount specified as excess in the South Florida Water Management District's Technical Publication 81-2."

In Technical Publication 81-2, the amount of excess phosphorus was estimated by a modified version of the Vollenweider (1976) phosphorus loading model. The target loading rate is a function of how much water enters the lake and how long that water resides in the lake. Therefore, the target loads will fluctuate due to hydrologic variability.

To compare Lake Okeechobee's phosphorus loads to the model's target loading rate, the actual and target loads were computed for successive 12-month periods. The difference between the actual and the target loads shown in the graph (Figure 64) for the year ending December 31, 1994 is about 267 tons (1 ton = 2000 pounds). Most of the loads came in after September 1994. At the end of September 1994, TP load into the lake was 20 percent over the target; at the end of December 1994, TP load into the lake was 50 percent above the target.

Performance Standards and Trends

This section charts the progress toward achieving the phosphorus management goals as stated in the Lake Okeechobee SWIM Plan. The Plan sets a target of 0.18 milligrams per liter (mg/L) for inflows that have elevated phosphorus concentrations. Other inflows with lower concentrations are limited to their historical flow-weighted averages.

Figures 65A and 65B display flow-weighted total phosphorus concentrations (TP) for the Lower Kissimmee River (C-38), S-154, Fisheating Creek, and Taylor Creek/Nubbin Slough (S-191) basins. The plots are 12-month moving averages; the last data point of each time series reflects the flow-weighted phosphorus concentration for the year ending December 31, 1994. For the Lower Kissimmee River basin, phosphorus loads at S-65 (Lake Kissimmee) are subtracted from those at S-65E before calculating the flow-weighted concentration.

As shown on Figures 65A and 65B, total phosphorus (TP) concentrations at S-154 (0.47 mg/L) and S191 (0.43 mg/L) are above the 0.18 mg/L target concentration. However, measured TP concentrations at S-191 have generally shown a declining trend during the past ten years. The most recently calculated 12-month TP concentration for S-191 is 68 percent less than the maximum concentration recorded in March 1982. The total phosphorus concentration at C-38 (0.65 mg/L) is above the target level while the TP concentration at Fisheating Creek (0.17 mg/L) is less than the target concentration.

Tributary Inflows and Outflows

While direct rainfall contributes most of the water in the Lake, most nutrients and other material transport to and from the Lake are by stream flows. Figure 66A depicts historical monthly stream flow from all tributaries into and out of the Lake, excluding rainfall. In 1994, the peak monthly flow of 537 thousand acre-feet in September is less than one-half of the historical maximum in July 1974. However, sustained high flows of over 270,000 acre-feet per month have been rushing into the Lake since June 1994. Outflows did not pickup until the Lake stage reached 17 ft. msl in October 1994.

The District generally uses a phosphorus management strategy to slow down the eutrophication process in the Lake. Figures 66B and 66C depict total phosphorus loads and concentrations, respectively, into and out of the Lake. Shown in Figure 66B is a striking difference in the inflow and outflow loads. The reduction trend in TP inflow concentrations is appreciable in Figure 66C, while outflow concentrations fluctuate around the same range.

Nitrogen also plays a critical role in the Lake management. Figures 66D and 66E are the similar plots for total nitrogen. A steady decline of total nitrogen outflow concentrations was interrupted by upturns in 1993 and 1994. Clearly the Lake is acting as a sink (reservoir): higher nutrient loads and concentrations are getting into the Lake than those getting out of the Lake. The material deposited in 1994 will take years for the Lake to assimilate.

Most inflows move southward through the Lake. However, the Lake also has an outlet toward the east (St. Lucie River) and an outlet toward the west (Caloosahatchee River). Figures 66F and 66G show the water quality at S79 on the Caloosahatchee River. The outflow volume in 1994 is among the highest in historical records. From these two figures, it is evident that there is a high correlation between total phosphorous concentration and the flow. Outflows through the St. Lucie River were released in "pulses." Figure 66H shows the flow through S80 on the St. Lucie River. The 590,000 acre-feet of total flow in 1994 is one-half of the historical maximum in 1983. However, most of the flow (570,000 acre-feet) in 1994 occurred in the second half of the year. Silt discharging through the St. Lucie River appeared to impact the ecosystem of the coastal area. Figure 66I shows the historical loads and concentrations of the total suspended solid (TSS) at S80 on St. Lucie River. In 1994, 106 metric tons of TSS (84 metric tons between July and December) passed through S80, in comparison to the annual average of about 60 metric tons per year before 1994.

Water Quality in Lake Okeechobee

The water quality conditions of Lake Okeechobee are indicated by chlorophyll a, total phosphorus and total nitrogen concentrations and the lake stage in Figure 67A. The peak lake stage occurred in March 1983 at 18.26 feet msl. In 1994, the maximum stage occurred on

December 7 (17.48 feet msl). Total phosphorus concentrations in the Lake are continuing their low level that started in 1992. The downward trend of total nitrogen concentration was interrupted by the upturn at the beginning of 1993. In 1994, chlorophyll a concentrations did not peak in the summer as in previous years.

In many ecosystem studies the Lake has been treated as a well-mixed body of water. However, with an area of over 700 square miles, Lake Okeechobee can have a large spatial variations in water quality at any given time. These variations are shown in Figures 67A-D for total nitrogen, total phosphorus, and chlorophyll a, respectively, for the month of October 1994, the latest completed data available. Note that samples were not collected from the western littoral zone. Total nitrogen is usually rather uniform throughout the Lake. When spatial variation in total phosphorus concentrations occurred in the Lake, it was caused by either high concentration point inflows or sediment resuspension in the deep open water. Maximum algal chlorophyll a values from samples collected in the months of October 1994 are shown on Figure 67D to indicate the potential for algal bloom. Chlorophyll a concentration of less than 20 ppb (ug/L) is considered to be normal for the Lake. The portion of the water body with chlorophyll a concentration between 20 to 40 ppb is considered to have a bloom condition; between 40 to 60 ppb is considered to have a bloom potential; and over 60 ppb may be considered to have an algal bloom. A chlorophyll a concentration of over 90 ppb is definitely a bloom. The data indicate that bloom (over 40 µg/L) conditions were present at 7 of 40 sampled sites. Overall, 1994 was a mild year of algal activities.

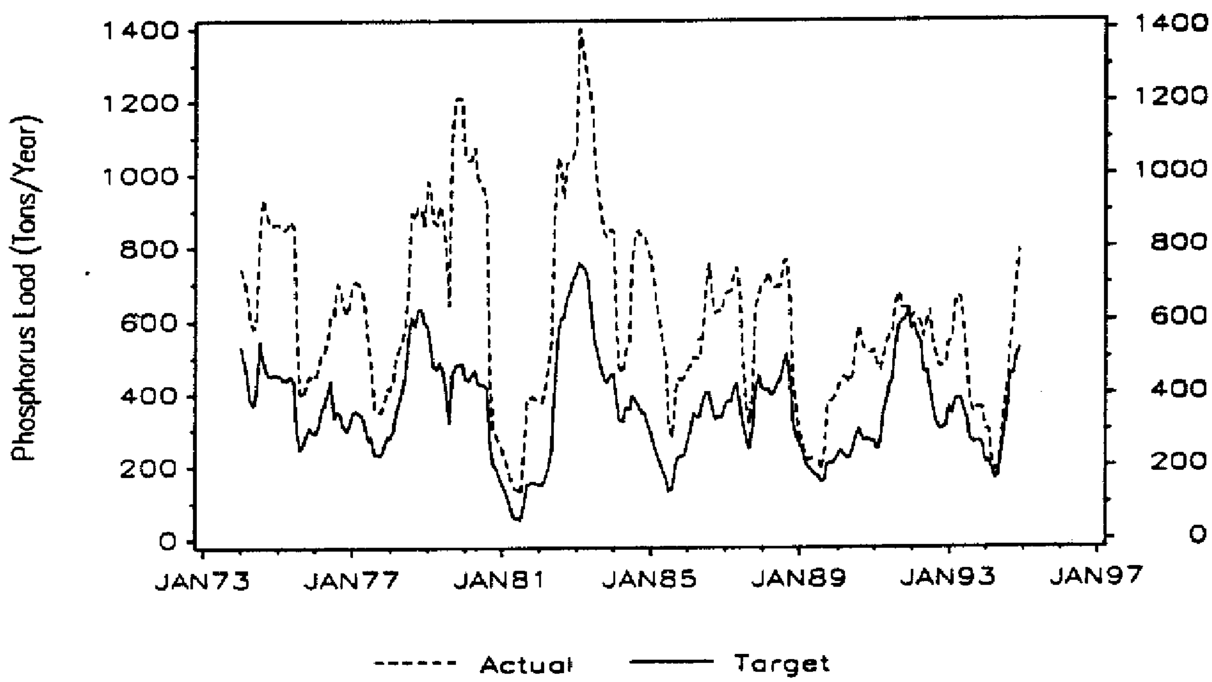


Figure. 64. Annual Lake Okeechobee phosphorus load compared to target load from Vollenweider (1976) model.

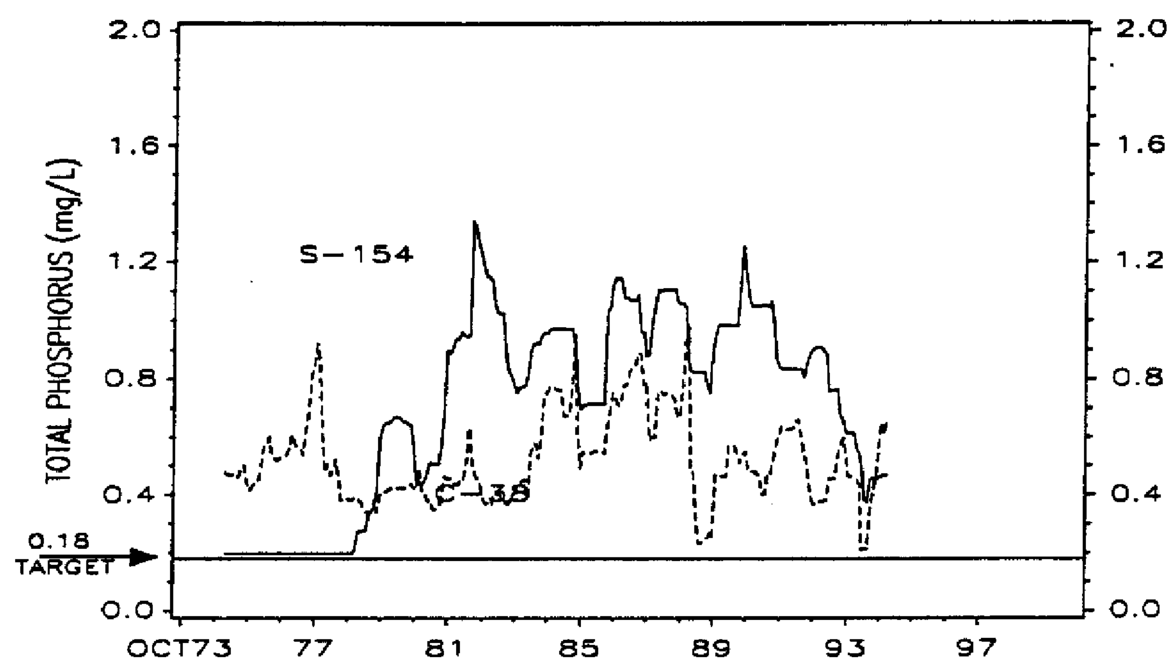


Figure 65A. Phosphorus concentrations for S-154 and C-38 Basins - 12 month moving flow - weighted values.

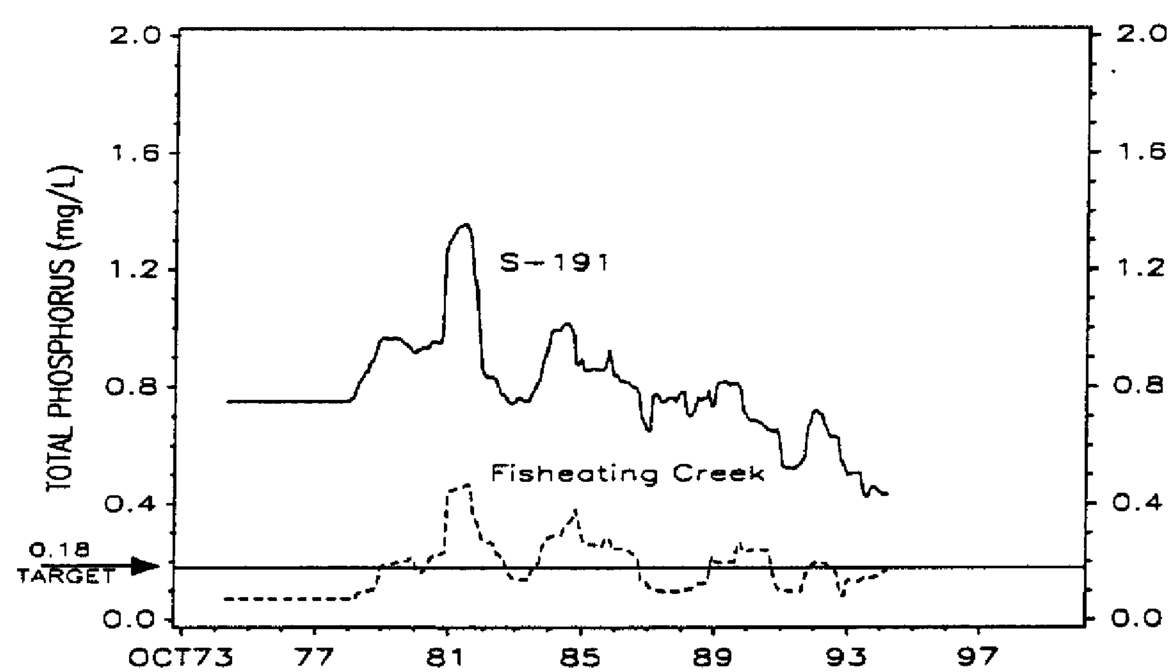


Figure 65B. Phosphorus concentrations for S-191 and Fisheating Creek Basins - 12-month moving flow-weighted values.

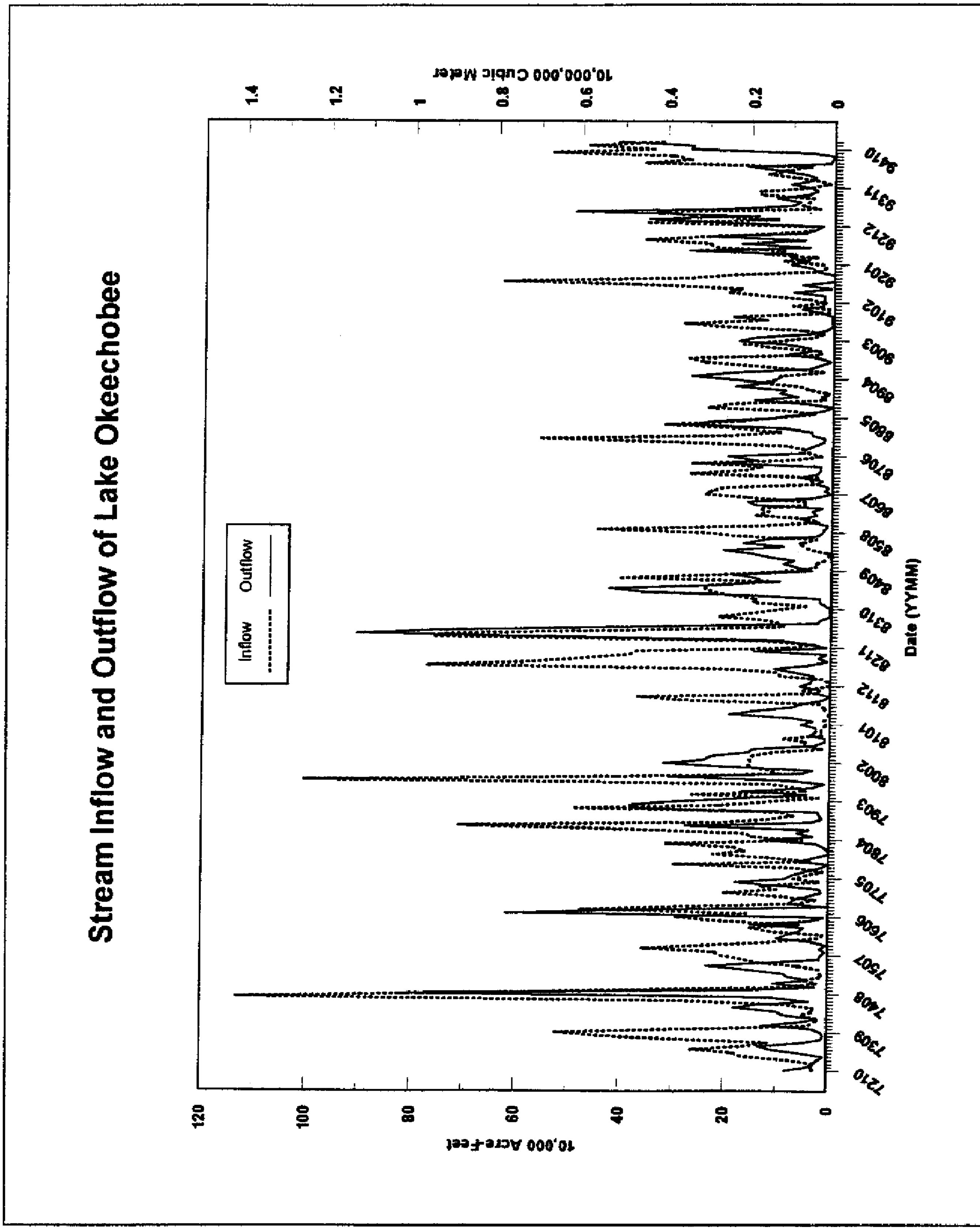


Figure 66A. Historical monthly stream inflow and outflow of Lake Okeechobee.

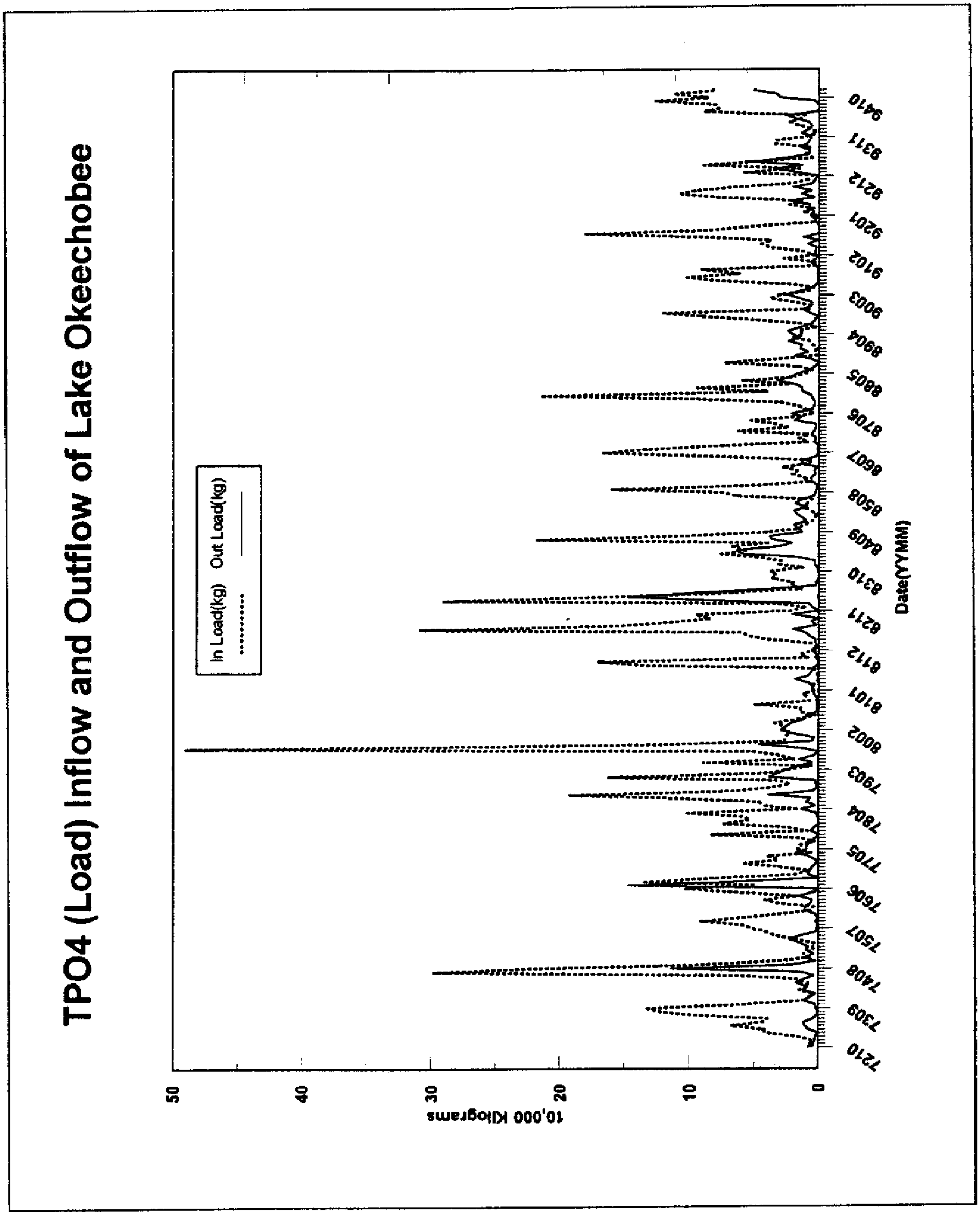


Figure 66B. Historical monthly total phosphorus load of inflow and outflow of Lake Okeechobee

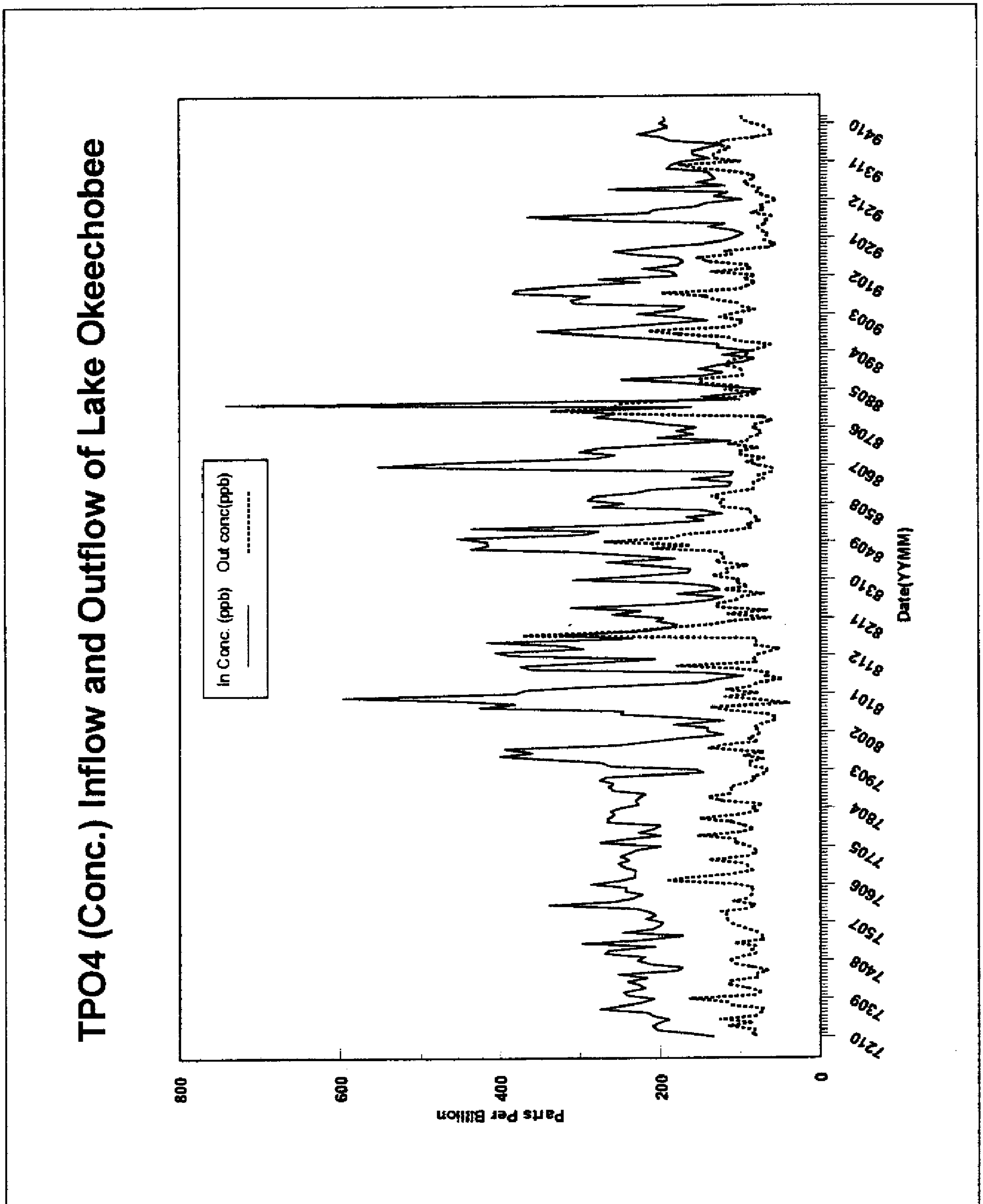


Figure 66C. Historical monthly total phosphorus concentration of inflow and outflow of Lake Okeechobee

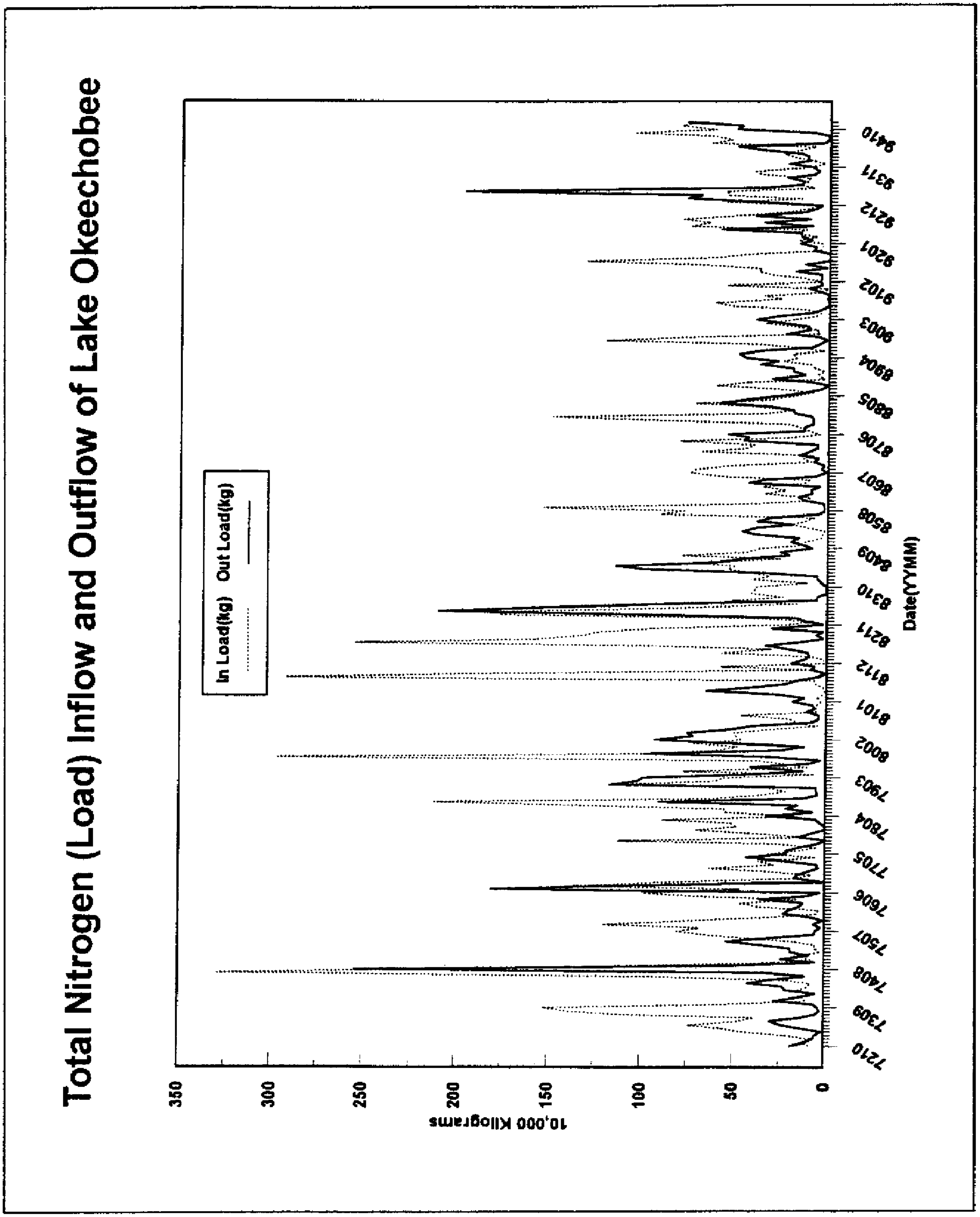


Figure 66D. Historical monthly total nitrogen load of inflow and outflow of Lake Okeechobee

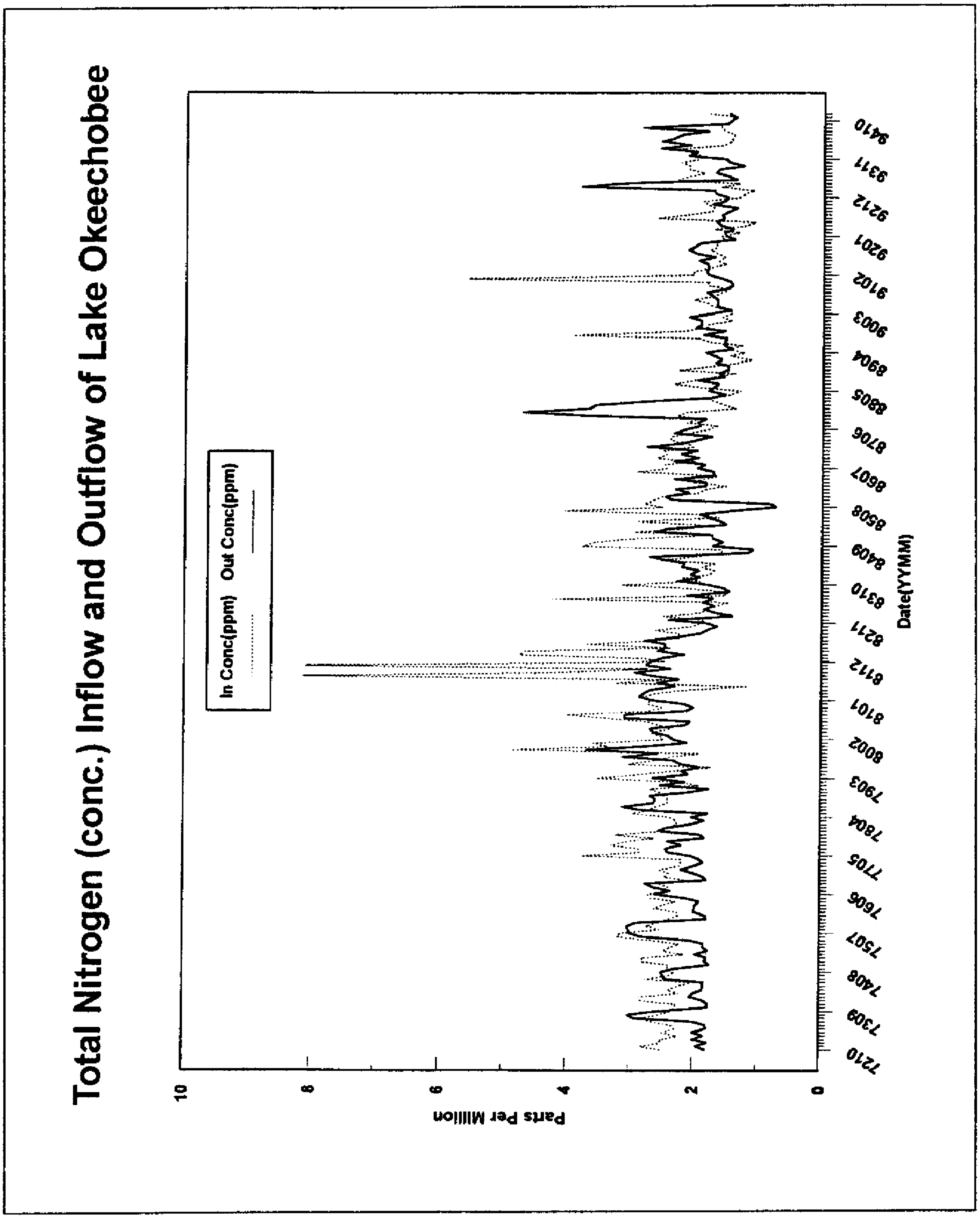


Figure 66E. Total nitrogen inflow and outflow of Lake Okeechobee.

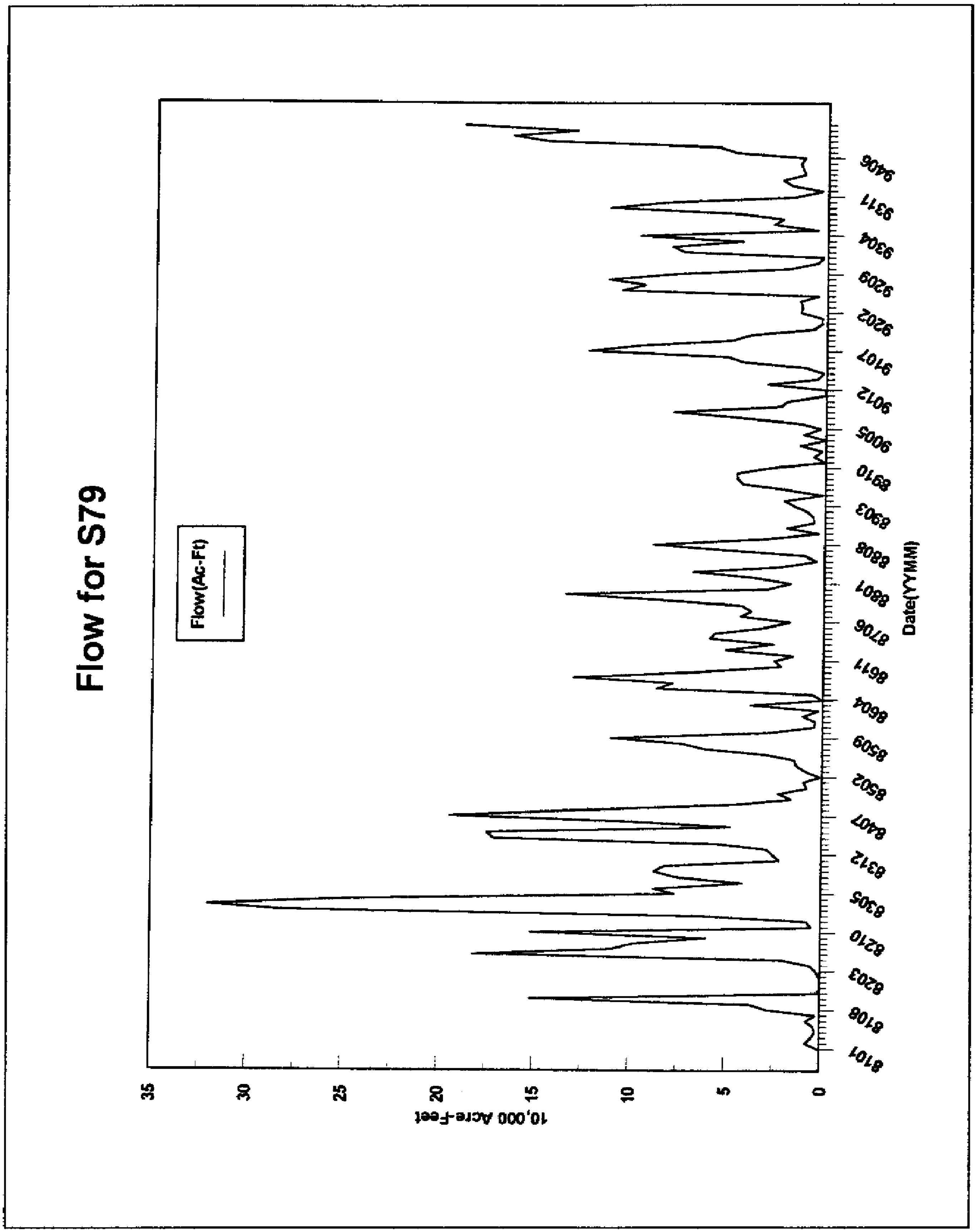


Figure 66F. Historical monthly flow at S79 on the Caloosahatchee River.

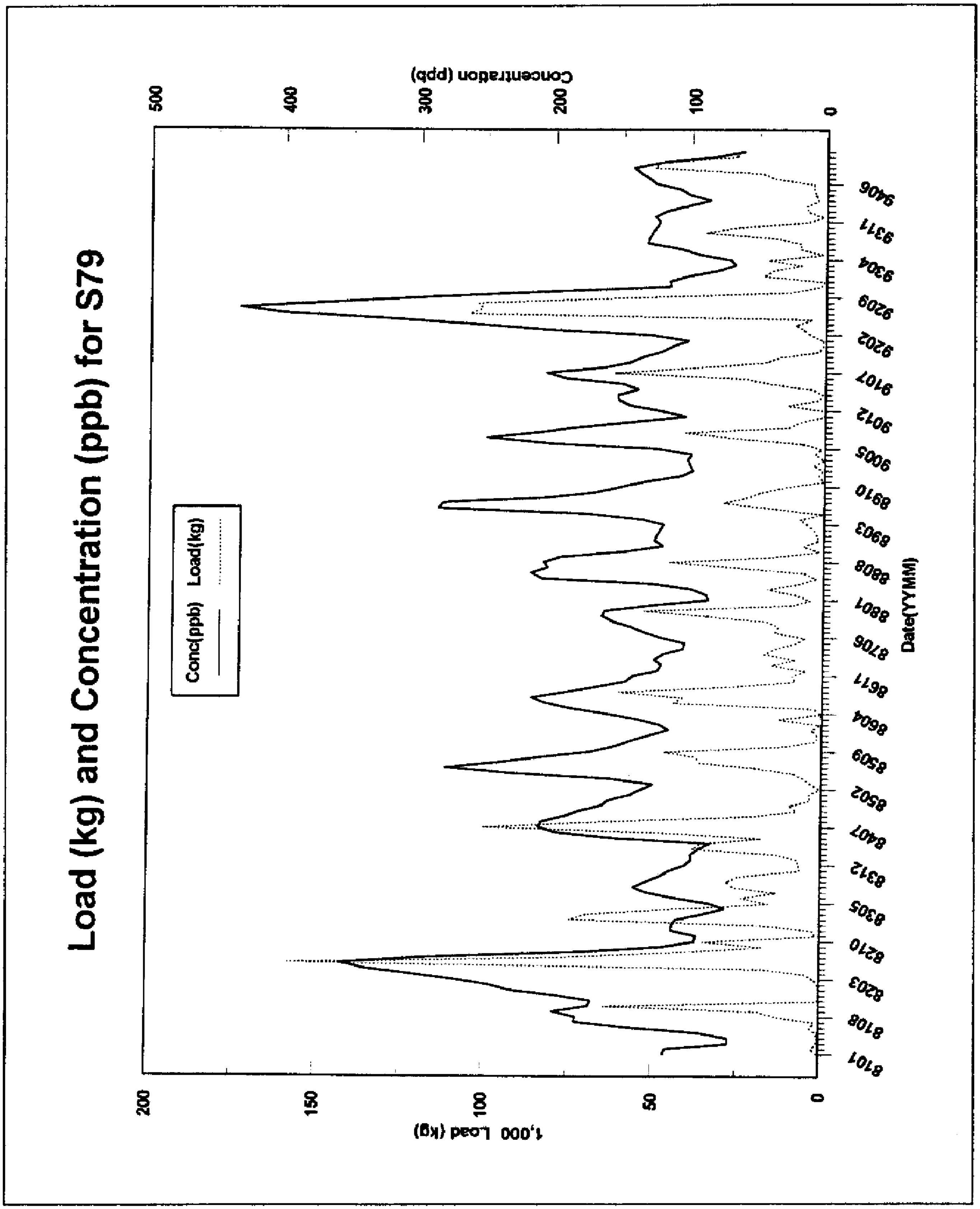


Figure 66G. Historical monthly total phosphorus load and concentration at S79 on the Caloosahatchee River.

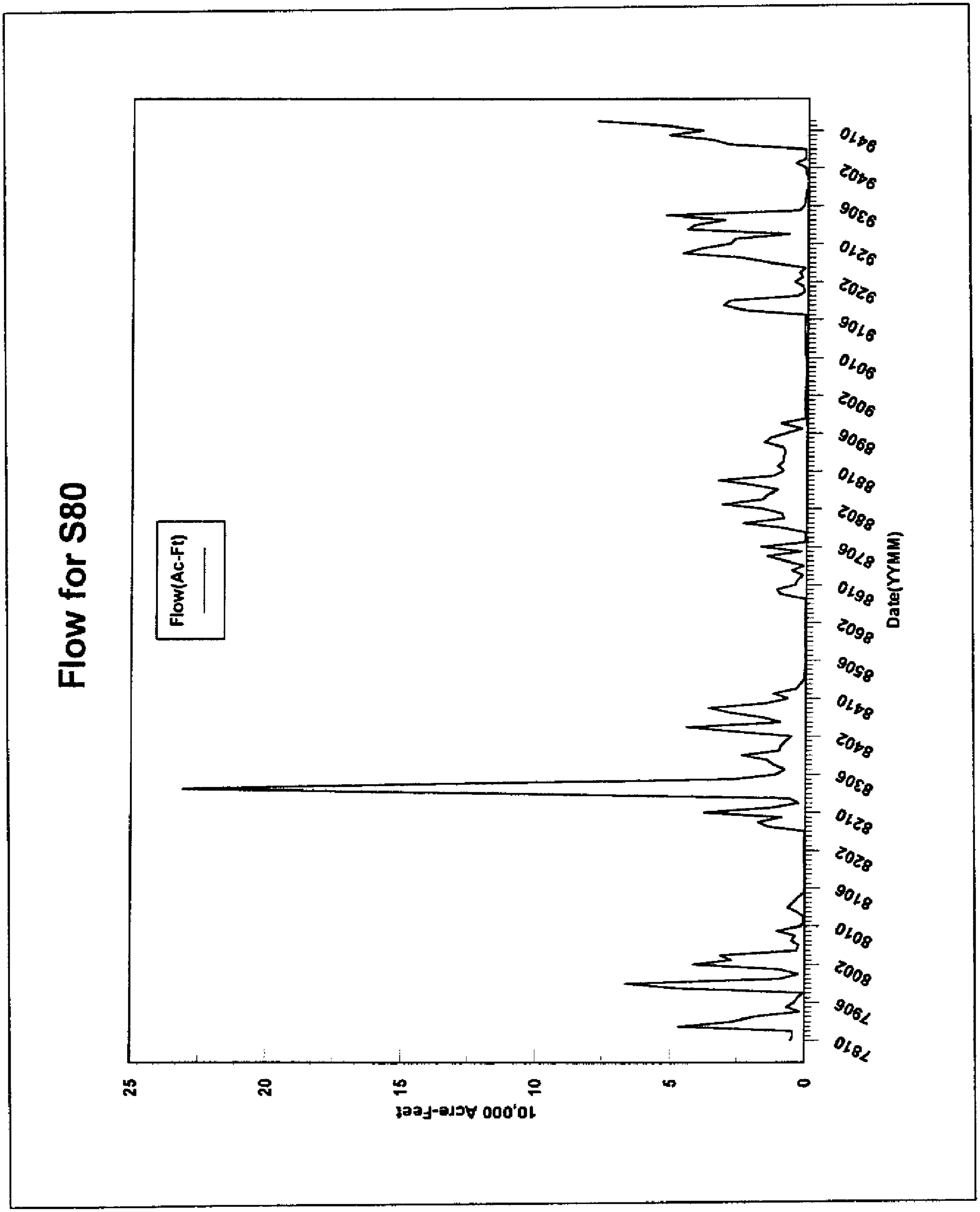


Figure 66H. Historical monthly flows at S80 on the St. Lucie River.

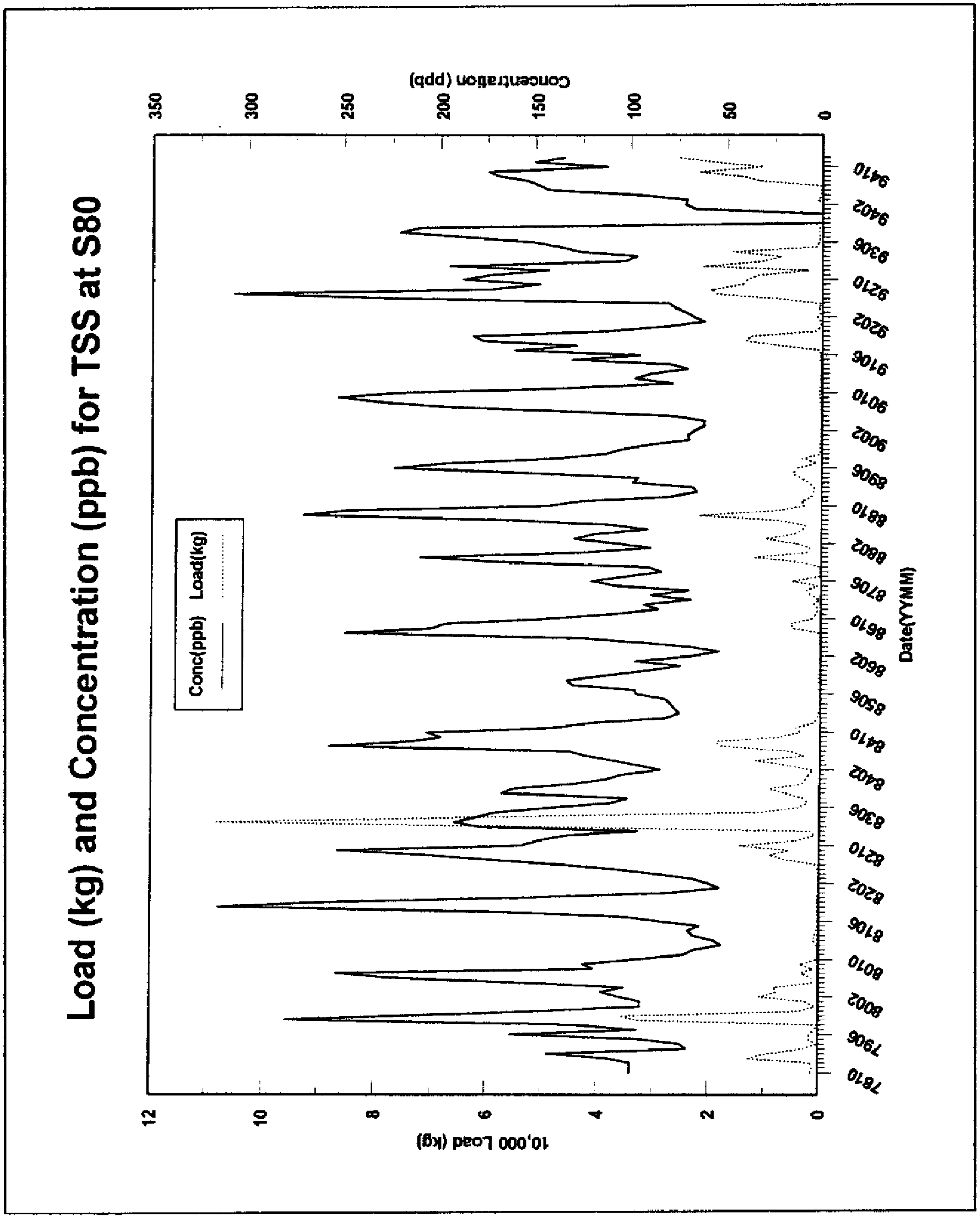


Figure 66I. Historical monthly total suspended solids load and concentration at S80 on the St. Lucie River.

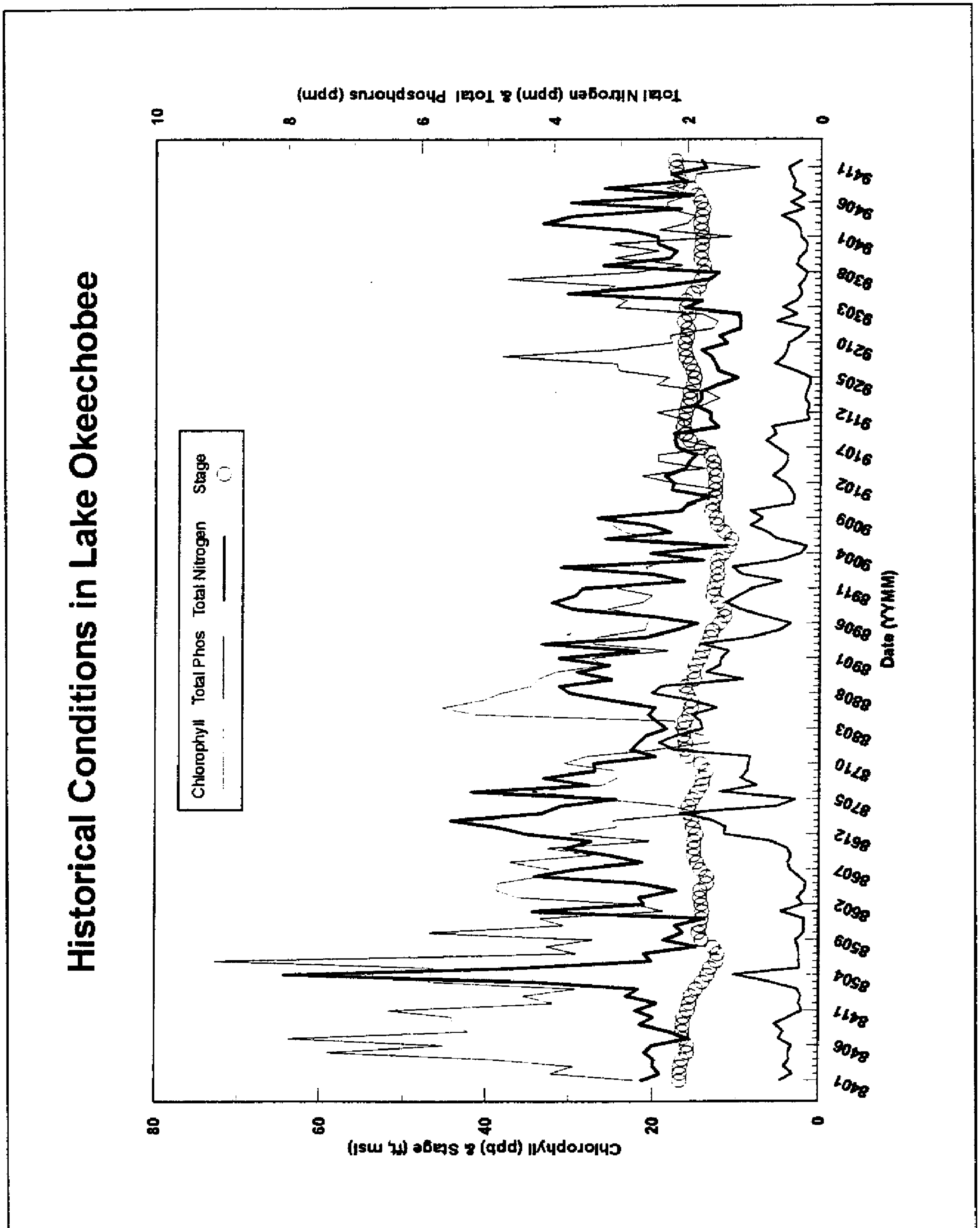


Figure 67A. Historical conditions in Lake Okeechobee.

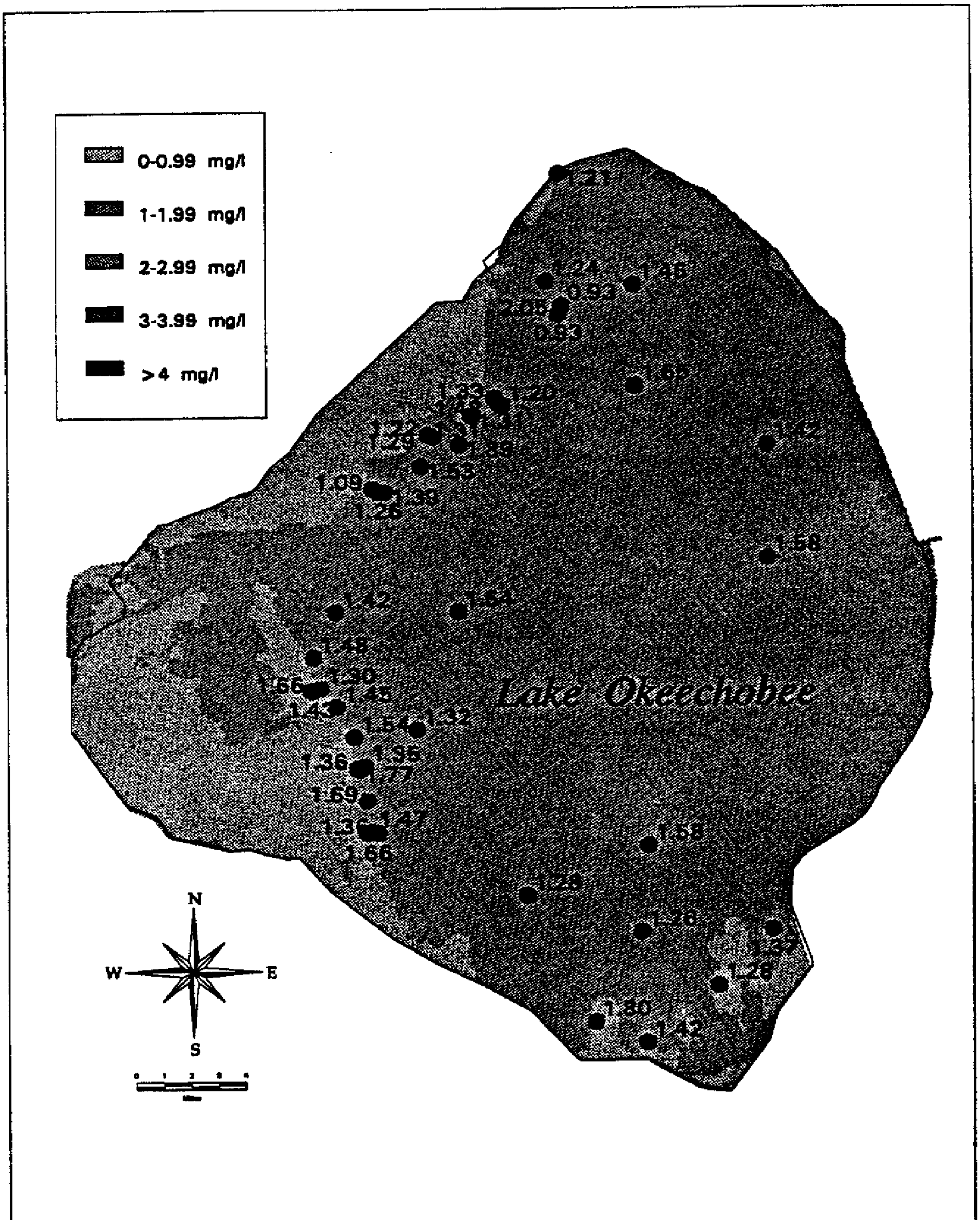


Figure 67B. Lake Okeechobee total nitrogen maxima for October 1994.

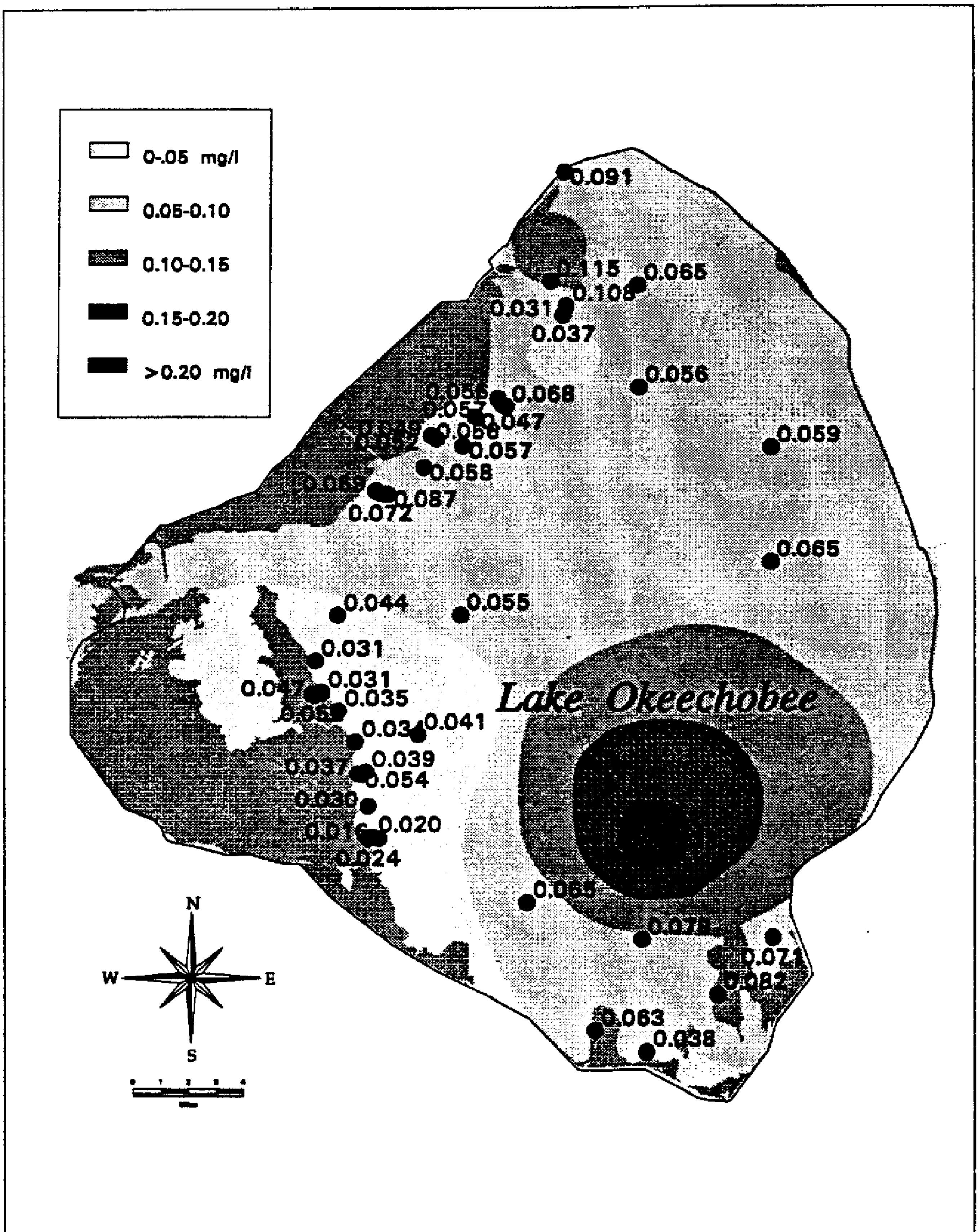


Figure 67C. Lake Okeechobee total phosphorus maxima for October 1994.

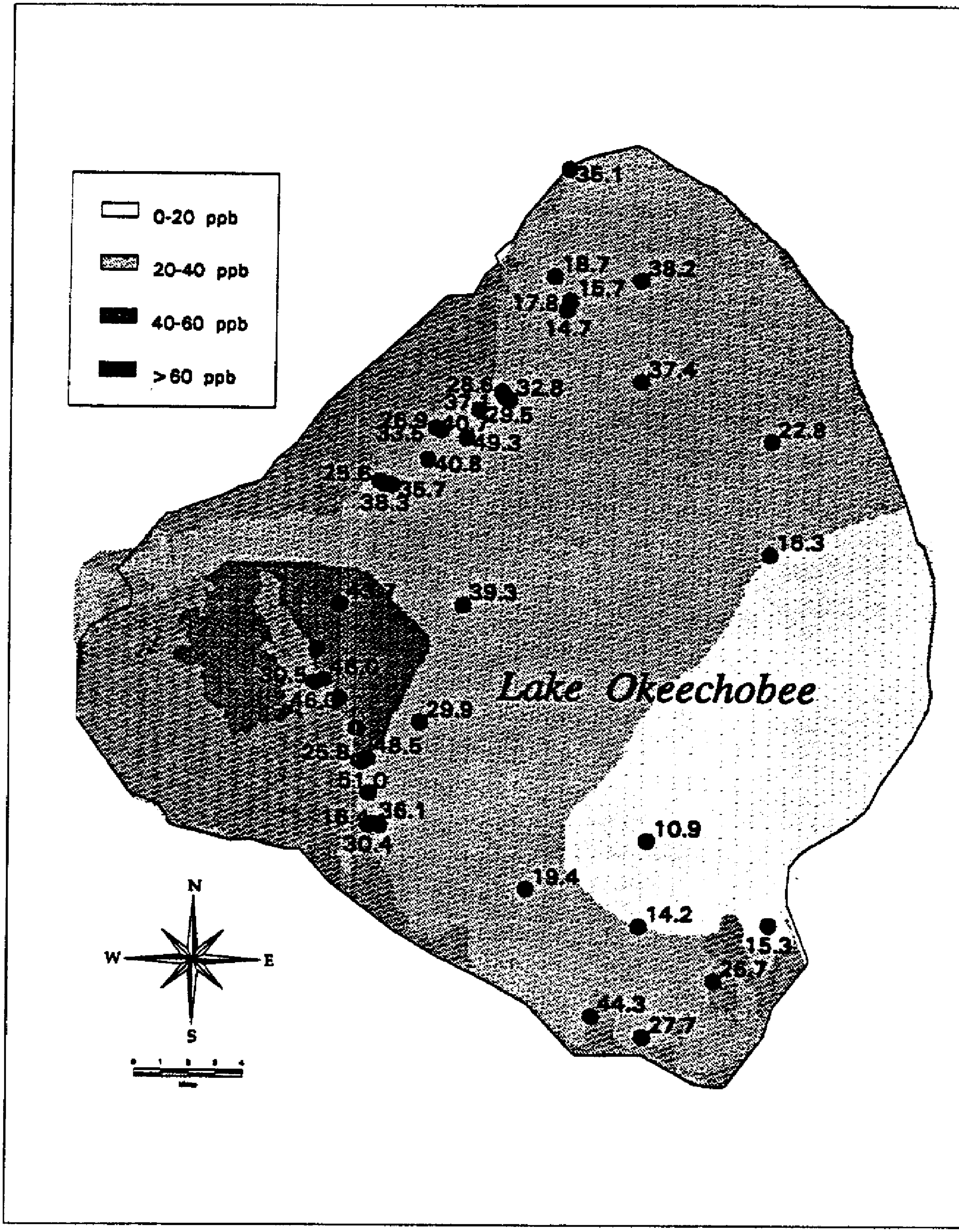


Figure 67D. Lake Okeechobee chlorophyll a maxima for October 1994.

EVERGLADES WATER QUALITY STATUS

EAA Basin

Figure 68A is an evaluation report of water quality monitoring data for the Everglades Agricultural Area (EAA) prepared pursuant to Rule 40E-63.145(3)(b), F.A.C. It depicts an annual moving sum of the EAA basin total phosphorus (TP) loadings measured at pumping stations S-5A, S-6, S-7, S-150 and S-8. It also compares actual TP loadings from the entire EAA with 25 percent load reduction requirement relative to the base period 1979-1988. The load reduction goals are variable because they are adjusted for annual rainfall. Also depicted is the load reduction goal of 80 percent to be accomplished by the existing EAA Regulatory Program and the proposed Stormwater Treatment Areas (STAs). A 50 percent reduction goal is also included for reference. Since the last report, three months of running sum annual TP load data, ending September 1994, have been added to the figure. Since December 1992, the actual loadings from the EAA have been above the 25 percent load reduction target level. At the end of 1994, the actual total phosphorus load was estimated to be 286 metric tons, while the target was 238 metric tons.

Figure 68B depicts 12-month rolling sum of the basin rainfall, and the monthly total phosphorus load out of EAA. It is observed that the estimated basin rainfall of 72.64 inches in the year of 1994 was the highest of any consecutive 12-month period on record. The total outflow volume of 1.87 million acre feet in 1994 was about the same as the second highest rainfall (65.05 inches) which occurred from April 1982 to March 1993. Due to much lower material concentrations, in 1994 EAA only produced 286 metric tons of total phosphorus, while the April 1982 to March 1983 period generated 479 metric tons. The large amount of water sent to water conservation areas from EAA in 1994 will probably help the ecosystem downstream and replenish the aquifer in the Lower East Coast.

Inflow to the Everglades National Park

S12 Structures

In 1994, the total volume that flowed through S12A, S12B, S12C and S12D was 1.34 million acre-feet. It was more than double the average annual flow through these structures that occurred before 1994. The flows have been steadily increasing since January 1994 at 11,000 acre-feet to over 400,000 acre-feet in December 1994. Figure 69 depicts the total phosphorus loads and concentrations of water flow through the S12 structures. Steady decline of TP concentrations is observable since 1990. Even more remarkable is the reduction of the TP concentrations from the outflows of EAA (over 100 ppb) to about 10 ppb at S12s in 1994. This is a strong indication that water conservation areas are functioning as nutrient filters.

S332

Figure 70A is a plot of monthly flow volume through S332 in south Dade County. The flow used to be highly regulated to supplement the agricultural need for the area. Since 1993, in order to suppress hypersalinity in Florida Bay, more water is pumped through S332. Figure 70B depicts the loads and concentrations at S332. The water quality flowing through the structure is usually very good, unless the water picks up a sufficient amount of agricultural return flow.

S18C and S197

Agricultural return flow in south Dade County is mostly collected at S18C. Figure 71A is a plot of flow through S18C. Figure 71B shows the total phosphorus loads and concentrations through S18C. It is observed that, at S18C, the highest monthly total phosphorus load occurred in September 1994 and the highest total phosphorus concentration occurred in November 1994.

S197 is the southernmost gated structure of the District. For water conservation, the gate was rarely open. However, in 1994 the gate was open to pass 30,000 acre-feet of water into Florida Bay.

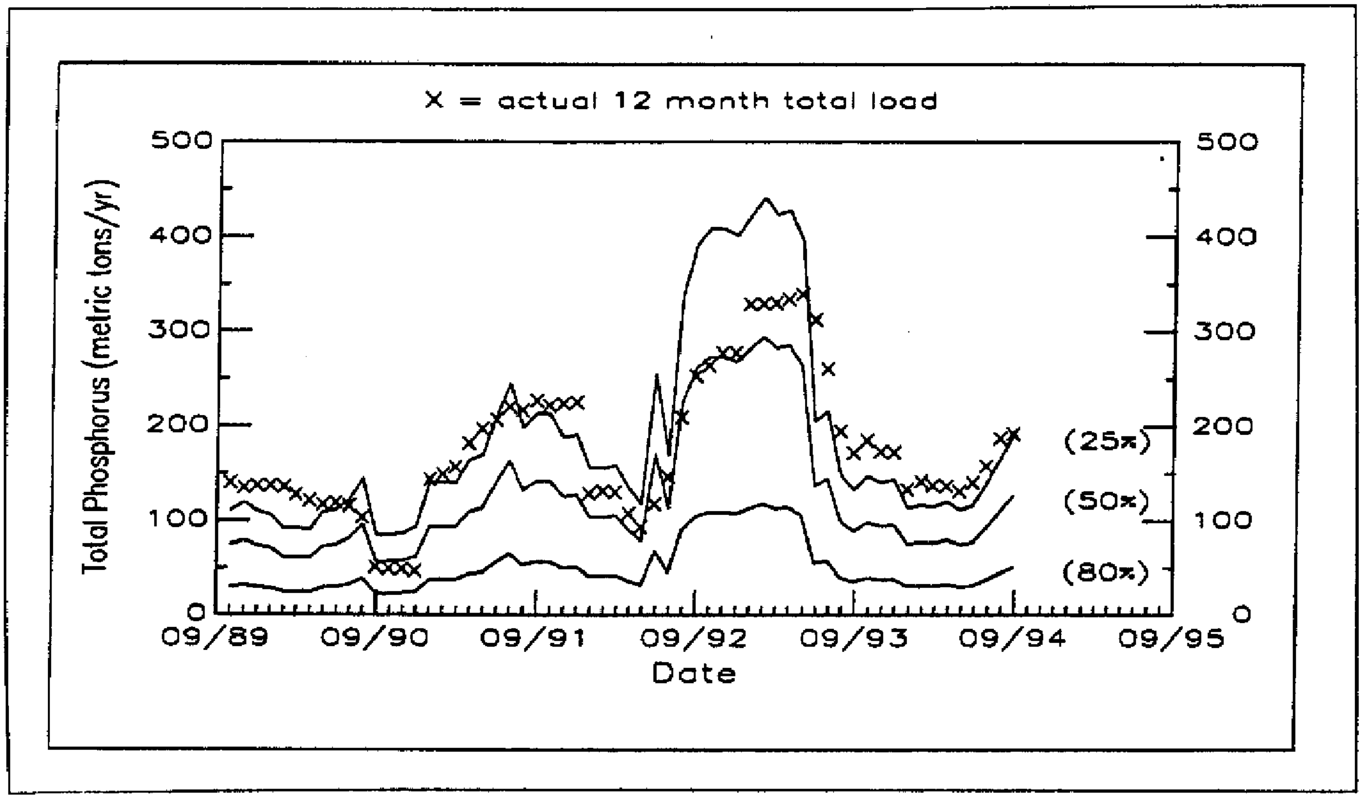


Figure 68A. EAA Basin phosphorus loadings (metric tons/yr) - 12-month moving sum of S-5A, S-6, S-7, S-150, and S-8.

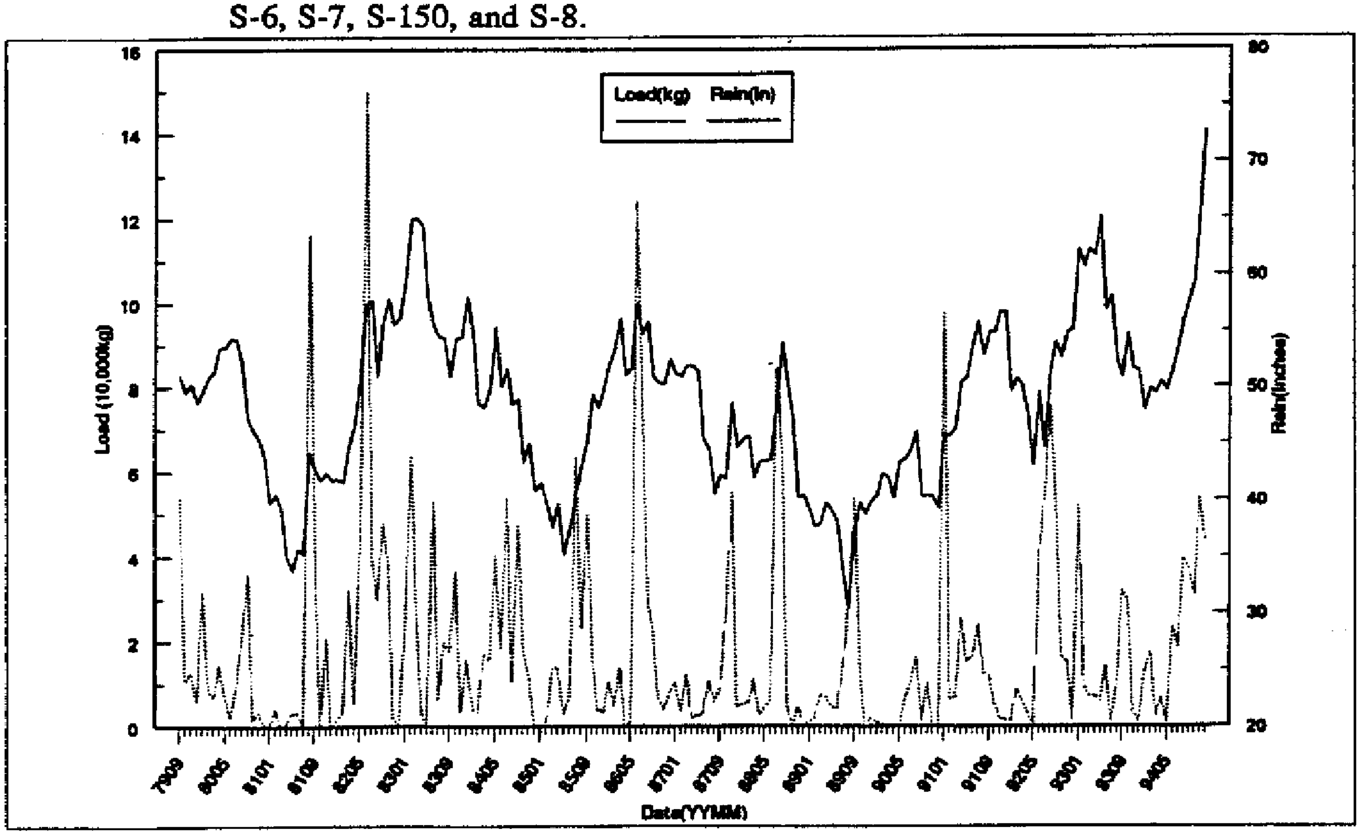


Figure 68B. Monthly total phosphorus load and 12-month rolling sum of the basin rainfall for EAA.

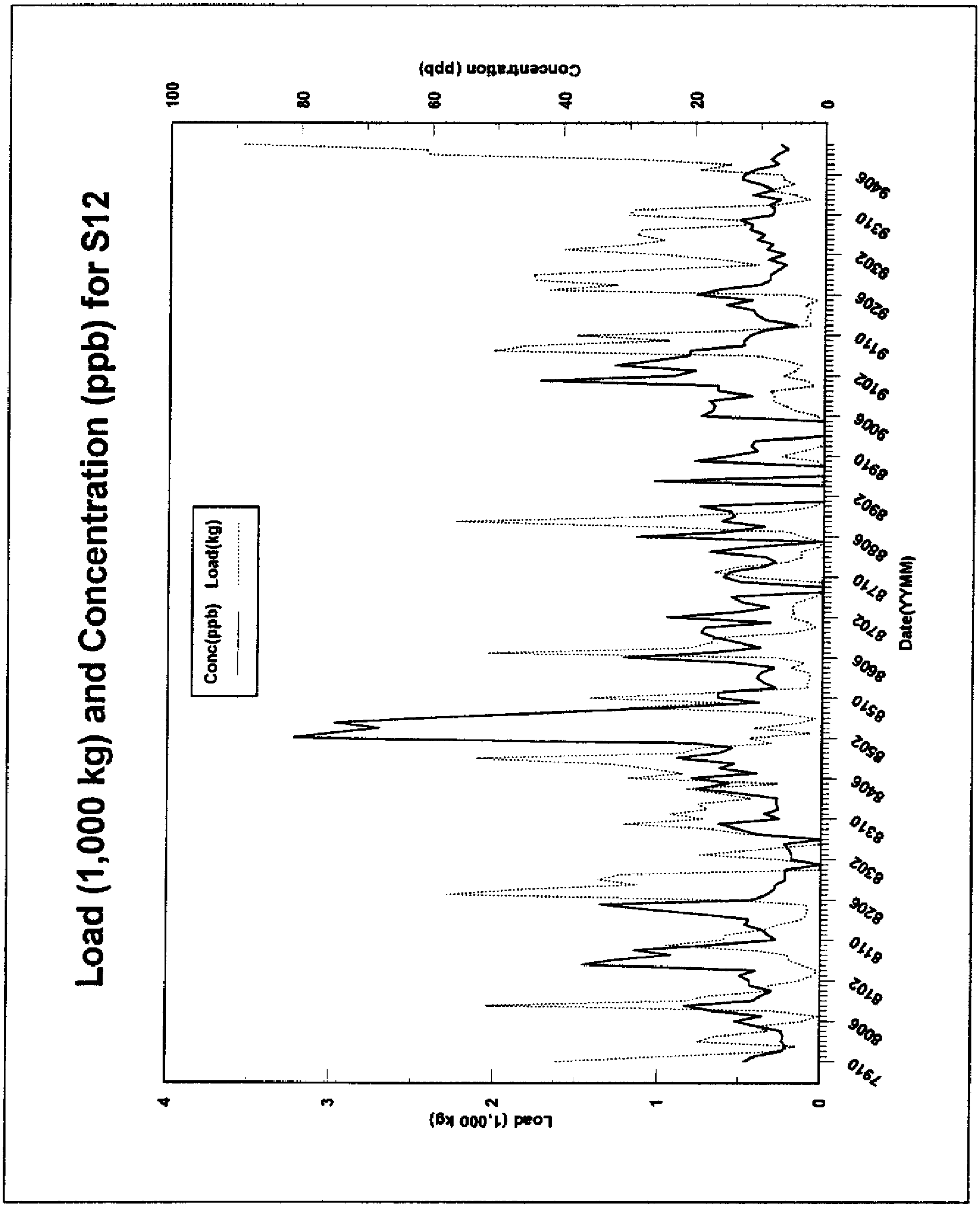


Figure 69. Historical monthly total phosphorus load and concentration through S12 structures.

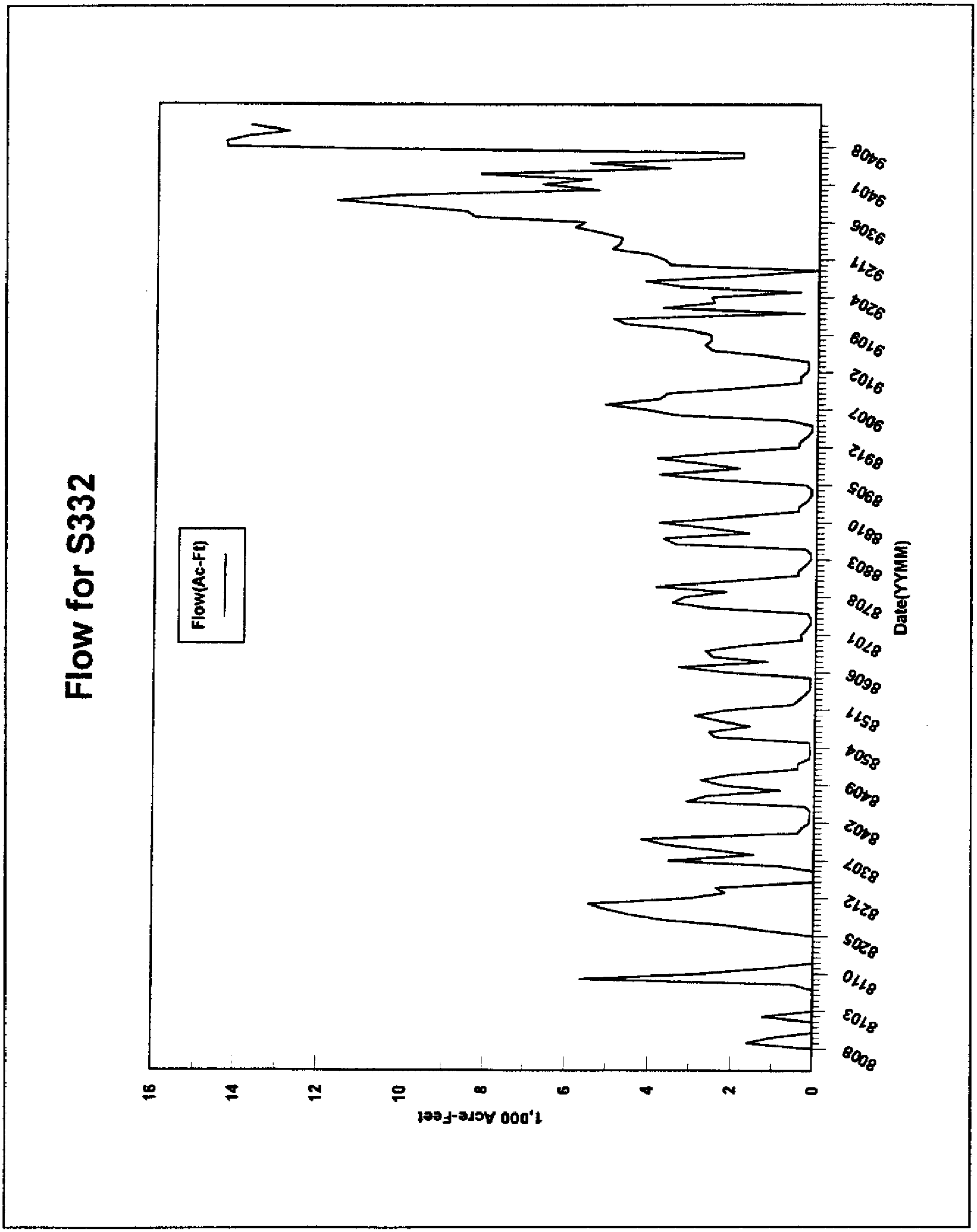


Figure 70A. Historical monthly flow at S332.

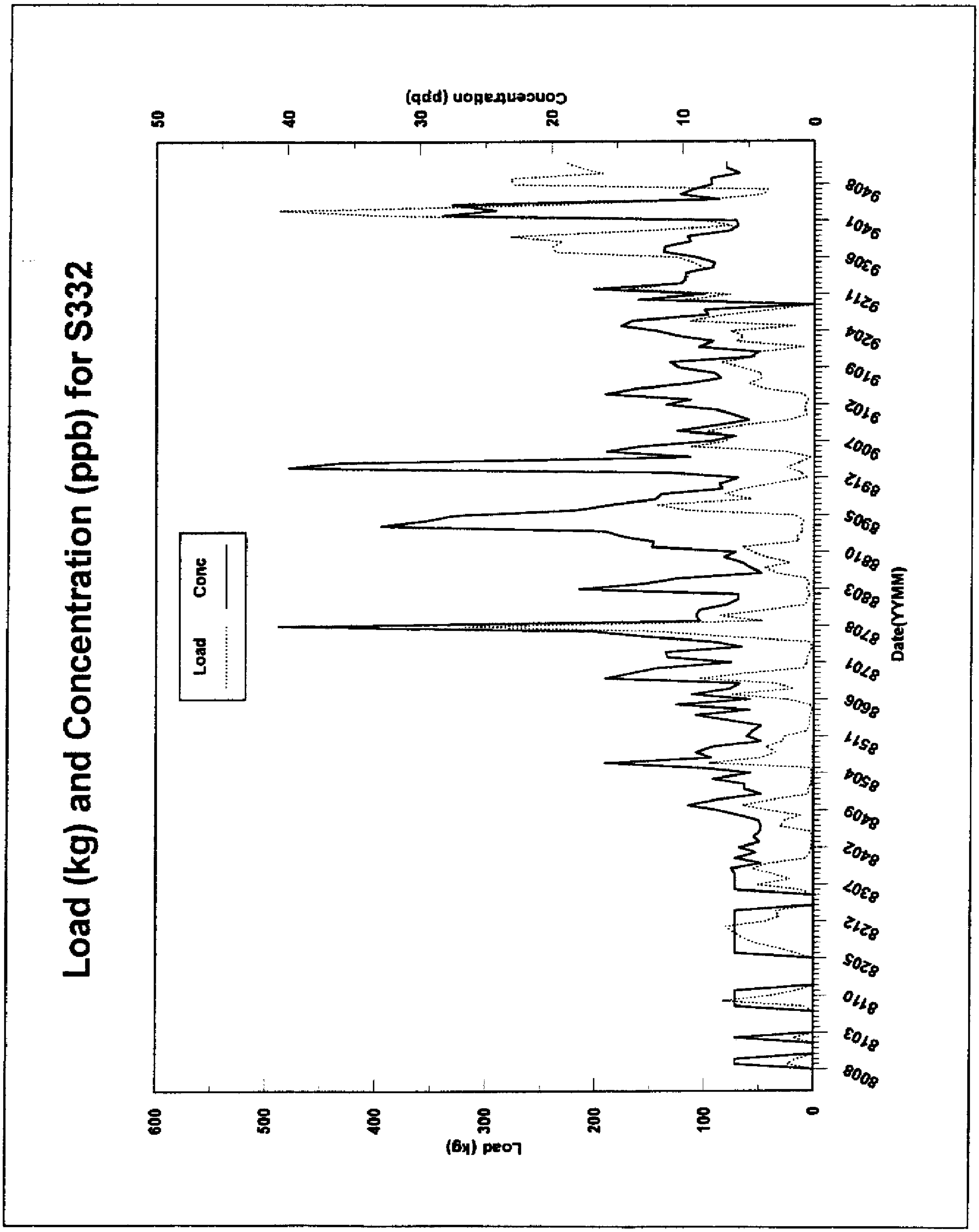


Figure 70B. Historical monthly total phosphorus load and concentration at S332.

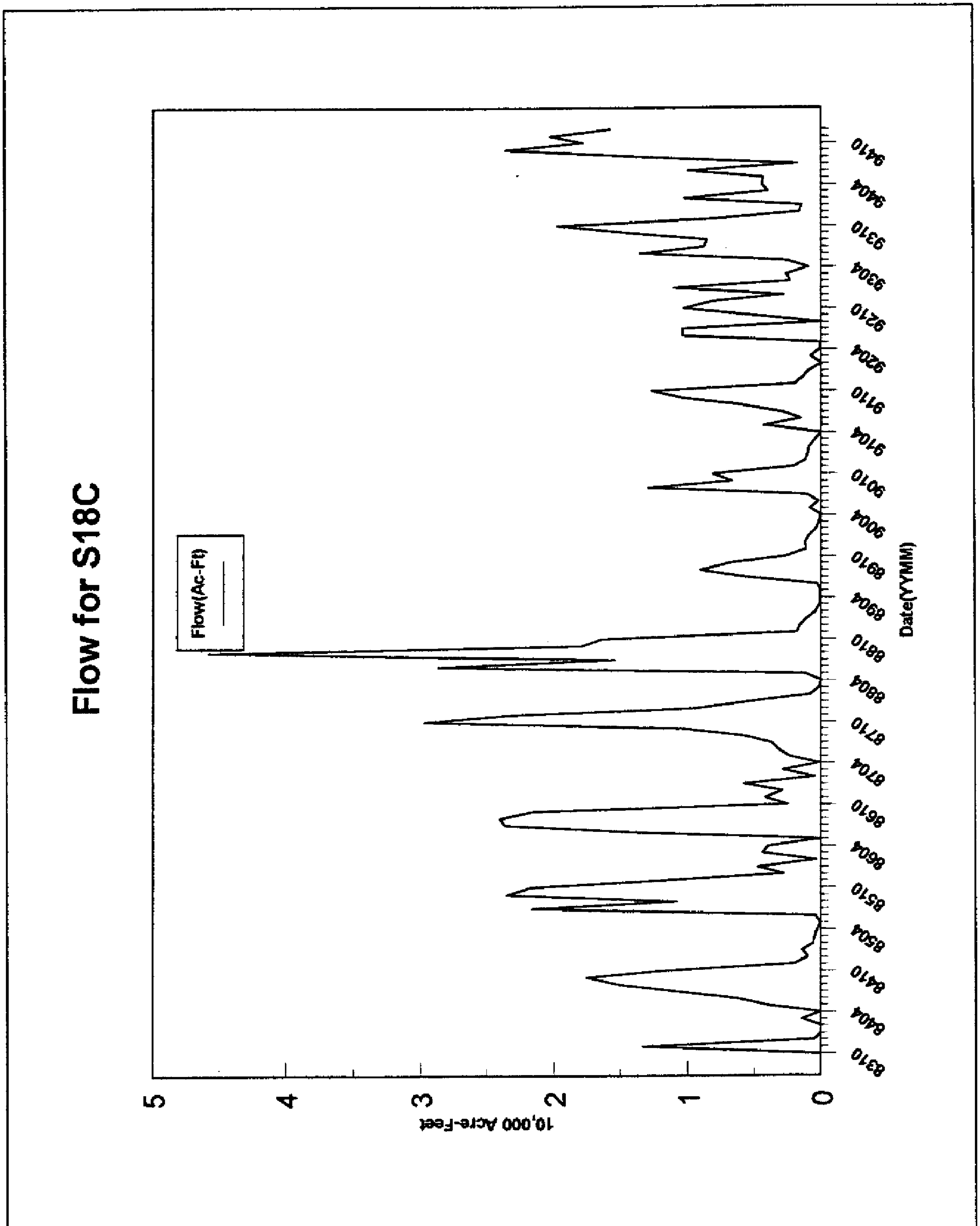


Figure 71A. Historical monthly flow at S18C.

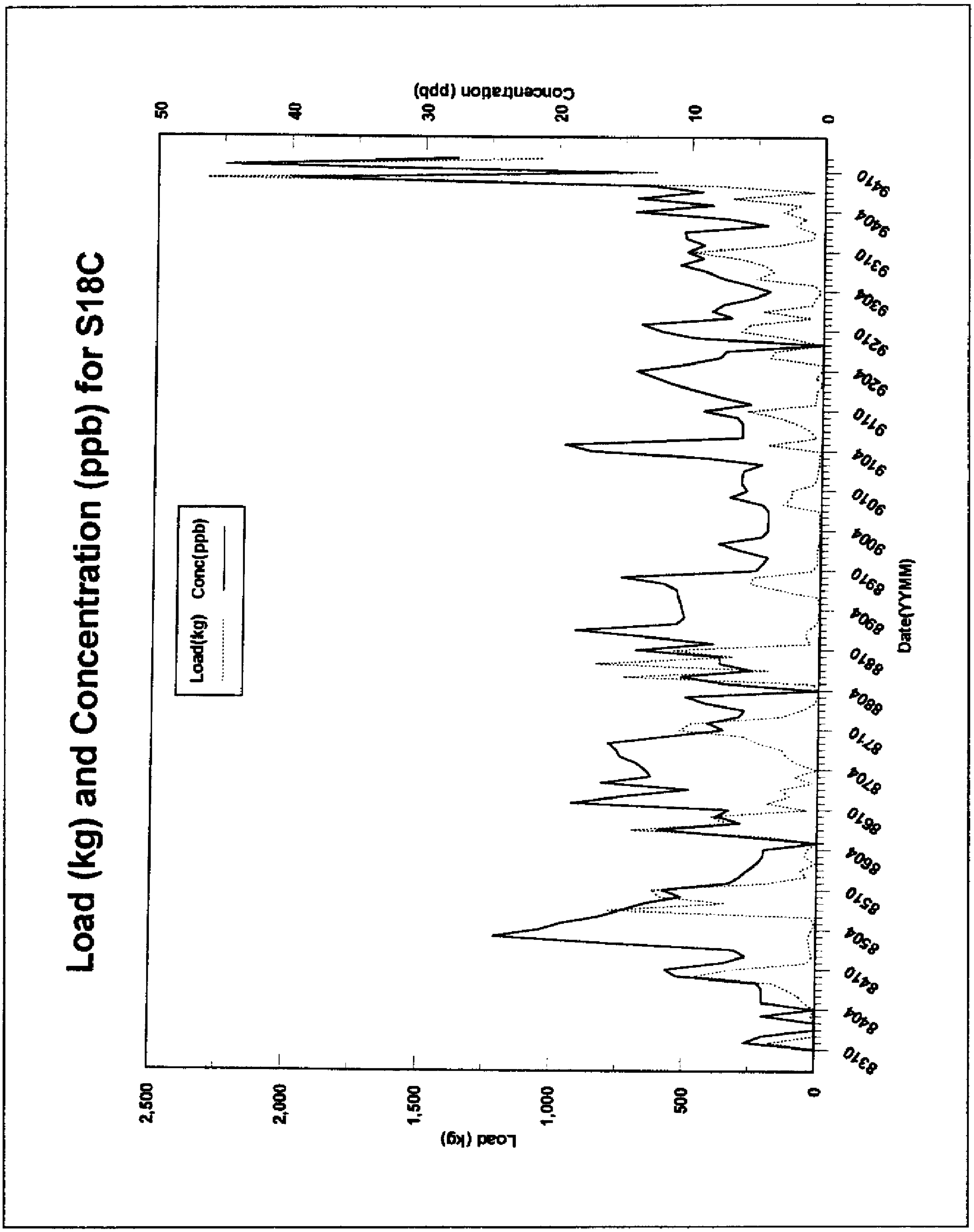


Figure 71B. Historical monthly total phosphorus load and concentration at S18C.

This page intentionally left blank

APPENDICES

APPENDIX A

Table A-1. Stages and Discharge for the Kissimmee Basin (Upper and Lower)

	S65			S65E		
	HW	TW	FLOW	HW	TW	FLOW
Dbkeys	00185	00187	00186	00240	00243	00241
Date						
19940501	50.65	46.32	.00	21.26	13.99	103.00
19940502	50.71	46.29	.00	21.05	13.97	138.00
19940503	50.75	46.27	.00	20.98	14.03	84.00
19940504	50.88	46.24	.00	20.96	13.98	56.00
19940505	50.93	46.20	.00	20.92	13.89	.00
19940506	50.93	46.17	.00	20.91	13.91	.00
19940507	50.93	46.22	150.00	21.10	13.96	29.00
19940508	51.00	46.33	205.00	21.21	13.84	108.00
19940509	51.03	46.30	207.00	21.19	13.83	71.00
19940510	51.08	46.29	208.00	21.23	13.82	301.00
19940511	51.09	46.27	208.00	21.22	13.76	310.00
19940512	51.10	46.29	208.00	21.01	13.78	171.00
19940513	51.10	46.29	208.00	21.00	13.79	171.00
19940514	51.09	46.34	207.00	21.02	13.75	142.00
19940515	51.08	46.32	207.00	20.97	13.73	128.00
19940516	51.11	46.31	208.00	20.94	13.71	66.00
19940517	51.15	46.28	210.00	21.02	13.64	43.00
19940518	51.12	46.33	208.00	21.20	13.60	110.00
19940519	51.17	46.34	209.00	21.37	13.67	163.00
19940520	51.34	46.32	213.00	21.35	13.37	180.00
19940521	51.30	46.30	213.00	20.99	13.38	176.00
19940522	51.25	46.29	211.00	20.89	13.42	85.00
19940523	51.20	46.32	210.00	21.00	13.57	130.00
19940524	51.17	46.31	209.00	21.03	13.58	130.00
19940525	51.16	46.32	209.00	21.04	13.57	113.00
19940526	51.18	46.34	209.00	21.08	13.54	44.00
19940527	51.19	46.32	210.00	21.16	13.44	44.00
19940528	51.20	46.32	210.00	21.22	13.38	72.00
19940529	51.19	46.31	210.00	21.31	13.41	179.00
19940530	51.19	46.26	211.00	21.23	13.50	614.00
19940531	51.20	46.32	210.00	20.94	13.47	299.00
19940601	51.22	46.35	210.00	20.81	13.46	48.00
19940602	51.26	46.36	210.00	21.02	13.45	92.00
19940603	51.27	46.33	211.00	21.29	13.46	441.00
19940604	51.33	46.35	212.00	21.06	13.56	921.00
19940605	51.35	46.31	213.00	21.07	13.71	90.00
19940606	51.43	46.40	470.00	21.42	13.74	1010.00
19940607	51.45	46.39	641.00	21.17	13.84	1510.00
19940608	51.51	46.40	722.00	21.39	13.87	1840.00
19940609	51.58	46.41	621.00	20.88	13.87	1870.00
19940610	51.60	46.35	906.00	21.05	13.89	1630.00
19940611	51.58	46.31	1050.00	21.36	13.90	2050.00
19940612	51.62	46.27	1050.00	21.23	13.97	2200.00
19940613	51.59	46.33	1050.00	21.20	13.98	2240.00
19940614	51.58	46.31	1050.00	20.96	13.98	1980.00
19940615	51.55	46.32	1210.00	20.98	13.99	1610.00
19940616	51.57	46.33	1480.00	21.25	13.95	1590.00
19940617	51.69	46.45	1590.00	21.20	13.94	2270.00
19940618	51.84	46.46	411.00	21.12	14.00	2680.00
19940619	51.91	46.46	914.00	21.03	14.04	2290.00
19940620	52.05	46.48	409.00	21.26	14.05	1790.00
19940621	51.98	46.38	2260.00	21.15	14.04	2270.00
19940622	51.49	46.68	5220.00	21.11	14.15	3630.00
19940623	51.08	46.83	5870.00	20.95	14.24	6340.00
19940624	50.81	46.82	5690.00	21.15	14.33	7090.00
19940625	50.75	46.64	5070.00	21.24	14.33	6650.00
19940626	50.74	46.59	4320.00	21.05	14.36	6460.00
19940627	50.67	46.56	4050.00	21.06	14.37	5760.00
19940628	50.53	46.51	4000.00	21.11	14.35	5490.00
19940629	50.42	46.48	3960.00	20.98	14.38	5320.00
19940630	50.29	46.50	3890.00	21.00	14.41	4910.00
19940701	50.21	46.50	3850.00	21.11	14.43	4290.00
19940702	50.24	46.52	3630.00	21.05	14.53	5580.00
19940703	50.22	46.52	3370.00	21.38	14.58	5270.00
19940704	50.25	46.54	3080.00	21.07	14.55	6030.00
19940705	50.24	46.40	2870.00	21.51	14.59	4680.00
19940706	50.23	46.44	2730.00	21.01	14.62	5130.00
19940707	50.35	46.60	2570.00	21.32	14.71	4770.00
19940708	50.37	46.43	2360.00	20.84	14.67	5340.00
19940709	50.36	46.33	2440.00	21.25	14.70	4670.00
19940710	50.34	46.37	2500.00	21.31	14.69	4390.00
19940711	50.31	46.39	2480.00	20.90	14.69	4260.00
19940712	50.27	46.40	2470.00	21.10	14.69	3420.00
19940713	50.23	46.44	2440.00	21.19	14.74	3920.00
19940714	50.18	46.38	2440.00	21.03	14.73	3280.00

19940715	50.16	46.35	2360.00	21.51	14.75	3920.00
19940716	50.15	46.34	2220.00	21.39	14.73	3670.00
19940717	50.12	46.35	2210.00	21.28	14.73	3510.00
19940718	50.07	46.37	2190.00	21.07	14.74	2690.00
19940719	49.99	46.37	2170.00	21.06	14.78	3170.00
19940720	49.97	46.37	2160.00	20.84	14.76	2810.00
19940721	50.02	46.45	1940.00	21.05	14.74	2330.00
19940722	50.02	46.38	1710.00	21.27	14.76	2840.00
19940723	50.01	46.39	1630.00	20.94	14.80	2210.00
19940724	50.02	46.32	1430.00	21.09	14.80	1850.00
19940725	50.04	46.36	1310.00	20.85	14.77	1620.00
19940726	50.07	46.34	1200.00	21.07	14.84	1440.00
19940727	50.09	46.34	961.00	21.08	14.86	1420.00
19940728	50.13	46.39	748.00	21.07	14.86	1800.00
19940729	50.19	46.38	542.00	21.25	14.86	1300.00
19940730	50.26	46.36	382.00	21.26	14.83	1400.00
19940731	50.39	46.39	269.00	21.20	14.79	1290.00
19940801	50.44	46.33	383.00	21.25	14.82	1470.00
19940802	50.48	46.29	583.00	21.10	14.87	1800.00
19940803	50.50	46.32	583.00	20.92	14.88	1380.00
19940804	50.52	46.32	584.00	21.12	14.90	956.00
19940805	50.55	46.34	746.00	21.39	14.92	1680.00
19940806	50.58	46.46	810.00	21.06	14.88	1910.00
19940807	50.62	46.42	818.00	20.82	14.90	1690.00
19940808	50.67	46.36	828.00	21.17	14.94	1860.00
19940809	50.70	46.32	835.00	21.12	14.98	2070.00
19940810	50.74	46.33	838.00	21.04	14.99	1650.00
19940811	50.80	46.33	844.00	21.06	15.04	1650.00
19940812	50.84	46.31	850.00	21.21	15.13	1840.00
19940813	50.94	46.31	858.00	21.14	15.14	1700.00
19940814	51.02	46.38	860.00	20.90	15.24	1540.00
19940815	51.13	46.35	1040.00	21.00	15.20	1390.00
19940816	51.24	46.35	1200.00	21.15	15.23	1580.00
19940817	51.33	46.31	1280.00	20.99	15.24	1610.00
19940818	51.41	46.32	1290.00	20.98	15.28	1610.00
19940819	51.45	46.37	1640.00	21.11	15.29	1450.00
19940820	51.49	46.36	1810.00	21.18	15.29	1700.00
19940821	51.54	46.32	1830.00	21.25	15.31	2300.00
19940822	51.52	46.42	2830.00	20.89	15.27	1570.00
19940823	51.48	46.38	3220.00	21.24	15.31	1940.00
19940824	51.50	46.46	3640.00	21.02	15.31	3960.00
19940825	51.39	46.53	4200.00	21.22	15.34	2400.00
19940826	51.30	46.56	4340.00	21.13	15.36	3670.00
19940827	51.25	46.56	4320.00	20.90	15.40	4450.00
19940828	51.20	46.56	4300.00	21.21	15.49	2750.00
19940829	51.17	46.51	4310.00	21.22	15.49	5810.00
19940830	51.09	46.49	4280.00	21.50	15.55	6310.00
19940831	51.02	46.49	4240.00	21.16	15.59	5190.00
19940901	50.95	46.50	4210.00	21.27	15.60	5380.00
19940902	50.94	46.50	3960.00	21.13	15.58	4840.00
19940903	50.93	46.46	3860.00	21.14	15.58	4710.00
19940904	50.92	46.43	3710.00	21.11	15.60	4850.00
19940905	50.87	46.44	3600.00	21.33	15.58	4200.00
19940906	50.79	46.44	3570.00	21.08	15.63	4750.00
19940907	50.71	46.44	3530.00	20.93	15.68	3610.00
19940908	50.68	46.42	3290.00	21.01	15.72	4310.00
19940909	50.65	46.41	3170.00	20.88	15.73	3390.00
19940910	50.59	46.41	3150.00	21.23	15.78	3940.00
19940911	50.58	46.42	2980.00	20.92	15.76	3600.00
19940912	50.60	46.40	2680.00	21.03	15.77	3350.00
19940913	50.64	46.44	2570.00	21.18	15.87	3390.00
19940914	50.66	46.45	2410.00	21.12	15.90	3470.00
19940915	50.71	46.40	2120.00	21.09	15.97	3200.00
19940916	50.87	46.38	2050.00	21.24	16.00	3830.00
19940917	50.94	46.38	1900.00	20.93	16.01	3350.00
19940918	51.04	46.46	1830.00	21.00	16.07	3070.00
19940919	51.14	46.37	1870.00	20.98	16.05	3150.00
19940920	51.26	46.34	1900.00	21.34	16.24	4050.00
19940921	51.37	46.33	1920.00	21.00	16.29	4110.00
19940922	51.43	46.37	2360.00	21.09	16.27	3420.00
19940923	51.43	46.40	2560.00	21.25	16.40	4010.00
19940924	51.51	46.43	2570.00	20.94	16.42	3960.00
19940925	51.55	46.47	3010.00	21.10	16.49	4230.00
19940926	51.56	46.53	3640.00	20.87	16.65	4770.00
19940927	51.39	46.59	4600.00	21.47	16.66	5580.00
19940928	51.30	46.61	4940.00	21.39	16.70	5730.00
19940929	51.28	46.56	4950.00	21.58	16.76	6110.00
19940930	51.43	46.51	4060.00	21.25	16.81	5760.00
19941001	51.30	46.49	1500.00	20.96	16.92	6640.00
19941002	51.31	46.60	4950.00	21.20	17.05	6950.00
19941003	51.40	46.62	4990.00	21.27	17.04	6800.00
19941004	51.51	46.61	5050.00	21.01	16.92	7200.00
19941005	51.53	46.57	5080.00	21.05	16.88	6330.00
19941006	51.57	46.46	5150.00	21.19	16.92	5590.00
19941007	51.61	46.42	4800.00	20.96	16.95	5590.00
19941008	51.61	46.47	1540.00	21.13	16.96	5910.00
19941009	51.71	46.39	4180.00	20.83	16.97	5050.00
19941010	51.61	46.54	4490.00	21.00	17.02	4680.00

19941011	51.62	46.54	4500.00	21.03	17.08	5550.00
19941012	51.55	46.52	4470.00	21.08	17.15	5180.00
19941013	51.48	46.51	4450.00	21.13	17.17	5350.00
19941014	51.50	46.52	4090.00	M	17.19	M
19941015	51.55	46.52	3830.00	M	17.04	M
19941016	51.48	46.44	3840.00	M	17.05	M
19941017	51.40	46.48	3550.00	M	17.11	M
19941018	51.39	46.49	3250.00	M	17.15	M
19941019	51.37	46.49	2920.00	M	17.16	M
19941020	51.36	46.44	2620.00	M	17.15	M
19941021	51.35	46.42	2290.00	M	17.16	M
19941022	51.31	46.38	2150.00	M	17.13	M
19941023	51.30	46.41	1970.00	M	17.08	M
19941024	51.32	46.33	1640.00	M	17.03	M
19941025	51.35	46.30	801.00	21.10	16.96	1800.00
19941026	51.41	46.36	.00	20.77	16.97	522.00
19941027	51.51	46.31	.00	21.13	16.88	2310.00
19941028	51.54	46.30	.00	21.34	16.89	2990.00
19941029	51.50	46.36	.00	21.15	16.96	2590.00
19941030	51.57	46.37	.00	21.29	16.94	2500.00
19941031	51.65	46.37	.00	21.20	17.02	3410.00
19941101	51.72	46.36	.00	21.09	16.96	2630.00
19941102	51.80	46.30	.00	21.12	16.79	2420.00
19941103	51.82	46.32	.00	21.28	16.79	2620.00
19941104	51.85	46.31	.00	21.21	16.79	2520.00
19941105	51.91	46.31	.00	21.17	16.77	2170.00
19941106	51.99	46.32	.00	21.30	16.72	2560.00
19941107	52.07	46.32	.00	21.06	16.66	2240.00
19941108	52.12	46.36	.00	21.16	16.67	2170.00
19941109	52.16	46.33	.00	21.25	16.68	2490.00
19941110	52.20	46.29	.00	21.12	16.67	2410.00
19941111	52.29	46.31	.00	21.09	16.59	2260.00
19941112	52.34	46.29	481.00	21.01	16.48	2270.00
19941113	52.36	46.30	702.00	21.01	16.43	2160.00
19941114	52.42	46.25	708.00	21.11	16.24	2630.00
19941115	52.38	46.30	2150.00	21.17	16.70	3470.00
19941116	52.50	46.68	4640.00	21.16	17.20	6150.00
19941117	52.26	47.14	6890.00	21.13	16.94	6620.00
19941118	52.07	47.66	7180.00	21.42	17.08	8830.00
19941119	52.08	47.71	7150.00	21.26	17.15	9610.00
19941120	52.08	47.70	7160.00	21.08	17.18	9130.00
19941121	52.04	47.65	7160.00	21.13	17.27	9430.00
19941122	51.93	47.69	7450.00	20.97	17.25	8950.00
19941123	51.73	47.94	7770.00	21.16	17.17	8920.00
19941124	51.64	47.95	7660.00	21.00	17.15	9060.00
19941125	51.50	47.89	7580.00	20.95	17.26	8900.00
19941126	51.56	47.68	7150.00	20.91	17.26	8690.00
19941127	51.56	47.42	6960.00	20.87	17.31	8120.00
19941128	51.65	47.16	6490.00	21.00	17.34	7850.00
19941129	51.72	46.83	6310.00	20.98	17.34	7380.00
19941130	51.73	46.74	6360.00	20.89	17.28	6920.00
19941201	51.86	46.59	5800.00	20.90	17.20	6500.00
19941202	51.97	46.50	4930.00	21.01	17.28	6300.00
19941203	52.02	46.57	4660.00	20.85	17.31	5200.00
19941204	52.05	46.57	4240.00	21.13	17.37	4790.00
19941205	52.13	46.54	4040.00	21.02	17.39	4760.00
19941206	52.19	46.52	3630.00	20.89	17.32	3580.00
19941207	52.22	46.48	3410.00	21.14	17.31	4090.00
19941208	52.25	46.49	3060.00	21.00	17.26	3200.00
19941209	52.26	46.43	2750.00	21.12	17.33	3590.00
19941210	52.26	46.40	2760.00	20.94	17.32	3090.00
19941211	52.36	46.38	2330.00	20.93	17.21	2170.00
19941212	52.43	46.35	1680.00	21.07	17.16	2900.00
19941213	52.49	46.39	1410.00	20.78	17.12	1380.00
19941214	52.51	46.37	1410.00	21.19	17.05	893.00
19941215	52.54	46.34	1420.00	21.15	16.98	1780.00
19941216	52.48	46.32	1410.00	21.07	17.04	1750.00
19941217	52.45	46.35	1410.00	20.91	17.06	1380.00
19941218	52.43	46.31	1410.00	21.00	17.04	1280.00
19941219	52.46	M	1170.00	20.98	16.86	1190.00
19941220	52.40	46.39	978.00	21.00	16.94	969.00
19941221	52.48	46.39	2650.00	21.04	16.87	2930.00
19941222	52.19	46.60	5530.00	20.89	17.24	3380.00
19941223	52.21	46.63	5900.00	21.24	17.14	5760.00
19941224	52.25	46.50	4690.00	21.05	17.24	6180.00
19941225	52.27	46.53	3660.00	20.95	17.33	5390.00
19941226	52.38	46.50	3030.00	20.96	17.27	4720.00
19941227	52.43	46.40	2800.00	20.88	17.23	3950.00
19941228	52.44	46.41	2380.00	20.96	17.27	3370.00
19941229	52.43	46.42	2100.00	21.07	17.31	3050.00
19941230	52.43	46.46	2090.00	20.91	17.28	2740.00
19941231	52.43	46.39	2100.00	21.20	17.28	2510.00

APPENDIX B

Table B-1. Stages and Mean Daily Discharge for St. Lucie and Caloosahatchee Waterways and Fisheating Creek

	S77			S308		FISHEATING CREEK
	HW	FLOW	HW	TW	FLOW	STAGE
DBKEYS	00852	00853	00276	00278	00277	00090
DATE						
19940501	10.92	.00	14.13	14.14	-582.00	22.00
19940502	10.86	100.00	14.16	14.15	-114.00	20.00
19940503	10.81	297.00	14.16	14.15	251.00	20.00
19940504	10.86	711.00	14.21	14.29	-2900.00	20.00
19940505	11.16	764.00	14.24	14.20	2160.00	19.00
19940506	10.92	267.00	14.13	14.07	2530.00	17.00
19940507	10.93	924.00	14.07	14.06	508.00	15.00
19940508	11.14	860.00	14.11	14.15	-1400.00	13.00
19940509	11.10	388.00	14.14	14.12	1680.00	12.00
19940510	11.03	806.00	14.10	14.09	775.00	9.90
19940511	11.12	664.00	14.06	14.04	1530.00	8.60
19940512	11.09	391.00	14.03	14.01	498.00	7.30
19940513	11.03	459.00	14.01	13.98	813.00	6.30
19940514	11.09	586.00	13.96	13.91	2430.00	5.30
19940515	11.10	547.00	13.90	13.87	1260.00	4.50
19940516	11.15	372.00	13.87	13.86	348.00	3.80
19940517	11.04	374.00	13.86	13.88	-838.00	3.20
19940518	11.08	378.00	13.88	13.87	543.00	4.30
19940519	11.27	270.00	13.88	13.91	-1200.00	2.50
19940520	11.17	301.00	13.87	13.87	-36.00	2.00
19940521	11.28	353.00	13.84	13.84	-359.00	15.00
19940522	11.06	203.00	13.83	13.81	1360.00	15.00
19940523	10.94	460.00	13.83	13.83	-538.00	7.30
19940524	11.07	302.00	13.79	13.80	-1030.00	.72
19940525	10.91	909.00	13.75	13.78	-1760.00	.63
19940526	11.19	644.00	13.71	13.74	-1710.00	.57
19940527	11.12	566.00	13.70	13.70	350.00	.50
19940528	11.12	565.00	13.69	13.67	1390.00	.43
19940529	11.11	546.00	13.62	13.58	1980.00	1.20
19940530	11.21	355.00	13.63	13.66	-1390.00	4.60
19940531	11.15	354.00	13.66	13.65	292.00	4.60
19940601	11.17	.00	13.66	13.65	623.00	7.50
19940602	11.20	.00	13.65	13.66	-747.00	7.80
19940603	11.01	.00	13.66	13.70	-1680.00	7.10
19940604	11.07	.00	13.74	13.82	-1950.00	11.00
19940605	11.30	.00	13.88	13.93	-1350.00	13.00
19940606	11.22	.00	13.92	13.96	-1520.00	15.00
19940607	11.26	.00	13.99	14.02	-1280.00	26.00
19940608	11.26	.00	14.03	14.06	-1030.00	43.00
19940609	11.17	.00	14.07	14.09	-936.00	55.00
19940610	10.90	.00	14.12	14.14	-802.00	61.00
19940611	11.17	.00	14.15	14.17	-1190.00	68.00
19940612	11.06	.00	14.14	14.15	-963.00	96.00
19940613	M	.00	14.14	14.15	-826.00	112.00
19940614	M	.00	14.15	14.16	-905.00	114.00
19940615	M	.00	14.12	14.14	-893.00	152.00
19940616	M	.00	14.11	14.12	-1140.00	201.00
19940617	M	.00	14.12	14.14	-1450.00	251.00
19940618	M	.00	14.16	14.18	-1550.00	329.00
19940619	M	.00	14.25	14.27	-1590.00	453.00
19940620	M	.00	14.28	14.30	-1380.00	482.00
19940621	M	.00	14.32	14.35	-1320.00	425.00
19940622	M	.00	14.38	14.41	-1790.00	385.00
19940623	M	.00	14.41	14.43	-1510.00	354.00
19940624	M	.00	14.45	14.47	-1260.00	381.00
19940625	M	.00	14.47	14.48	-1250.00	458.00
19940626	M	.00	14.43	14.44	-982.00	495.00
19940627	M	.00	14.46	14.47	-845.00	487.00
19940628	M	.00	14.48	14.49	-635.00	475.00
19940629	M	.00	14.50	14.51	-933.00	441.00
19940630	M	.00	14.52	14.52	-132.00	428.00
19940701	M	.00	14.57	14.63	-820.00	409.00
19940702	M	.00	14.62	14.73	.00	435.00
19940703	M	.00	14.66	14.57	.00	423.00
19940704	M	.00	14.70	14.50	.00	434.00
19940705	M	.00	14.71	14.30	.00	370.00
19940706	M	.00	14.78	14.29	.00	311.00
19940707	M	.00	14.77	14.24	.00	257.00
19940708	M	.00	14.77	14.37	.00	221.00
19940709	M	.00	14.79	14.13	.00	206.00
19940710	M	.00	14.80	14.04	.00	206.00
19940711	M	.00	14.83	14.18	.00	218.00
19940712	11.04	.00	14.86	14.07	.00	218.00
19940713	11.21	.00	14.89	14.25	.00	196.00
19940714	10.96	.00	14.91	14.43	.00	164.00
19940715	11.24	.00	14.91	14.16	.00	134.00
19940716	11.07	.00	14.93	14.51	.00	105.00
19940717	11.07	.00	14.91	14.29	.00	83.00

19940718	11.19	.00	14.92	14.28	.00	65.00
19940719	11.25	.00	14.94	14.31	.00	51.00
19940720	11.23	.00	14.94	14.28	.00	44.00
19940721	10.85	.00	14.96	14.20	.00	41.00
19940722	11.12	.00	14.95	14.26	.00	44.00
19940723	11.08	.00	14.95	14.26	.00	51.00
19940724	11.20	.00	14.98	14.24	.00	61.00
19940725	11.03	.00	14.99	14.24	.00	75.00
19940726	11.01	.00	15.00	14.38	.00	91.00
19940727	11.13	.00	15.00	14.15	.00	117.00
19940728	11.20	.00	15.00	14.02	.00	155.00
19940729	11.20	.00	15.01	14.40	.00	195.00
19940730	11.10	.00	15.03	13.76	.00	210.00
19940731	10.99	.00	15.01	14.31	.00	245.00
19940801	10.98	.00	15.01	14.20	.00	281.00
19940802	11.21	.00	15.04	14.22	.00	330.00
19940803	10.91	.00	15.05	14.27	.00	328.00
19940804	11.23	.00	15.07	14.29	.00	374.00
19940805	11.11	.00	15.12	14.29	.00	498.00
19940806	11.10	.00	15.17	14.19	.00	554.00
19940807	11.18	.00	15.18	14.21	.00	588.00
19940808	10.94	.00	15.21	14.13	.00	519.00
19940809	11.01	.00	15.16	14.15	.00	482.00
19940810	11.27	.00	15.13	14.16	.00	511.00
19940811	11.27	.00	15.14	14.35	.00	561.00
19940812	11.13	.00	15.13	14.30	.00	543.00
19940813	11.21	.00	15.17	14.25	.00	497.00
19940814	11.01	.00	15.25	14.28	.00	456.00
19940815	11.25	.00	15.30	14.40	.00	419.00
19940816	11.26	.00	15.34	14.31	.00	368.00
19940817	11.08	.00	15.38	14.28	.00	319.00
19940818	10.95	.00	15.39	14.26	.00	278.00
19940819	11.16	.00	15.40	14.49	.00	246.00
19940820	11.25	.00	15.40	14.55	.00	224.00
19940821	10.96	.00	15.41	14.34	.00	217.00
19940822	10.99	.00	15.46	14.20	.00	238.00
19940823	11.18	.00	15.47	14.34	.00	380.00
19940824	11.25	.00	15.47	14.33	.00	777.00
19940825	10.92	.00	15.47	14.27	.00	868.00
19940826	11.09	.00	15.51	14.38	.00	807.00
19940827	11.17	.00	15.56	14.24	.00	718.00
19940828	10.99	.00	15.62	14.42	.00	684.00
19940829	11.24	.00	15.67	14.15	.00	765.00
19940830	11.16	.00	15.72	14.12	.00	900.00
19940831	11.06	.00	15.75	14.12	.00	965.00
19940901	10.87	.00	15.77	M	.00	983.00
19940902	10.98	.00	15.78	M	.00	1030.00
19940903	11.03	.00	15.81	M	.00	1020.00
19940904	11.21	.00	15.81	M	.00	987.00
19940905	11.29	.00	15.80	M	.00	1110.00
19940906	11.25	.00	15.83	M	.00	1380.00
19940907	11.07	.00	15.84	M	.00	1390.00
19940908	11.18	.00	15.86	M	.00	1290.00
19940909	10.93	.00	15.91	M	.00	1130.00
19940910	11.16	.00	15.91	M	.00	1010.00
19940911	11.28	.00	15.91	M	.00	937.00
19940912	10.99	.00	15.90	M	.00	931.00
19940913	11.16	.00	15.92	M	.00	965.00
19940914	10.97	.00	15.99	M	.00	957.00
19940915	11.30	.00	16.07	M	.00	969.00
19940916	11.36	.00	16.13	M	.00	990.00
19940917	11.36	.00	16.16	M	.00	1100.00
19940918	11.12	.00	16.23	M	.00	1590.00
19940919	11.39	.00	16.26	M	.00	2070.00
19940920	11.13	.00	16.38	M	.00	2110.00
19940921	11.07	579.00	16.47	M	.00	2120.00
19940922	10.92	2050.00	16.50	M	.00	2480.00
19940923	10.95	3200.00	16.54	M	303.00	2650.00
19940924	11.23	3060.00	16.59	M	67.00	2440.00
19940925	11.26	1870.00	16.63	M	.00	2280.00
19940926	11.26	1390.00	16.74	M	.00	2070.00
19940927	10.98	1620.00	16.82	M	.00	1910.00
19940928	11.01	1230.00	16.86	M	.00	2040.00
19940929	11.01	962.00	16.90	M	.00	2240.00
19940930	10.93	1260.00	16.93	M	.00	2160.00
19941001	10.90	1830.00	16.96	M	517.00	1960.00
19941002	10.99	3750.00	17.03	M	607.00	1760.00
19941003	11.38	5830.00	17.11	M	1030.00	1590.00
19941004	11.56	5950.00	17.17	M	715.00	1430.00
19941005	11.31	4980.00	17.18	M	297.00	1290.00
19941006	11.20	3880.00	17.14	M	112.00	1170.00
19941007	11.14	2860.00	17.13	M	14.00	1060.00
19941008	11.12	1830.00	17.11	M	.00	966.00
19941009	10.88	983.00	17.14	M	.00	877.00
19941010	11.06	1420.00	17.14	M	638.00	796.00
19941011	11.21	3750.00	17.20	M	1750.00	728.00
19941012	11.51	5810.00	17.29	M	805.00	718.00
19941013	11.46	5810.00	17.38	M	273.00	846.00

19941014	11.27	4780.00	17.44	M	342.00	900.00
19941015	11.16	3750.00	17.50	M	94.00	840.00
19941016	11.14	2730.00	17.42	M	.00	716.00
19941017	11.05	1700.00	17.30	M	.00	588.00
19941018	10.93	854.00	17.34	M	207.00	544.00
19941019	10.89	1300.00	17.33	M	57.00	475.00
19941020	10.91	3750.00	17.35	M	1060.00	422.00
19941021	11.39	5520.00	17.35	M	2220.00	376.00
19941022	11.35	5880.00	17.32	M	2110.00	333.00
19941023	11.44	5810.00	17.29	M	1630.00	293.00
19941024	11.33	4840.00	17.24	M	1050.00	254.00
19941025	11.24	3880.00	17.21	M	961.00	220.00
19941026	11.16	2860.00	17.19	M	892.00	190.00
19941027	11.16	1770.00	17.18	M	206.00	170.00
19941028	10.94	914.00	17.18	M	55.00	156.00
19941029	10.94	642.00	17.16	M	212.00	142.00
19941030	11.13	1180.00	17.16	M	1040.00	135.00
19941031	11.29	3120.00	17.20	M	248.00	146.00
19941101	11.48	4920.00	17.21	M	1200.00	141.00
19941102	11.45	4720.00	17.09	M	800.00	143.00
19941103	11.32	3750.00	17.01	M	537.00	148.00
19941104	11.21	2980.00	16.96	M	535.00	152.00
19941105	11.18	2210.00	16.95	M	277.00	154.00
19941106	11.10	1440.00	16.95	M	228.00	154.00
19941107	11.00	846.00	16.91	M	540.00	148.00
19941108	10.95	642.00	16.87	M	145.00	135.00
19941109	11.08	642.00	16.86	M	.00	117.00
19941110	11.06	642.00	16.87	M	935.00	101.00
19941111	11.18	1600.00	16.85	M	1630.00	91.00
19941112	11.24	2350.00	16.77	M	1720.00	81.00
19941113	11.33	1980.00	16.64	M	1110.00	72.00
19941114	11.31	4450.00	16.48	M	449.00	66.00
19941115	11.03	3550.00	16.62	M	104.00	77.00
19941116	11.06	2650.00	17.17	M	.00	167.00
19941117	11.11	1950.00	17.37	M	.00	189.00
19941118	11.00	1210.00	17.40	M	.00	191.00
19941119	11.35	2340.00	17.43	M	429.00	207.00
19941120	11.40	3780.00	17.49	M	1290.00	285.00
19941121	11.59	4620.00	17.49	M	1340.00	420.00
19941122	11.30	4620.00	17.49	M	1620.00	451.00
19941123	11.52	4620.00	17.48	M	1660.00	420.00
19941124	11.39	4620.00	17.40	M	1750.00	370.00
19941125	11.34	4620.00	17.48	M	2010.00	323.00
19941126	11.24	4620.00	17.50	M	1910.00	279.00
19941127	11.38	4620.00	17.50	M	2050.00	238.00
19941128	11.45	4620.00	17.51	M	2160.00	206.00
19941129	11.40	4620.00	17.52	M	2290.00	177.00
19941130	11.50	4620.00	17.51	M	2270.00	150.00
19941201	11.39	4620.00	17.48	M	2170.00	125.00
19941202	11.42	4620.00	17.48	M	1540.00	111.00
19941203	11.50	4620.00	17.51	M	1840.00	107.00
19941204	11.41	4620.00	17.50	M	1980.00	96.00
19941205	11.43	4620.00	17.56	M	1650.00	94.00
19941206	11.52	4620.00	17.57	M	1720.00	99.00
19941207	11.43	4620.00	17.57	M	1990.00	105.00
19941208	11.47	4620.00	17.53	M	1880.00	112.00
19941209	11.49	4620.00	17.53	M	1950.00	116.00
19941210	11.51	4620.00	17.53	M	2060.00	116.00
19941211	11.41	4620.00	17.56	M	2120.00	119.00
19941212	11.34	4620.00	17.46	M	2080.00	135.00
19941213	11.48	4620.00	17.45	M	2170.00	140.00
19941214	11.48	4620.00	17.42	M	2250.00	140.00
19941215	11.40	4620.00	17.35	M	2270.00	134.00
19941216	11.32	4640.00	17.33	M	2340.00	124.00
19941217	11.46	4750.00	17.32	M	2350.00	116.00
19941218	11.50	4750.00	17.31	M	2320.00	109.00
19941219	11.57	4750.00	17.21	M	2310.00	100.00
19941220	11.57	4850.00	17.18	M	2380.00	91.00
19941221	11.75	4880.00	17.27	M	1230.00	180.00
19941222	11.81	4880.00	17.60	M	553.00	318.00
19941223	11.68	4880.00	17.86	M	826.00	395.00
19941224	11.50	4880.00	17.75	M	1420.00	462.00
19941225	11.69	4880.00	17.64	M	1750.00	602.00
19941226	11.48	4880.00	17.60	M	1790.00	715.00
19941227	11.55	4880.00	17.58	M	1980.00	704.00
19941228	11.41	4880.00	17.55	M	2080.00	651.00
19941229	11.41	4880.00	17.54	M	2080.00	589.00
19941230	11.53	4880.00	17.52	M	2120.00	528.00
19941231	11.56	4880.00	17.50	M	2190.00	469.00

APPENDIX C

Table C-1. Stages(ft) and Mean Daily Discaharge (cfs) for the Eaa from the Lake

FLOW	HW	S-2 HW	TW	TW (NNR) FLOW	TW (HILLS)	S-3	FLOW		S-352 (HGS5X) HW	TW
DBKEYS	00425	00432	00345	00426	00532	00537	00539	00311	00315	00313
DATE										
19940501	14.25	10.35	10.40	.00	14.18	10.61	146.00	14.13	10.26	.00
19940502	14.25	10.23	10.28	.00	14.16	10.32	151.00	14.14	10.03	.00
19940503	14.17	10.70	10.74	.00	14.09	10.20	293.00	14.12	10.19	.00
19940504	14.25	10.89	10.93	.00	14.08	10.97	179.00	14.24	11.07	.00
19940505	14.33	10.68	10.72	.00	14.21	10.73	89.00	14.20	10.70	.00
19940506	14.25	10.63	10.68	116.00	14.17	10.43	247.00	14.07	10.71	.00
19940507	14.15	10.64	10.68	218.00	14.04	10.26	384.00	14.04	10.99	.00
19940508	14.16	10.29	10.34	172.00	14.01	9.98	361.00	14.12	11.07	.00
19940509	14.19	10.28	10.33	452.00	14.06	10.19	703.00	14.12	11.06	.00
19940510	14.16	10.70	10.75	501.00	14.05	10.78	733.00	14.08	11.20	.00
19940511	14.17	10.81	10.85	437.00	14.08	11.02	664.00	14.05	11.37	.00
19940512	14.10	10.87	10.91	779.00	14.01	10.99	796.00	14.00	11.21	198.00
19940513	14.02	10.96	11.00	1240.00	13.92	11.17	879.00	13.94	11.40	470.00
19940514	13.94	11.19	11.22	1360.00	13.90	11.35	817.00	13.88	11.46	544.00
19940515	13.88	11.28	11.31	1240.00	13.84	11.48	765.00	13.84	11.40	546.00
19940516	13.85	11.18	11.22	1180.00	13.79	11.35	798.00	13.81	11.35	550.00
19940517	13.83	11.04	11.08	1150.00	13.76	11.32	805.00	13.83	11.27	560.00
19940518	13.92	11.42	11.47	330.00	13.85	10.90	300.00	13.87	10.96	160.00
19940519	13.94	11.19	11.24	.00	13.88	9.87	23.00	13.90	10.45	.00
19940520	14.29	11.08	11.12	.00	14.28	9.66	460.00	13.99	10.15	.00
19940521	14.20	10.86	10.90	.00	14.16	10.76	810.00	13.93	10.38	.00
19940522	14.10	10.65	10.70	.00	14.04	11.06	716.00	13.86	10.99	.00
19940523	13.82	10.57	10.61	628.00	13.74	11.02	764.00	13.76	11.13	482.00
19940524	13.73	10.94	10.98	1080.00	13.67	11.01	892.00	13.56	11.31	802.00
19940525	13.67	11.12	11.15	1500.00	13.60	11.06	1020.00	13.62	11.50	924.00
19940526	13.62	11.42	11.44	1580.00	13.55	11.41	975.00	13.60	11.94	898.00
19940527	13.68	11.51	11.54	1060.00	13.59	11.48	747.00	13.64	11.98	758.00
19940528	13.67	11.12	11.16	737.00	13.58	11.09	645.00	13.63	11.75	720.00
19940529	13.64	10.99	11.03	674.00	13.58	10.92	656.00	13.55	11.57	738.00
19940530	13.64	10.96	11.00	625.00	13.54	11.12	601.00	13.62	11.61	744.00
19940531	13.65	11.07	11.11	569.00	13.53	11.19	404.00	13.62	11.46	528.00
19940601	13.67	11.53	11.58	224.00	13.58	11.36	328.00	13.63	11.15	292.00
19940602	13.68	11.62	11.67	.00	13.60	11.28	96.00	13.64	11.22	.00
19940603	13.74	10.76	10.82	.00	13.66	10.68	80.00	13.69	9.83	.00
19940604	13.74	11.44	11.50	.00	13.66	10.17	60.00	13.76	10.88	.00
19940605	13.87	11.05	11.11	.00	13.77	9.89	50.00	13.87	11.06	.00
19940606	13.89	10.75	10.81	.00	13.80	10.39	50.00	13.89	11.32	.00
19940607	13.90	10.59	10.64	.00	13.81	10.93	13.00	13.93	11.33	.00
19940608	13.96	10.22	10.28	.00	13.87	10.75	49.00	13.99	10.32	.00
19940609	14.06	10.76	10.81	.00	13.98	10.19	40.00	14.02	9.22	.00
19940610	14.16	12.13	12.19	.00	14.08	10.41	40.00	14.12	10.68	.00
19940611	14.17	11.38	11.44	.00	14.09	10.88	40.00	14.15	9.54	.00
19940612	14.16	10.05	10.12	.00	14.09	10.83	40.00	14.13	9.27	.00
19940613	14.17	10.62	10.68	.00	14.09	10.44	41.00	14.13	11.06	.00
19940614	14.17	10.75	10.80	.00	14.10	10.25	50.00	14.14	10.70	.00
19940615	14.14	10.29	10.34	779.00	14.08	9.85	435.00	14.11	10.20	.00
19940616	14.14	10.48	10.53	928.00	14.07	10.68	539.00	14.10	10.22	.00
19940617	14.17	10.51	10.57	496.00	14.10	10.90	349.00	14.12	10.47	.00
19940618	14.20	10.92	10.97	.00	14.14	10.88	40.00	14.16	10.86	.00
19940619	14.23	11.39	11.44	.00	14.15	10.90	40.00	14.24	10.44	.00
19940620	14.30	11.41	11.45	.00	14.21	11.41	40.00	14.28	9.92	.00
19940621	14.32	9.72	9.79	.00	14.23	10.25	40.00	14.32	9.94	.00

19940622	14.32	10.92	10.97	.00	14.23	10.13	40.00	14.37	9.93	.00
19940623	14.36	11.94	11.98	.00	14.27	12.05	-174.00	14.39	9.71	.00
19940624	14.37	10.63	10.68	.00	14.28	11.33	40.00	14.42	10.00	.00
19940625	14.42	9.73	9.78	.00	14.35	10.34	40.00	14.44	9.52	.00
19940626	14.43	10.47	10.53	.00	14.38	11.02	35.00	14.41	9.56	.00
19940627	14.46	10.46	10.51	.00	14.39	10.65	40.00	14.45	9.82	.00
19940628	14.54	10.26	10.33	.00	14.48	10.16	40.00	14.48	9.90	.00
19940629	14.49	10.07	10.13	.00	14.43	10.45	40.00	14.48	9.87	.00
19940630	14.55	9.99	10.04	.00	14.48	10.95	40.00	14.51	9.91	.00
19940701	14.57	9.84	9.90	.00	14.49	10.63	19.00	14.55	9.96	.00
19940702	14.60	10.26	10.31	.00	14.52	10.83	35.00	14.58	9.88	.00
19940703	14.62	11.38	11.41	.00	14.54	10.84	2.20	14.62	10.53	.00
19940704	14.72	11.90	11.93	.00	14.65	10.23	30.00	14.68	10.86	.00
19940705	14.77	11.03	11.08	.00	14.70	10.96	30.00	14.72	9.45	.00
19940706	14.81	10.50	10.54	.00	14.73	10.83	30.00	14.77	10.25	.00
19940707	14.77	10.52	10.56	.00	14.72	10.87	35.00	14.73	10.59	.00
19940708	14.79	9.92	9.97	.00	14.74	10.65	15.00	14.75	10.48	.00
19940709	14.83	10.30	10.34	.00	14.77	10.61	30.00	14.76	10.07	.00
19940710	14.83	10.63	10.69	.00	14.77	10.77	30.00	14.78	9.89	.00
19940711	14.88	10.64	10.69	.00	14.81	10.69	21.00	14.83	9.90	.00
19940712	14.87	10.67	10.72	.00	14.80	10.39	30.00	14.85	10.05	.00
19940713	14.93	10.64	10.70	.00	14.86	10.25	30.00	14.88	9.99	.00
19940714	14.95	10.91	10.95	.00	14.88	10.15	30.00	14.90	10.12	.00
19940715	14.95	10.56	10.61	.00	14.87	9.81	30.00	14.91	9.99	.00
19940716	14.97	10.27	10.33	.00	14.90	9.83	30.00	14.93	9.78	.00
19940717	14.96	10.01	10.07	.00	14.89	10.05	30.00	14.92	9.61	.00
19940718	14.95	9.85	9.90	.00	14.87	10.28	30.00	14.89	9.48	.00
19940719	14.91	9.91	9.96	.00	14.83	10.35	27.00	14.88	9.56	.00
19940720	14.92	10.03	10.08	.00	14.85	10.29	30.00	14.88	9.97	.00
19940721	14.97	9.94	9.99	.00	14.90	10.07	30.00	14.97	10.09	.00
19940722	14.98	10.18	10.24	.00	14.91	9.56	30.00	14.97	9.96	.00
19940723	14.94	9.99	10.05	.00	14.86	9.38	30.00	14.97	10.27	.00
19940724	14.93	9.90	9.95	.00	14.84	9.59	380.00	14.99	10.49	.00
19940725	14.98	10.20	10.25	.00	14.90	10.48	403.00	15.02	10.77	.00
19940726	14.98	10.61	10.66	.00	14.91	10.46	30.00	15.01	10.58	.00
19940727	14.96	10.84	10.89	.00	14.87	10.79	30.00	15.00	10.51	.00
19940728	14.95	11.02	11.07	.00	14.87	10.96	30.00	14.98	10.45	.00
19940729	14.96	12.11	12.15	.00	14.88	11.10	30.00	15.03	11.50	.00
19940730	15.04	10.95	11.00	.00	14.98	10.32	30.00	15.03	10.46	.00
19940731	15.05	11.42	11.47	.00	15.00	11.08	30.00	15.02	11.23	.00
19940801	15.03	10.13	10.18	.00	15.00	10.65	47.00	15.05	9.37	.00
19940802	15.09	10.97	10.98	.00	15.06	11.05	30.00	15.08	10.76	.00
19940803	15.06	10.74	10.79	.00	15.04	10.60	30.00	15.07	10.44	.00
19940804	15.07	10.70	10.75	.00	15.04	10.10	30.00	15.09	10.85	.00
19940805	15.08	10.24	10.29	.00	15.04	9.67	16.00	15.13	10.72	.00
19940806	15.16	10.42	10.48	.00	15.11	9.46	30.00	15.19	10.49	.00
19940807	15.15	10.73	10.78	.00	15.10	10.01	30.00	15.20	10.77	.00
19940808	15.20	10.62	10.67	.00	15.15	10.70	32.00	15.23	10.58	.00
19940809	15.17	10.67	10.72	.00	15.14	10.99	40.00	15.19	M	.00
19940810	15.20	10.36	10.39	.00	15.18	9.94	30.00	15.19	M	.00
19940811	15.19	11.15	11.20	.00	15.17	10.37	30.00	15.18	M	.00
19940812	15.19	11.16	11.14	.00	15.17	10.38	30.00	15.19	M	.00
19940813	15.24	12.09	12.11	.00	15.21	10.22	30.00	15.26	M	.00
19940814	15.25	12.12	12.14	.00	15.21	9.99	30.00	15.31	M	.00
19940815	15.29	11.63	11.69	.00	15.26	9.89	32.00	15.34	M	.00
19940816	15.32	10.61	10.67	.00	15.28	10.32	10.00	15.39	M	.00
19940817	15.39	10.03	10.09	.00	15.35	10.59	12.00	15.43	M	.00
19940818	15.41	10.49	10.53	.00	15.39	10.54	30.00	15.43	M	.00
19940819	15.45	11.01	11.06	.00	15.42	10.60	44.00	15.46	M	.00
19940820	15.45	11.48	11.52	.00	15.41	11.15	30.00	15.46	M	.00
19940821	15.44	11.11	11.15	.00	15.40	10.35	21.00	15.48	M	.00
19940822	15.49	11.08	11.08	.00	15.44	9.93	13.00	15.50	M	.00
19940823	15.51	11.63	11.65	.00	15.47	10.28	14.00	15.51	M	.00
19940824	15.56	11.02	11.05	.00	15.53	10.47	53.00	15.54	M	.00

19940825	15.59	11.10	11.07	.00	15.57	11.17	50.00	15.52	M	.00
19940826	15.58	11.11	11.15	.00	15.56	11.39	50.00	15.54	M	.00
19940827	15.59	11.06	11.07	.00	15.54	11.24	50.00	15.58	M	.00
19940828	15.62	11.45	11.47	.00	15.59	11.47	50.00	15.64	M	.00
19940829	15.71	11.34	11.37	.00	15.68	11.06	50.00	15.70	M	.00
19940830	15.73	10.91	10.94	.00	15.68	10.90	48.00	15.71	M	.00
19940831	15.72	10.55	10.59	-144.00	15.69	11.25	22.00	15.74	M	.00
19940901	15.74	10.23	10.28	.00	15.70	10.97	36.00	15.75	M	.00
19940902	15.78	10.44	10.49	.00	15.73	10.88	30.00	15.77	M	.00
19940903	15.80	10.76	10.81	.00	15.75	10.68	35.00	15.81	M	.00
19940904	15.87	10.98	11.03	.00	15.82	10.90	40.00	15.82	M	.00
19940905	15.90	11.42	11.47	.00	15.87	11.41	50.00	15.82	M	.00
19940906	15.89	11.22	11.26	.00	15.85	11.40	-259.00	15.83	M	.00
19940907	15.88	10.81	10.84	.00	15.83	11.00	41.00	15.84	M	.00
19940908	15.88	10.82	10.86	.00	15.84	10.91	47.00	15.85	M	.00
19940909	15.94	11.60	11.64	.00	15.89	11.29	50.00	15.89	M	.00
19940910	15.94	10.33	10.39	.00	15.90	10.70	50.00	15.92	M	.00
19940911	16.01	10.94	10.98	.00	15.98	11.26	50.00	15.95	M	.00
19940912	16.03	11.12	11.17	.00	16.02	10.75	60.00	15.95	M	.00
19940913	16.04	10.65	10.70	.00	16.04	11.29	47.00	15.95	M	.00
19940914	16.06	10.73	10.78	.00	16.03	11.12	39.00	16.01	M	.00
19940915	16.10	10.55	10.59	.00	16.07	11.33	60.00	16.08	M	.00
19940916	16.17	10.53	10.57	.00	16.13	11.61	64.00	16.14	M	.00
19940917	16.21	10.91	10.94	.00	16.16	10.50	50.00	16.17	M	.00
19940918	16.22	11.77	11.80	.00	16.16	10.21	10.00	16.21	M	.00
19940919	16.32	11.37	11.41	.00	16.24	10.60	60.00	16.26	M	.00
19940920	16.43	11.57	11.62	.00	16.37	11.64	60.00	16.38	M	.00
19940921	16.55	12.24	12.28	.00	16.50	12.50	-318.00	16.51	M	.00
19940922	16.66	11.83	11.88	.00	16.62	11.77	-360.00	16.56	M	.00
19940923	16.62	10.87	10.92	.00	16.56	11.19	34.00	16.58	M	.00
19940924	16.63	9.98	10.05	.00	16.58	10.19	50.00	16.61	M	.00
19940925	16.71	9.95	10.01	.00	16.66	10.00	50.00	16.67	M	.00
19940926	16.80	10.56	10.60	747.00	16.75	9.95	58.00	16.78	M	266.00
19940927	16.87	11.03	11.06	866.00	16.81	9.97	50.00	16.83	M	378.00
19940928	16.95	10.53	10.58	.00	16.88	10.43	50.00	16.90	M	.00
19940929	16.98	11.25	11.28	1060.00	16.92	10.12	60.00	16.92	10.17	296.00
19940930	17.00	11.36	11.41	762.00	16.95	10.03	60.00	16.94	10.53	230.00
19941001	M	9.90	9.96	.00	16.94	9.91	30.00	16.98	9.26	.00
19941002	M	11.09	11.14	445.00	16.96	10.11	30.00	17.05	10.52	228.00
19941003	M	11.41	11.46	702.00	16.98	10.09	30.00	17.15	11.32	564.00
19941004	M	11.56	11.60	628.00	17.11	10.15	30.00	17.17	11.30	636.00
19941005	M	11.70	11.74	577.00	17.21	10.36	30.00	17.18	11.23	640.00
19941006	M	11.20	11.23	1050.00	17.17	9.92	30.00	17.14	11.28	770.00
19941007	M	11.43	11.45	1510.00	17.14	9.77	30.00	17.13	11.70	814.00
19941008	M	11.45	11.47	1560.00	17.15	9.54	30.00	17.11	11.38	838.00
19941009	M	11.19	11.21	1530.00	17.14	9.80	30.00	17.14	11.26	848.00
19941010	M	11.49	11.51	1260.00	17.11	10.10	30.00	17.14	11.41	748.00
19941011	M	12.42	12.49	-336.00	17.18	11.16	30.00	17.22	10.96	.00
19941012	M	11.55	11.67	-1570.00	17.25	11.58	30.00	17.30	11.01	.00
19941013	M	10.74	10.89	-1790.00	17.34	11.36	30.00	17.38	11.28	.00
19941014	M	11.15	11.22	-291.00	17.38	10.56	30.00	17.44	10.21	.00
19941015	M	10.53	10.59	.00	17.56	9.88	30.00	17.50	9.38	.00
19941016	M	10.29	10.33	439.00	17.58	9.93	30.00	17.42	10.32	376.00
19941017	M	11.04	11.08	1080.00	17.44	9.65	30.00	17.30	11.47	634.00
19941018	M	11.20	11.23	1280.00	17.36	9.84	30.00	17.34	11.28	646.00
19941019	M	11.18	11.20	1610.00	17.34	10.32	30.00	17.33	11.53	632.00
19941020	M	11.38	11.40	1700.00	17.37	10.42	30.00	17.35	11.47	636.00
19941021	M	11.31	11.33	1640.00	17.34	10.34	30.00	17.33	11.39	640.00
19941022	M	11.64	11.65	1890.00	17.30	10.58	30.00	17.30	11.45	634.00
19941023	M	12.12	12.12	1960.00	17.25	11.06	30.00	17.27	11.48	632.00
19941024	M	12.07	12.08	1920.00	17.25	11.29	30.00	17.23	11.55	626.00
19941025	M	11.91	11.92	1910.00	17.24	10.49	30.00	17.20	11.78	612.00
19941026	M	11.25	11.28	1510.00	17.17	10.04	29.00	17.18	11.87	604.00
19941027	M	11.99	12.01	1850.00	17.27	10.41	30.00	17.20	11.84	608.00

19941028	M	11.62	11.64	1630.00	17.23	10.86	30.00	17.18	11.67	616.00
19941029	M	11.60	11.62	1550.00	17.12	10.85	15.00	17.13	11.56	620.00
19941030	M	11.52	11.53	1520.00	17.14	10.66	26.00	17.14	11.68	614.00
19941031	M	11.34	11.38	114.00	17.09	10.85	33.00	17.16	11.50	80.00
19941101	M	11.07	11.10	953.00	17.12	10.86	33.00	17.18	10.24	310.00
19941102	M	11.56	11.58	1680.00	17.23	10.20	65.00	17.12	11.24	706.00
19941103	M	11.70	11.72	1860.00	17.14	9.54	55.00	17.01	11.77	800.00
19941104	M	11.92	11.94	1910.00	17.04	9.68	50.00	16.94	12.04	774.00
19941105	M	11.76	11.79	1900.00	16.98	10.39	59.00	16.93	11.88	786.00
19941106	M	11.70	11.72	1880.00	17.00	10.76	65.00	16.94	11.83	790.00
19941107	M	11.76	11.79	1830.00	17.02	10.73	65.00	16.91	12.02	774.00
19941108	M	11.71	11.74	1800.00	16.94	10.58	65.00	16.85	12.21	754.00
19941109	M	11.72	11.74	1770.00	16.89	10.82	66.00	16.83	12.51	728.00
19941110	M	11.50	11.53	1780.00	16.85	10.91	20.00	16.84	12.29	746.00
19941111	M	11.54	11.56	1750.00	16.91	10.58	55.00	16.85	12.35	742.00
19941112	M	11.56	11.58	1730.00	16.99	10.49	60.00	16.82	11.82	782.00
19941113	M	11.02	11.06	993.00	17.02	10.52	68.00	16.72	11.22	502.00
19941114	M	9.60	9.68	.00	17.32	9.27	99.00	16.68	9.52	.00
19941115	M	11.02	11.06	.00	16.92	9.80	54.00	16.64	10.07	.00
19941116	M	12.02	12.16	-2950.00	16.83	11.85	-1050.00	17.04	13.19	.00
19941117	M	11.57	11.73	-3550.00	17.41	11.37	-1430.00	17.42	13.86	.00
19941118	M	10.65	10.82	-3390.00	17.38	11.06	-1080.00	17.42	13.38	.00
19941119	M	10.40	10.52	-2330.00	17.44	11.24	36.00	17.45	12.27	.00
19941120	M	11.25	11.31	-908.00	17.49	10.87	35.00	17.51	11.07	.00
19941121	M	10.84	10.90	-783.00	17.45	10.48	25.00	17.48	10.18	.00
19941122	M	10.94	10.99	.00	17.51	10.09	65.00	17.51	9.64	.00
19941123	M	10.21	10.27	.00	17.58	9.61	85.00	17.54	9.47	.00
19941124	M	9.95	10.01	.00	17.58	9.45	65.00	17.48	9.46	.00
19941125	M	9.89	9.95	.00	17.49	9.45	55.00	17.48	9.33	.00
19941126	M	9.83	9.89	.00	17.52	9.51	55.00	17.51	9.14	.00
19941127	M	9.86	9.92	.00	17.47	9.86	50.00	17.48	9.31	.00
19941128	M	10.80	10.86	.00	17.44	11.29	27.00	17.49	10.02	.00
19941129	M	10.88	10.93	.00	17.46	11.79	22.00	17.50	10.16	.00
19941130	M	10.75	10.81	.00	17.49	11.25	30.00	17.52	10.00	.00
19941201	M	10.59	10.65	.00	17.57	10.44	100.00	17.53	9.80	.00
19941202	M	10.81	10.87	.00	17.54	10.66	69.00	17.50	10.16	.00
19941203	M	10.81	10.88	.00	17.49	10.68	44.00	17.51	10.94	.00
19941204	M	10.61	10.67	.00	17.42	10.50	50.00	17.45	10.61	.00
19941205	M	11.73	11.81	-1800.00	17.49	11.00	55.00	17.53	11.10	.00
19941206	M	11.10	11.18	-1830.00	17.60	10.67	87.00	17.59	9.77	.00
19941207	M	10.97	11.03	-823.00	17.57	10.10	90.00	17.58	9.44	.00
19941208	M	10.74	10.79	.00	17.60	9.79	143.00	17.56	9.33	.00
19941209	M	10.95	10.99	.00	17.50	10.09	60.00	17.52	9.85	.00
19941210	M	10.94	10.99	.00	17.45	9.89	78.00	17.51	10.29	.00
19941211	M	10.44	10.49	.00	17.56	9.53	111.00	17.59	10.27	.00
19941212	M	10.30	10.35	.00	17.59	9.43	147.00	17.52	10.64	.00
19941213	M	10.13	10.18	.00	17.55	9.39	155.00	17.50	10.27	.00
19941214	M	10.14	10.19	.00	17.54	9.42	125.00	17.47	9.85	.00
19941215	M	10.53	10.59	.00	17.57	10.40	152.00	17.44	9.93	.00
19941216	M	10.38	10.45	.00	17.43	10.75	87.00	17.37	10.36	.00
19941217	M	10.14	10.20	.00	17.31	10.81	85.00	17.33	10.08	.00
19941218	M	10.23	10.28	.00	17.30	10.75	85.00	17.31	9.84	.00
19941219	M	10.62	10.67	.00	17.40	10.61	129.00	17.29	9.80	.00
19941220	M	10.26	10.31	.00	17.24	10.18	125.00	17.19	9.74	.00
19941221	M	11.05	11.14	-1440.00	17.77	10.73	125.00	17.39	11.34	.00
19941222	M	10.96	11.12	-3490.00	17.48	11.64	-1560.00	17.59	12.54	.00
19941223	M	10.59	10.72	-2550.00	17.72	10.36	-1570.00	17.92	11.64	.00
19941224	M	10.39	10.47	-1470.00	17.65	10.34	-747.00	17.78	10.46	.00
19941225	M	10.65	10.70	-43.00	17.54	10.31	45.00	17.63	9.45	.00
19941226	M	10.39	10.44	.00	17.60	10.10	85.00	17.61	9.31	.00
19941227	M	10.00	10.05	.00	17.61	10.02	113.00	17.60	9.38	.00
19941228	M	10.56	10.62	.00	17.55	9.68	101.00	17.55	9.06	.00
19941229	M	11.16	11.20	.00	17.47	9.54	40.00	17.52	9.90	.00
19941230	M	11.15	11.20	.00	17.46	9.53	45.00	17.51	9.90	.00
19941231	M	10.94	10.99	.00	17.44	9.61	45.00	17.49	9.62	.00

APPENDIX D

Table D-1. Stages(ft) and Mean Daily Discharges (cfs) to the WCA's from the EAA

		S-6			S-7			S-8			S5A+S5AW	
	HW	TW	FLOW	HW	TW	FLOW	HW	TW	FLOW	HW	TW	FLOW
DBKEYS	00356	06685	00357	06695	06696	00438	06697	06698	00546	06676	06677	00317
DATE												
19940501	10.60	15.11	40.00	10.51	10.91	8.00	10.60	10.54	39.00	10.33	15.06	.00
19940502	10.47	14.97	-115.00 ?	10.46 E	10.77 E	37.00	10.31	10.42 E	35.00	10.11 E	14.89 E	56.00
19940503	10.86	14.95 E	-113.00 ?	11.04 E	10.67 E	12.00	10.16 E	10.55 E	56.00	10.35 E	14.85 E	-294.00
19940504	10.58	15.14 E	445.00	11.07	10.78	88.00	10.93	10.55	57.00	11.20	15.07	-157.00
19940505	10.97	15.13 E	-100.00 ?	10.90	10.81	37.00	10.71	10.52	37.00	10.84	15.04	-128.00
19940506	10.85	15.09	-49.00 ?	10.83	10.84	16.00	10.39	10.47	35.00	10.85	14.94	-333.00
19940507	10.83	15.03	-104.00 ?	10.79	10.87	16.00	10.21	10.42	56.00	11.11	14.88	-313.00
19940508	10.54	14.93	-103.00 ?	10.46	10.89	9.50	9.92	10.24	26.00	11.22	14.81	-303.00
19940509	10.47	14.83	-161.00 ?	10.45	10.91	18.00	10.09	10.00	25.00	11.22	14.71	-295.00
19940510	10.84	14.74	-120.00 ?	10.86	10.95	38.00	10.66	10.36	121.00	11.36	14.61	-274.00
19940511	10.98	14.71	-91.00 ?	10.97	11.03	52.00	10.91	10.46	73.00	11.47	14.57 E	-268.00
19940512	10.92	14.72	-198.00 ?	10.93	11.07	27.00	10.84	10.26	37.00	11.19	14.62	-216.00
19940513	10.81	14.71	-146.00 ?	10.86	11.08	18.00	10.97	10.16	29.00	11.13	14.63	-77.00
19940514	10.86	14.68	-190.00 ?	11.00	11.07	11.00	11.19	10.11	37.00	11.17	14.59	.00
19940515	11.01	14.59	-153.00 ?	11.17	11.05	15.00	11.32	10.07	39.00	11.21	14.50	.00
19940516	11.05	14.53	-166.00 ?	11.09	11.02	42.00	11.19	10.02	19.00	11.10	14.45	.00
19940517	10.93	14.48	-158.00 ?	10.96	11.04	15.00	11.13	9.99	50.00	10.96	14.43	.00
19940518	11.61	14.53 E	-39.00 ?	11.51 E	11.22 E	88.00	10.76 E	10.20 E	18.00	10.96	14.45 E	.00
19940519	11.53	14.60	-9.00 ?	11.31	11.24	127.00	9.77	10.09	-2.20	10.55	14.53	.00
19940520	10.90	14.76	415.00	11.33	11.11	56.00	9.63	9.94	27.00	10.34	14.60	.00
19940521	11.16	14.68	-202.00 ?	11.21	11.00	14.00	10.65	9.86	43.00	10.22	14.56	.00
19940522	10.91	14.66	-210.00 ?	10.92	10.92	5.00	10.96	9.82	43.00	10.71	14.56	.00
19940523	10.64	14.66	-143.00 ?	10.69	10.88	20.00	10.85	9.78	55.00	10.60	14.57	.00
19940524	10.80	14.56	-224.00 ?	10.90	10.90	6.50	10.80	9.73	3.70	10.41	14.49	.00
19940525	10.59	14.52	-153.00 ?	10.81	10.98	12.00	10.78	9.70	21.00	10.31	14.45	23.00
19940526	10.87	14.44	-98.00 ?	11.10	10.99	43.00	11.14	9.66	68.00	10.82	14.39	.00
19940527	11.32	14.46 E	-109.00 ?	11.41 E	11.00 E	30.00	11.30 E	9.63 E	48.00	11.28 E	14.40 E	79.00
19940528	11.21	14.46	-89.00 ?	11.16	11.01	18.00	10.97	9.58	33.00	11.32	14.39	.00
19940529	11.08	14.46	-92.00 ?	11.03	11.01	20.00	10.79	9.52	-18.00	11.14	14.36	.00
19940530	11.02	14.41	-54.00 ?	10.99	11.00	21.00	10.97	9.53	3.30	11.22	14.35	.00
19940531	11.13	14.37	-130.00 ?	11.13	11.00	33.00	11.06	9.63	14.00	11.19	14.29	.00
19940601	10.68	14.59	252.00	11.17	11.03	66.00	11.14	10.24	136.00	10.46	14.57	609.00
19940602	10.09	14.95	882.00	10.04	12.62	1310.00	11.08	11.01	162.00	10.04	15.05	1400.00
19940603	9.96	15.22	930.00	9.81	12.49	930.00	10.57	10.48	27.00	9.31	15.21	874.00
19940604	9.40	15.60 E	2330.00	9.90 E	12.69	1170.00	9.86 E	11.18 E	359.00	8.77 E	15.56	2170.00
19940605	9.29	15.80	1920.00	9.21	13.10	1540.00	9.70	11.15	220.00	8.84	15.81	2620.00
19940606	9.24	15.89 E	1680.00	9.19	13.14	1570.00	10.10	11.38	379.00	8.92	16.03	2970.00
19940607	9.24	15.93	1270.00	9.17	13.16	1440.00	10.52	11.56	480.00	8.80	16.26	2950.00
19940608	9.30	15.96 E	1260.00	9.63 E	12.66 E	855.00	10.32	11.57 E	447.00	8.90	16.33	2450.00
19940609	10.04	15.95 E	985.00	10.72 E	11.60 E	25.00	10.11 E	10.87 E	5.90	9.33 E	16.22 E	986.00
19940610	9.85	16.14	2210.00	10.19	12.94	1420.00	10.35	10.76	33.00	9.10	16.30	3120.00
19940611	9.23	16.20	1930.00	9.28	13.58	1780.00	10.82	10.80	90.00	8.74	16.39	2430.00
19940612	9.59	16.03	884.00	9.57	12.71	765.00	10.77	10.72	29.00	9.41	16.26	933.00
19940613	10.52	15.84	443.00	10.74	11.65	37.00	10.39	10.38	3.30	10.63	16.09	889.00
19940614	10.49	15.75	456.00	10.83	11.22	34.00	10.17	10.45	33.00	10.25	15.97	834.00
19940615	10.47	15.59	-116.00 ?	10.44	10.95	29.00	9.74	10.45	33.00	10.28	15.69	.00
19940616	10.65	15.43	-153.00 ?	10.61	10.81	25.00	10.56	10.40	32.00	10.26	15.44	.00
19940617	10.74	15.34	-106.00 ?	10.70	10.95	19.00	10.81	10.39	8.30	10.65	15.30	-76.00
19940618	11.17	15.37 E	-12.00 ?	11.03 E	11.16 E	21.00	10.82 E	10.63 E	47.00	10.61 E	15.44 E	860.00
19940619	11.61	15.38 E	1.00	11.42 E	11.43 E	80.00	10.27 E	11.91 E	854.00	10.14	15.50 E	861.00
19940620	10.25	15.50	1010.00	10.85	12.58	1070.00	10.17	12.91	1710.00	9.74	15.46	690.00
19940621	9.68	15.40	221.00	9.71	12.56	670.00	9.21	13.22	1810.00	10.12	15.37	.00
19940622	11.09	15.30 E	-158.00 ?	11.06 E	11.66 E	18.00	9.94 E	12.09 E	609.00	9.74 E	15.35 E	491.00

19940623	10.23	15.46 E	1390.00	10.33	13.05 E	1560.00	10.60	13.13 E	1820.00	9.83 E	15.41 E	332.00
19940624	9.20	15.56	1470.00	9.22	13.26	1500.00	9.35	13.70	2550.00	9.86 E	15.63 E	737.00
19940625	9.58	15.47 E	392.00	9.73	12.32 E	381.00	9.72 E	12.63 E	1240.00	9.43	15.50	394.00
19940626	10.66	15.32	-103.00 ?	10.63	11.71	17.00	10.61	11.96	556.00	9.65	15.26	.00
19940627	10.69	15.18 E	-68.00 ?	10.63 E	11.47 E	8.50	10.30	11.87	506.00	9.90 E	15.12 E	.00
19940628	10.52	15.15 E	-52.00 ?	10.45 E	11.34 E	6.50	9.92 E	11.79 E	429.00	10.00 E	15.06 E	.00
19940629	10.29	15.17	-47.00 ?	10.24	11.19	6.50	10.40	11.28	58.00	9.92	15.09	-119.00
19940630	10.21	15.16	-7.80 ?	10.14	11.08	4.10	10.89	11.22	62.00	10.02	15.10	-191.00
19940701	10.07	15.17	-102.00 ?	10.03	11.05	6.50	10.37	11.63	386.00	10.05	15.11	-111.00
19940702	10.43	15.21	-124.00 ?	10.42 E	11.25 E	17.00	10.77	11.22	18.00	10.00	15.14	.00
19940703	10.06	15.39	1150.00	11.05 E	11.86 E	382.00	9.90	12.62	1180.00	10.68	15.27	.00
19940704	9.28	15.73	2280.00	9.84	14.00	2330.00	9.82	12.41	935.00	9.84	15.62	1490.00
19940705	9.26	15.79	1680.00	9.23	14.08	2240.00	10.60	11.91	518.00	9.39	15.67	519.00
19940706	9.25	15.69	1240.00	9.18	13.95	1960.00	10.27	12.29	1030.00	10.39	15.63	.00
19940707	9.29	15.61	1340.00	9.42	13.73	1720.00	10.26	12.55	1230.00	10.61	15.55	25.00
19940708	9.24	15.56	992.00	9.55	13.30	1070.00	10.05	12.54	1110.00	10.49	15.50	.00
19940709	9.58	15.45	460.00	10.54	12.29	31.00	10.39	11.98	527.00	10.10	15.39	.00
19940710	10.82	15.24	-153.00 ?	10.81	11.87	10.00	10.48	11.96	553.00	9.94	15.17	.00
19940711	10.86	15.08	-139.00 ?	10.82	11.48	23.00	10.42	11.93	507.00	9.99	15.01	.00
19940712	10.86	15.03	-189.00 ?	10.83	11.17	18.00	10.10	11.99	580.00	10.12	14.96	.00
19940713	10.86	15.03	-190.00 ?	10.83	11.13	16.00	10.05	11.90	489.00	10.10	14.96	.00
19940714	11.11	15.03	-71.00 ?	11.05	11.06	10.00	9.97	11.89	489.00	10.20	14.97	.00
19940715	10.79	15.01 E	-119.00 ?	10.74 E	10.96 E	9.50	9.67 E	11.84 E	410.00	10.08 E	14.93 E	.00
19940716	10.53	14.98	-19.00 ?	10.46	10.90	23.00	9.85	11.41	54.00	9.88	14.91	.00
19940717	10.26	14.95	-60.00 ?	10.20	10.81	11.00	10.05	11.34	61.00	9.70	14.89	.00
19940718	10.10	14.92	-77.00 ?	10.04	10.78	15.00	10.27	11.27	60.00	9.58	14.85	.00
19940719	10.16	14.92 E	-18.00 ?	10.11 E	10.84 E	10.00	10.34 E	11.23 E	56.00	9.65	14.85 E	.00
19940720	10.28	14.94	-9.00 ?	10.22	10.85	7.50	10.27	11.18	42.00	10.05	14.87	.00
19940721	10.20	14.98	-30.00 ?	10.14	10.93	8.00	10.04	11.15	57.00	10.21	14.89	.00
19940722	10.46	15.06 E	-16.00 ?	10.39 E	10.97 E	9.00	9.52 E	11.11 E	67.00	9.81 E	15.06 E	613.00
19940723	10.26	15.07	-15.00 ?	10.16	10.99	4.20	9.30	11.07	53.00	10.38	15.02	.00
19940724	10.17	15.07	-20.00 ?	10.10	10.85	59.00	9.49	10.59	-29.00	10.59	15.02	.00
19940725	10.48	15.07 E	-39.00 ?	10.42 E	10.85 E	52.00	10.38 E	10.87 E	74.00	10.89 E	15.01	23.00
19940726	10.86	15.14	-47.00 ?	10.80	10.91	9.50	10.41	10.95	64.00	10.38 E	15.16	625.00
19940727	11.09	15.19	11.00	10.96	10.90	9.00	10.72	10.94	62.00	10.21	15.25	680.00
19940728	10.76	15.34	607.00	11.07	10.98	58.00	10.89	10.93	57.00	10.46	15.34	711.00
19940729	10.50	15.65 E	1700.00	10.39 E	13.03 E	1630.00	9.87 E	12.66 E	M	10.14 E	15.75 E	2660.00
19940730	9.57	15.82	1170.00	9.56	13.03	1260.00	9.55	12.76	M	9.63 E	15.91 E	1820.00
19940731	10.29	15.86	1230.00	10.06	13.07	1400.00	10.31	12.23	M	10.20	15.90	2120.00
19940801	9.28	15.94 E	1210.00	9.69	12.77	840.00	10.20	11.90	M	9.37	15.92 E	1020.00
19940802	9.31	15.93 E	1590.00	10.46	12.40	655.00	10.61	11.75 E	M	10.16	15.95	1460.00
19940803	9.29	15.97 E	1630.00	10.36	12.27	610.00	10.12 E	11.91	M	10.22	15.99 E	914.00
19940804	9.42	15.97	1720.00	10.34	12.26	535.00	9.81	11.75	417.00	10.60	15.99	945.00
19940805	9.56	15.91 E	980.00	10.02 E	12.24 E	466.00	9.46 E	11.68 E	M	10.29 E	16.02 E	1100.00
19940806	10.45	15.79 E	435.00	10.23	12.28	495.00	9.40 E	11.26 E	M	10.32 E	15.97 E	939.00
19940807	10.29	15.87	1120.00	10.38	12.53	610.00	9.95	11.26	77.00	10.33 E	16.01	1570.00
19940808	9.41	16.00	1730.00	10.35	12.55	735.00	10.38	11.84	543.00	10.13	16.09	1650.00
19940809	9.25	16.01	1590.00	10.42	12.61	665.00	10.37	12.16	725.00	10.08	16.08	1190.00
19940810	9.27	15.99	1510.00	10.18	12.53	530.00	9.73	11.83	395.00	10.16	16.08	1250.00
19940811	9.31	16.10	2100.00	10.21	13.14	1220.00	10.03	11.94	506.00	9.96	16.23	2060.00
19940812	9.48	16.31	2420.00	10.23	13.51	1510.00	9.69	12.73	1220.00	9.56	16.37	2480.00
19940813	9.98	16.49	2700.00	10.25	14.05	2130.00	9.48	13.19	1630.00	8.95	16.68	3270.00
19940814	9.97	16.59	2640.00	10.21	14.20	2200.00	9.38	13.09	1490.00	8.86	16.82	3270.00
19940815	9.62	16.60	2490.00	10.10	14.11	1860.00	9.58	12.65	M	9.01	16.77	2440.00
19940816	9.27	16.55	1950.00	10.31	13.49 E	750.00	10.11 E	12.30 E	M	9.06 E	16.74	1540.00
19940817	9.50	16.37	979.00	10.16	13.07	206.00	10.19	12.14 E	M	9.75	16.62	708.00
19940818	10.75	16.12	-104.00 ?	10.70	12.86	9.50	10.24	12.05	M	9.55	16.42	512.00
19940819	11.26	15.99	-53.00 ?	11.21	12.74	17.00	10.27	12.08	581.00	10.40	16.27	.00
19940820	10.74	16.06	1100.00	11.55	12.65	52.00	11.10	11.46	73.00	10.20	16.19	703.00
19940821	10.99	15.99	618.00	11.00	13.02	515.00	10.01	11.88	452.00	9.72	16.15	354.00
19940822	10.92	15.90	585.00	10.96	13.03	441.00	9.86	11.40	81.00	10.38	16.05	.00
19940823	10.27	16.00 E	1650.00	11.12	13.22	655.00	10.19 E	11.36	59.00	9.84	16.08 E	996.00
19940824	9.22	16.10 E	1780.00	10.86 E	13.13 E	484.00	10.43 E	11.36 E	91.00	9.62 E	16.16 E	776.00
19940825	9.26	16.09	1600.00	10.96	13.11	425.00	10.95 E	11.88 E	461.00	9.40	16.14	461.00
19940826	9.20	16.06	1450.00	10.90	13.06	493.00	10.79	12.58	1110.00	10.13	16.08	41.00

19940827	9.23	16.04	1260.00	11.21	12.85	22.00	11.01	11.99	430.00	10.20	16.10	1100.00
19940828	9.27	16.08	1310.00	11.54	12.88	18.00	10.58	12.85	1380.00	10.19	16.17	1130.00
19940829	9.24	16.11	1450.00	11.17	13.15	550.00	10.28	13.22	1660.00	10.01	16.20	1090.00
19940830	9.54	16.07 E	926.00	10.89 E	12.99 E	419.00	10.66 E	12.50 E	824.00	9.57 E	16.18 E	891.00
19940831	10.33	15.94	366.00	10.59	12.95	378.00	10.77	12.48	918.00	10.06	16.05	.00
19940901	10.09	15.85 E	266.00	10.37	12.78	197.00	10.72	12.14	479.00	10.02 E	15.91 E	.00
19940902	10.67	15.74 E	-129.00 ?	10.66 E	12.65 E	8.50	10.72 E	11.95 E	345.00	9.77 E	15.81 E	.00
19940903	10.98	15.68	-204.00 ?	10.98	12.59	17.00	10.58	11.85	280.00	9.66	15.71	.00
19940904	11.16	15.64	-199.00 ?	11.20	12.61	16.00	10.78	11.86	319.00	9.45	15.65	.00
19940905	11.57	15.64	-163.00 ?	11.64	12.54	25.00	11.14	12.01	488.00	9.22	15.64	.00
19940906	10.27	15.80	973.00	11.13	12.90	494.00	10.82	12.70	1240.00	9.83	15.75	.00
19940907	9.27	15.94	1330.00	10.82	12.82	366.00	10.34	13.02	1450.00	10.31	15.87	.00
19940908	9.60	15.99	992.00	10.86	12.85	333.00	10.53	12.74	1080.00	10.54	15.99	.00
19940909	10.26	16.12	1320.00	10.65	13.62 E	1340.00	10.56	12.89	1330.00	10.41 E	16.14	977.00
19940910	9.65	16.13	778.00	10.26	13.19	575.00	10.31	12.72	1070.00	10.23	16.21	752.00
19940911	10.62	16.11	452.00	10.83	13.28	595.00	10.60	12.77	1130.00	9.56 E	16.20	483.00
19940912	10.02	16.20	1310.00	10.67	13.49	990.00	10.26	13.11	1500.00	9.75	16.17	.00
19940913	9.22	16.33 E	1700.00	10.38	13.39 E	880.00	10.26 E	13.64 E	2280.00	9.63	16.39 E	1250.00
19940914	9.23	16.49	1740.00	10.41	13.45	950.00	10.33	13.57	2100.00	9.21	16.59	1680.00
19940915	9.25	16.51	1480.00	10.33	13.45	950.00	10.36	13.75	2320.00	9.30	16.60	1010.00
19940916	9.25	16.49	1230.00	10.40	13.43	790.00	10.08	14.08	2890.00	9.73	16.51	439.00
19940917	9.54	16.41	814.00	11.18	12.98	35.00	9.61	13.78	2270.00	10.25	16.45	.00
19940918	10.33	16.38	967.00	11.95	12.82	36.00	9.64	13.63	2000.00	11.07 E	16.38 E	.00
19940919	9.25	16.53 E	1490.00	10.78 E	13.54 E	1100.00	9.88 E	13.71 E	2120.00	10.00 E	16.62 E	2180.00
19940920	9.29	16.76 E	2120.00	10.37 E	14.12 E	1720.00	10.44 E	13.94 E	2470.00	9.24	16.87 E	2720.00
19940921	9.59	17.03 E	2330.00	10.20 E	14.68 E	2470.00	10.96 E	14.16 E	2800.00	9.24 E	17.14 E	2970.00
19940922	9.46	17.05 E	2290.00	10.05 E	14.62 E	2280.00	10.21 E	14.26 E	2900.00	9.15 E	17.25 E	2560.00
19940923	9.19	16.98	1570.00	9.92	14.37	1750.00	9.73	14.20	2800.00	9.42	17.14	1130.00
19940924	9.22	16.83	930.00	9.94	13.95	920.00	9.39	13.84	2150.00	9.65	17.14	1050.00
19940925	9.22	16.78	778.00	9.94	13.87	815.00	9.33	13.74	1980.00	9.18	17.11	870.00
19940926	9.26	16.79	1300.00	9.98	14.00	1050.00	9.36	13.69	1940.00	9.31	17.13	1570.00
19940927	9.23	16.87	1490.00	9.83	14.29	1540.00	9.30	13.70	1970.00	9.11	17.22	1910.00
19940928	9.21	16.93	1660.00	10.12	14.12	1080.00	9.51	13.90	2300.00	9.24	17.25	2030.00
19940929	9.26	16.92	1600.00	10.28	14.17	1210.00	9.49	13.73	2050.00	9.10 E	17.25	1890.00
19940930	9.22	16.92 E	1650.00	10.01 E	14.39	1540.00	9.40	13.70	2070.00	9.19 E	17.24	1790.00
19941001	9.23	16.88	1220.00	9.92	14.04	610.00	9.54	13.51	1660.00	9.26	17.16	814.00
19941002	9.30	16.94	1910.00	10.30	14.29	1180.00	9.61	13.59	1810.00	9.23	17.21	1690.00
19941003	9.22	16.99	2070.00	10.05	14.41	1600.00	9.45	13.66	1970.00	9.11	17.27	1970.00
19941004	9.56	17.06	2090.00	10.20	14.50	1610.00	9.49	13.69	1940.00	9.38	17.28 E	1620.00
19941005	9.59	17.09	2090.00	10.25	14.56	1770.00	9.48	13.83	2200.00	9.23	17.30 E	1900.00
19941006	9.25	17.04	1730.00	10.05	14.45	1450.00	9.42	13.60	1820.00	9.32	17.18 E	1020.00
19941007	9.25	16.97 E	1380.00	10.09 E	14.51	1330.00	9.37	13.47 E	1630.00	9.30 E	17.11 E	1050.00
19941008	9.25	16.90 E	1200.00	10.04 E	14.51 E	1400.00	9.36 E	13.28	1290.00	9.24 E	17.03 E	802.00
19941009	9.27	16.83	1030.00	9.92	14.44	1250.00	9.63	13.24	1290.00	9.34	16.95 E	653.00
19941010	9.28	16.82	1200.00	10.29	14.38	1160.00	9.75	13.35	1540.00	9.72	16.84 E	350.00
19941011	9.94	16.87	2030.00	10.05	14.78	1920.00	9.73	13.87	2450.00	9.79	16.82 E	1300.00
19941012	9.88	17.06 E	2340.00	9.81 E	14.69 E	1810.00	10.00 E	14.07 E	2650.00	9.18 E	17.11 E	2650.00
19941013	9.82	17.19 E	2290.00	9.90	14.54	1350.00	9.44 E	14.22 E	2880.00	9.19	17.32 E	3260.00
19941014	9.33	17.24 E	1990.00	9.92 E	14.50 E	1250.00	9.38 E	13.93 E	2350.00	9.10 E	17.33 E	2150.00
19941015	9.25	17.17 E	1440.00	10.07 E	14.30 E	885.00	9.43 E	13.55 E	1710.00	9.19 E	17.21 E	1120.00
19941016	9.26	17.06	1030.00	9.96	14.24	695.00	9.55	13.43	1480.00	9.29 E	17.09 E	722.00
19941017	9.25	17.03	1180.00	10.15	14.26	850.00	9.41	13.29	1330.00	9.24 E	17.04 E	1070.00
19941018	9.22	17.01 E	1210.00	10.32 E	14.26 E	890.00	9.63 E	13.06 E	987.00	9.52 E	17.02 E	610.00
19941019	9.25	16.96 E	957.00	10.17 E	14.21 E	900.00	10.05 E	12.82 E	502.00	9.85 E	16.94 E	444.00
19941020	9.25	16.94	1090.00	10.28 E	14.19 E	905.00	10.09	12.78	511.00	10.18	16.84 E	226.00
19941021	9.24	16.94 E	1020.00	10.21 E	14.19 E	865.00	10.18	12.65	382.00	9.82 E	16.80 E	463.00
19941022	9.26	16.92	985.00	10.24	14.14	875.00	10.54	12.40	12.00	10.34	16.80 E	.00
19941023	9.21	16.92	1170.00	10.53	14.09	930.00	11.02	12.35	18.00	10.61	16.80 E	.00
19941024	9.25	16.91 E	1180.00	10.47 E	13.92 E	945.00	11.25 E	12.32 E	.42	10.56 E	16.78 E	.00
19941025	9.22	16.91 E	1110.00	10.30 E	13.87 E	965.00	10.25 E	12.54 E	388.00	10.80 E	16.79 E	.00
19941026	9.47	16.92 E	903.00	10.20 E	13.74 E	645.00	10.01 E	12.26 E	21.00	10.98 E	16.82 E	.00
19941027	9.25	17.01 E	1180.00	10.34	14.06 E	1260.00	10.38 E	12.22 E	-3.40	10.46 E	16.94 E	717.00
19941028	9.24	17.05	1170.00	10.88	13.80	610.00	10.81	12.18	16.00	10.17 E	16.96 E	536.00
19941029	9.23	17.06	1070.00	10.90	13.82	595.00	10.78	12.13	50.00	10.65	16.95 E	.00
19941030	9.25	17.08	1160.00	10.94	13.74	615.00	10.58	12.09	39.00	11.04 E	16.99 E	.00

19941031	9.61	17.35 E	2270.00	10.77 E	13.99	1410.00	10.75	12.24	15.00	10.45	17.26 E	2100.00
19941101	9.41	17.45 E	2050.00	10.11	14.09 E	1580.00	10.81	12.21	-2.90	9.20	17.34 E	1820.00
19941102	9.28	17.49	1810.00	10.12	14.16	1660.00	10.18	12.16	7.60	9.17 E	17.37 E	1530.00
19941103	9.29	17.49	1510.00	10.04	14.12	1480.00	9.52	12.12	41.00	9.67	17.34 E	660.00
19941104	9.33	17.44	1380.00	10.11	14.19	1500.00	9.63	12.08	28.00	10.21 E	17.30 E	644.00
19941105	9.25	17.40	1240.00	10.01 E	14.15 E	1450.00	10.32	12.03	31.00	10.11	17.25 E	671.00
19941106	9.29	17.37	1060.00	10.02	14.00	1230.00	10.72	11.99	20.00	10.82 E	17.24 E	.00
19941107	9.36	17.35	1220.00	10.60	13.70	940.00	10.73	11.95	26.00	10.37 E	17.25 E	688.00
19941108	9.35	17.37 E	1160.00	10.55 E	13.68 E	970.00	10.55 E	11.92 E	53.00	11.01 E	17.21 E	.00
19941109	9.36	17.37 E	1190.00	10.36 E	13.86 E	1330.00	10.76 E	11.93 E	40.00	11.08 E	17.21 E	292.00
19941110	9.35	17.34 E	1100.00	10.14	13.83 E	1180.00	10.85 E	11.90 E	13.00	11.21 E	17.22 E	114.00
19941111	9.35	17.31 E	1200.00	10.48 E	13.57 E	945.00	10.56 E	11.86 E	26.00	11.52 E	17.20 E	.00
19941112	9.34	17.31 E	1170.00	10.57 E	13.53 E	950.00	10.51 E	11.82 E	-6.70	10.36 E	17.14 E	618.00
19941113	9.28	17.34 E	1100.00	10.14	13.67	1160.00	10.31	12.13	424.00	9.93	17.14 E	708.00
19941114	9.37	17.43	821.00	9.38	13.76	1180.00	9.03	12.57	815.00	9.33	17.18 E	659.00
19941115	9.82	17.71 E	1720.00	9.85 E	14.39 E	1880.00	9.18 E	12.81 E	1090.00	9.22	17.37 E	1840.00
19941116	11.74	18.09 E	2560.00	11.22 E	15.15 E	2690.00	9.61 E	14.01 E	2780.00	10.82 E	17.40 E	4350.00
19941117	12.07	18.16	2550.00	11.51	15.20	2700.00	9.15	14.24	2800.00	10.91	17.43 E	4750.00
19941118	11.66	18.14 E	2470.00	10.86 E	15.17 E	2570.00	9.07 E	14.26 E	2730.00	10.21 E	17.43 E	4770.00
19941119	11.04	18.13	2340.00	10.33	15.18	2210.00	9.14	14.34	2820.00	9.34 E	17.44 E	4400.00
19941120	10.51	18.10	2260.00	10.31	15.34	2250.00	9.12 E	14.23 E	2580.00	9.17	17.57 E	3520.00
19941121	9.94	18.05	2200.00	10.13	15.37	1890.00	9.11	14.07	2300.00	9.15 E	17.62 E	2730.00
19941122	9.74	18.00	2080.00	10.36	15.36	1670.00	9.14	13.95	2040.00	9.10	17.66 E	2050.00
19941123	9.34	17.91	1640.00	10.13	15.23	1140.00	9.08	13.86	1880.00	9.10	17.75 E	1580.00
19941124	9.36	17.77	1250.00	10.03	15.12	810.00	9.18	13.59	1510.00	9.15 E	17.92 E	1100.00
19941125	9.36	17.67	1100.00	10.06 E	15.08 E	555.00	9.14 E	13.54 E	1500.00	9.18 E	17.92 E	751.00
19941126	9.38	17.54 E	890.00	10.03	15.07	565.00	9.28	13.41	1300.00	9.09 E	17.80 E	470.00
19941127	9.75	17.37	393.00	10.08	15.00	212.00	9.79	13.08	678.00	9.38 E	17.67 E	.00
19941128	10.66	17.23 E	449.00	10.87 E	15.00 E	379.00	10.94 E	13.12 E	705.00	10.04 E	17.53 E	.00
19941129	10.81	17.17	423.00	10.90	15.00	417.00	11.47	13.07	635.00	10.22 E	17.43 E	.00
19941130	10.49	17.15 E	573.00	10.81 E	15.00 E	427.00	10.60 E	13.36 E	1220.00	10.07 E	17.33 E	.00
19941201	10.60	17.10 E	390.00	10.71	14.94 E	385.00	10.15 E	13.03 E	620.00	9.92 E	17.24 E	.00
19941202	10.58	17.13	559.00	10.82 E	14.95 E	402.00	10.23 E	13.07 E	771.00	10.25 E	17.22 E	.00
19941203	10.59	17.14	561.00	10.85 E	14.95 E	418.00	10.32	13.01	633.00	10.98 E	17.21 E	.00
19941204	10.46	17.13	475.00	10.70	14.95	313.00	10.21 E	12.99 E	568.00	10.63 E	17.17 E	.00
19941205	11.18	17.60 E	2440.00	11.65	15.96	2080.00	9.52 E	14.11 E	2540.00	9.59 E	17.50 E	2600.00
19941206	10.62	17.63 E	2480.00	10.86 E	15.97 E	2490.00	9.29 E	14.30 E	2760.00	9.13 E	17.61 E	2260.00
19941207	9.73	17.59 E	2290.00	10.33 E	15.97 E	2330.00	9.14 E	14.16 E	2400.00	9.24 E	17.60 E	1100.00
19941208	9.34	17.52 E	1940.00	10.15 E	15.93	2150.00	9.32 E	13.93 E	1910.00	9.28	17.60 E	450.00
19941209	9.36	17.45	1920.00	10.55	15.84	1790.00	9.55	13.93	1980.00	9.62	17.57	221.00
19941210	9.28	17.38	1820.00	10.63	15.77	1690.00	9.32	13.91	1970.00	10.30	17.45	-67.00
19941211	9.22	17.27	1570.00	10.23	15.73	1630.00	9.10	13.85	1780.00	10.35	17.38	.00
19941212	9.28	17.16 E	1380.00	10.09	15.67 E	1550.00	9.09 E	13.77 E	1630.00	10.64	17.29 E	.00
19941213	9.27	17.12	1220.00	10.19	15.51 E	1190.00	9.14 E	13.68 E	1440.00	10.36 E	17.21 E	.00
19941214	9.74	17.05	859.00	10.38	15.34	895.00	9.37	13.44	779.00	9.93	17.14	.00
19941215	10.90	16.94	127.00	10.41	15.48	1660.00	10.15	13.36	627.00	10.09	17.06	.00
19941216	10.74	16.94 E	112.00	10.16 E	15.43 E	1630.00	10.36	13.40	727.00	10.42 E	16.99 E	.00
19941217	10.44	16.94	139.00	10.12	15.24	1280.00	10.48	13.35	638.00	10.20	16.95	.00
19941218	10.51	16.92	183.00	10.33	15.06	825.00	10.45	13.28	568.00	9.97	16.91	.00
19941219	10.46	16.93	567.00	10.77	14.85	447.00	10.29	13.28	644.00	9.92	16.87	.00
19941220	9.93	16.95	782.00	10.35	14.75	605.00	9.82	13.34	995.00	9.81	16.87	.00
19941221	10.41	17.34	1830.00	10.61	15.32	1830.00	9.41	13.88	1930.00	9.57	17.26	2710.00
19941222	11.29	17.54	2320.00	10.68	15.78	2660.00	10.02	14.41	2850.00	9.20	17.74	4600.00
19941223	10.46	17.56	2190.00	9.98	15.73	2370.00	9.27	14.31	2450.00	9.18	17.91	4110.00
19941224	9.42	17.53	1950.00	9.76	15.52	1780.00	9.25	14.34	2510.00	9.06	17.95	3600.00
19941225	9.30	17.50	1680.00	9.91	15.42	1520.00	9.19	14.30	2420.00	9.06	17.93	2700.00
19941226	9.25	17.41	1440.00	9.72	15.43	1490.00	9.33	14.15	2100.00	9.08	17.82	2000.00
19941227	9.66	17.24	767.00	9.99	15.19	860.00	9.46	14.05	1880.00	9.24 E	17.65	1060.00
19941228	10.96	17.06	203.00	10.50	15.27	1100.00	9.20	13.98	1800.00	9.14 E	17.53	305.00
19941229	10.89	17.04	654.00	11.17	15.18	530.00	9.10	13.92	1710.00	9.97	17.53	.00
19941230	10.81	17.00	707.00	11.17	15.12	530.00	9.27	13.79	1430.00	9.73	17.53	462.00
19941231	10.65	16.99	714.00	11.04	15.05	462.00	9.47	13.61	1030.00	9.66	17.53	.00

APPENDIX E

Table E-1. Lake Okeechobee and WCA Mean Daily Stages (ft)

	WCA1 STAGE	WCA3A STAGE	LAKE STAGE
DBKEYS	15810	15943	15611
DATE			
19940501	15.36	9.60	14.12
19940502	15.20	9.60	14.10
19940503	15.17	9.63	14.09
19940504	15.35	9.62	14.09
19940505	15.39	9.61	14.05
19940506	15.31	9.60	14.09
19940507	15.25	9.58	14.05
19940508	15.18	9.57	14.01
19940509	15.10	9.55	13.97
19940510	15.01	9.54	13.95
19940511	14.94	9.52	13.96
19940512	14.94	9.50	13.94
19940513	14.93	9.48	13.93
19940514	14.91	9.46	13.89
19940515	14.80	9.44	13.84
19940516	14.75	9.42	13.80
19940517	14.74	9.42	13.75
19940518	14.77	9.41	13.71
19940519	14.83	9.41	13.76
19940520	14.91	9.38	13.87
19940521	14.93	9.36	13.84
19940522	14.90	9.34	13.80
19940523	14.85	9.32	13.77
19940524	14.76	9.30	13.71
19940525	14.69	9.28	13.67
19940526	14.64	9.27	13.64
19940527	14.69	9.26	13.60
19940528	14.70	9.24	13.60
19940529	14.64	9.25	13.60
19940530	14.61	9.25	13.60
19940531	14.57	9.24	13.60
19940601	14.68	9.28	13.61
19940602	14.93	9.27	13.58
19940603	15.24	9.30	13.62
19940604	15.46	9.33	13.68
19940605	15.62	9.34	13.75
19940606	15.76	9.35	13.81
19940607	15.82	9.38	13.87
19940608	15.85	9.37	13.92
19940609	15.82	9.45	14.01
19940610	15.82	9.46	14.01
19940611	15.80	9.45	14.03
19940612	15.77	9.45	14.05
19940613	15.72	9.45	14.07
19940614	15.66	9.45	14.09
19940615	15.61	9.44	14.08
19940616	15.51	9.44	14.08
19940617	15.47	9.49	14.07
19940618	15.51	9.61	14.10
19940619	15.55	9.61	14.13
19940620	15.56	9.62	14.16
19940621	15.55	9.62	14.19
19940622	15.50	9.69	14.23
19940623	15.50	9.69	14.27
19940624	15.58	9.69	14.33
19940625	15.57	9.69	14.35
19940626	15.47	9.68	14.36
19940627	15.37	9.69	14.38
19940628	15.34	9.70	14.38
19940629	15.36	9.72	14.44
19940630	15.36	9.73	14.46
19940701	15.40	9.74	14.47
19940702	15.43	9.82	14.51
19940703	15.50	9.89	14.55
19940704	15.67	9.87	14.59
19940705	15.77	9.86	14.63
19940706	15.73	9.87	14.67
19940707	15.65	9.87	14.71
19940708	15.60	9.86	14.73
19940709	15.52	9.86	14.74
19940710	15.38	9.84	14.76
19940711	15.24	9.83	14.77
19940712	15.21	9.81	14.80
19940713	15.23	9.80	14.83
19940714	15.22	9.78	14.84

19940715	15.21	9.77	14.85
19940716	15.18	9.76	14.85
19940717	15.16	9.74	14.86
19940718	15.14	9.77	14.86
19940719	15.14	9.74	14.85
19940720	15.15	9.73	14.85
19940721	15.22	9.75	14.88
19940722	15.28	9.82	14.88
19940723	15.30	9.78	14.89
19940724	15.30	9.81	14.89
19940725	15.29	9.78	14.90
19940726	15.33	9.77	14.93
19940727	15.39	9.76	14.94
19940728	15.46	9.88	14.89
19940729	15.64	9.89	14.96
19940730	15.77	9.88	14.95
19940731	15.83	9.87	14.94
19940801	15.90	9.90	14.93
19940802	15.90	9.92	14.98
19940803	15.91	9.93	15.02
19940804	15.93	9.94	15.00
19940805	15.95	9.95	15.03
19940806	15.99	9.98	15.05
19940807	16.00	9.98	15.08
19940808	15.99	10.00	15.10
19940809	15.94	9.98	15.09
19940810	15.88	10.00	15.10
19940811	15.86	10.02	15.13
19940812	16.02	10.15	15.15
19940813	16.24	10.18	15.19
19940814	16.28	10.22	15.22
19940815	16.29	10.23	15.26
19940816	16.28	10.24	15.27
19940817	16.26	10.25	15.28
19940818	16.22	10.25	15.35
19940819	16.15	10.25	15.37
19940820	16.09	10.26	15.38
19940821	16.05	10.27	15.38
19940822	15.99	10.29	15.39
19940823	15.98	10.28	15.44
19940824	16.09	10.30	15.45
19940825	16.11	10.32	15.47
19940826	16.08	10.31	15.49
19940827	16.03	10.39	15.53
19940828	16.02	10.50	15.58
19940829	16.00	10.50	15.62
19940830	15.98	10.49	15.64
19940831	15.96	10.49	15.68
19940901	15.90	10.50	15.70
19940902	15.86	10.50	15.72
19940903	15.85	10.52	15.74
19940904	15.83	10.53	15.76
19940905	15.84	10.53	15.78
19940906	15.89	10.54	15.81
19940907	15.94	10.55	15.80
19940908	16.00	10.58	15.81
19940909	16.06	10.58	15.83
19940910	16.10	10.59	15.85
19940911	16.12	10.64	15.88
19940912	16.15	10.63	15.90
19940913	16.23	10.67	15.91
19940914	16.32	10.83	16.01
19940915	16.32	10.85	16.04
19940916	16.33	10.86	16.09
19940917	16.31	10.86	16.12
19940918	16.29	10.89	16.14
19940919	16.33	11.08	16.17
19940920	16.48	11.10	16.29
19940921	16.55	11.11	16.41
19940922	16.58	11.12	16.48
19940923	16.60	11.16	16.49
19940924	16.62	11.17	16.56
19940925	16.61	11.21	16.63
19940926	16.63	11.24	16.70
19940927	16.65	11.27	16.75
19940928	16.69	11.31	16.81
19940929	16.69	11.34	16.85
19940930	16.69	11.38	16.86
19941001	16.70	11.53	16.91
19941002	16.72	11.57	16.97
19941003	16.72	11.60	17.02
19941004	16.76	11.67	17.00
19941005	16.78	11.69	16.99
19941006	16.78	11.72	17.02
19941007	16.77	11.75	17.03
19941008	16.76	11.75	17.04
19941009	16.76	11.76	17.05
19941010	16.75	11.76	17.06

19941011	16.74	11.88	17.06
19941012	16.86	11.94	17.14
19941013	16.87	11.95	17.17
19941014	16.92	11.98	17.20
19941015	16.95	11.98	17.21
19941016	16.94	11.98	17.22
19941017	16.92	11.96	17.23
19941018	16.91	11.96	17.23
19941019	16.92	11.96	17.24
19941020	16.95	11.95	17.21
19941021	16.98	11.94	17.21
19941022	16.98	11.93	17.17
19941023	16.98	11.92	17.14
19941024	16.98	11.91	17.10
19941025	17.00	11.91	17.07
19941026	17.03	11.88	17.04
19941027	17.12	11.86	17.05
19941028	17.15	11.84	17.04
19941029	17.15	11.81	17.04
19941030	17.16	11.79	17.04
19941031	17.21	12.00	17.04
19941101	17.26	11.99	16.98
19941102	17.31	11.96	17.02
19941103	17.35	11.92	16.97
19941104	17.38	11.89	16.96
19941105	17.40	11.86	16.94
19941106	17.42	11.83	16.92
19941107	17.43	11.80	16.90
19941108	17.42	11.78	16.88
19941109	17.44	11.76	16.83
19941110	17.44	11.73	16.83
19941111	17.43	11.71	16.81
19941112	17.43	11.68	16.79
19941113	17.44	11.64	16.77
19941114	17.46	11.75	16.76
19941115	17.59 E	11.76 e	16.68
19941116	18.09 E	12.10	16.96
19941117	18.10 E	12.34	17.13
19941118	18.13	12.40	17.20
19941119	18.09	12.34	17.26
19941120	18.07	12.33	17.31
19941121	18.03	12.35	17.37
19941122	17.98	12.37	17.36
19941123	17.93	12.39	17.41
19941124	17.86	12.38	17.41
19941125	17.78	12.37	17.41
19941126	17.72	12.37	17.41
19941127	17.64	12.37	17.41
19941128	17.55	12.37	17.41
19941129	17.48	12.38	17.42
19941130	17.41	12.36	17.43
19941201	17.35	12.35	17.42
19941202	17.37	12.33	17.41
19941203	17.34	12.35	17.40
19941204	17.31	12.33	17.39
19941205	17.60	12.50	17.38
19941206	17.62	12.53	17.46
19941207	17.56	12.53	17.48
19941208	17.51	12.54	17.47
19941209	17.47	12.56	17.44
19941210	17.41	12.57	17.41
19941211	17.36	12.57	17.39
19941212	17.30	12.58	17.36
19941213	17.24	12.58	17.36
19941214	17.21	12.58	17.33
19941215	17.18	12.58	17.30
19941216	17.15	12.58	17.28
19941217	17.14	12.57	17.24
19941218	17.12	12.55	17.21
19941219	17.10	12.54	17.18
19941220	17.07	12.52	17.14
19941221	17.29	12.49	17.16
19941222	17.47	12.71	17.40
19941223	17.49	12.73	17.40
19941224	17.47	12.73	17.40
19941225	17.43	12.72	17.41
19941226	17.39	12.71	17.42
19941227	17.35	12.70	17.42
19941228	17.32	12.69	17.42
19941229	17.28	12.69	17.42
19941230	17.23	12.68	17.42
19941231	17.19	12.66	17.41

APPENDIX F

Table F-1. Stage (ft) and Mean Daily Discharges(ft) to Florida Bay.

	S-18C			S-197		
DBKEY	HW 05776	TW 00719	FLOW 00718	HW 13093	TW 13094	FLOW 13092
DATE						
19940501	2.26	1.77	29.00	1.74	.93	.00
19940502	2.26 E	1.73	100.00	1.70	.76	.00
19940503	2.24 E	1.69	65.00	1.68	.51	.00
19940504	2.34	1.89	398.00	1.88	.38	.00
19940505	2.34	2.21	707.00	2.19	.49	.00
19940506	2.23	2.15	488.00	2.12	.62	.00
19940507	2.38	1.84	9.80	1.82	.69	.00
19940508	2.34	1.74	71.00	1.72	.67	.00
19940509	2.32	1.70	20.00	1.69	.63	.00
19940510	2.31	1.67	12.00	1.67	.60	.00
19940511	2.23 E	2.08	575.00	2.06	.68	.00
19940512	2.22	2.11	502.00	2.09	.73	.00
19940513	2.23	2.14	489.00	2.11	.80	.00
19940514	2.12	2.08	383.00	2.04	.88	.00
19940515	2.11	1.90	72.00	1.86	.91	.00
19940516	2.22	1.77	-23.00	1.75	.82	.00
19940517	2.20	1.72	-27.00	1.71	.68	.00
19940518	2.25 E	1.70	-20.00	1.69	.77	.00
19940519	2.54	1.72	60.00	1.70	.89	.00
19940520	2.51	1.70	-7.20	1.70	.99	.00
19940521	2.43	1.69	8.00	1.69	1.26	.00
19940522	2.37	1.67	-.81	1.68	1.41	.00
19940523	2.31	1.67	-10.00	1.67	1.42	.00
19940524	2.27	1.66	49.00	1.65	1.43	.00
19940525	2.26	1.65	19.00	1.63	1.32	.00
19940526	2.28	1.64	58.00	1.62	1.00	.00
19940527	2.27 E	1.62	81.00	1.60	.83	.00
19940528	2.25	1.63	37.00	1.63	.91	.00
19940529	2.26	1.68	21.00	1.66	.99	.00
19940530	2.40	1.81	85.00	1.80	.98	.00
19940531	2.40	1.79	4.40	1.76	.88	.00
19940601	2.36	1.77	34.00	1.74	.74	.00
19940602	2.38	1.75	43.00	1.73	.61	.00
19940603	2.39 E	1.74	33.00	1.73	.55	.00
19940604	2.31 E	1.93	321.00	1.93	.63	.00
19940605	2.30 E	2.27	758.00	2.25	.66	.00
19940606	2.42 E	2.37	855.00	2.34	.59	.00
19940607	2.41	2.35	764.00	2.32	.58	.00
19940608	2.37 E	2.32	682.00	2.29	.52	.00
19940609	2.27 E	2.26	529.00	2.25	.59	.00
19940610	2.20	2.21	391.00	2.20	.80	.00
19940611	2.24	2.21	400.00	2.20	.94	.00
19940612	2.47	2.10	267.00	2.08	.86	.00
19940613	2.48	2.07	354.00	2.04	.75	.00
19940614	2.47	2.05	336.00	2.03	.72	.00
19940615	2.37	2.03	313.00	2.00	.73	.00
19940616	2.26	2.00	299.00	1.97	.67	.00
19940617	2.21	1.97	256.00	1.95	.66	.00
19940618	2.17 E	1.96	259.00	1.95	.57	.00
19940619	2.17 E	1.94	301.00	1.94	.56	.00
19940620	2.24	1.95	278.00	1.94	.67	.00
19940621	2.19	1.94	251.00	1.93	.70	.00
19940622	2.16 E	1.93	242.00	1.92	.72	.00
19940623	2.14 E	1.93	247.00	1.91	.74	.00
19940624	2.11	1.92	251.00	1.90	.69	.00
19940625	2.07 E	1.91	288.00	1.89	.66	.00
19940626	2.03	1.90	265.00	1.86	.66	.00
19940627	2.00 E	1.88	260.00	1.85	.56	.00
19940628	2.03 E	1.89	251.00	1.88	.68	.00
19940629	2.02	1.91	215.00	1.89	.76	.00
19940630	1.99	1.90	223.00	1.88	.76	.00
19940701	1.98	1.89	168.00	1.87	.68	.00
19940702	2.01	1.84	141.00	1.81	.70	.00
19940703	2.13	1.77	53.00	1.75	.67	.00
19940704	2.28	1.77	71.00	1.74	.78	.00
19940705	2.28	1.75	34.00	1.72	.84	.00
19940706	2.28	1.74	25.00	1.71	.72	.00
19940707	2.26	1.73	77.00	1.69	.83	.00
19940708	2.23	1.71	55.00	1.67	.90	.00
19940709	2.22	1.69	38.00	1.67	.82	.00
19940710	2.21	1.68	24.00	1.65	.76	.00
19940711	2.18	1.67	71.00	1.64	.69	.00
19940712	2.14	1.64	61.00	1.62	.59	.00
19940713	2.11	1.62	67.00	1.60	.53	.00
19940714	2.06	1.60	60.00	1.57	.48	.00
19940715	2.02 E	1.57	81.00	1.54	.40	.00

19940716	1.98	1.55	3.20	1.51	.44	.00
19940717	1.96	1.52	61.00	1.49	.49	.00
19940718	1.94	1.52	36.00	1.49	.51	.00
19940719	2.10 E	1.53	45.00	1.52	.54	.00
19940720	2.30 E	1.56	78.00	1.54	.52	.00
19940721	2.27	1.54	41.00	1.53	.56	.00
19940722	2.35 E	1.54	-11.00	1.53	.67	.00
19940723	2.44	1.54	67.00	1.53	.69	.00
19940724	2.37	1.53	60.00	1.51	.70	.00
19940725	2.32 E	1.52	61.00	1.50	.71	.00
19940726	2.28	1.51	63.00	1.48	.73	.00
19940727	2.24	1.49	51.00	1.47	.68	.00
19940728	2.20	1.47	52.00	1.45	.65	.00
19940729	2.20 E	1.57	48.00	1.56	.65	.00
19940730	2.18	1.56	77.00	1.55	.65	.00
19940731	2.17	1.56	44.00	1.54	.69	.00
19940801	2.16 E	1.55	50.00	1.53	.76	.00
19940802	2.16 E	1.54	36.00	1.51	.88	.00
19940803	2.21 E	1.55	47.00	1.53	1.04	.00
19940804	2.21	1.55	58.00	1.52	.87	.00
19940805	2.20 E	1.54	26.00	1.53	.82	.00
19940806	2.27 E	1.56	32.00	1.56	.83	.00
19940807	2.31 E	1.71	185.00	1.71	.76	.00
19940808	2.09 E	2.01	419.00	2.00	.81	.00
19940809	2.24	2.10	509.00	2.09	.96	.00
19940810	2.31	2.14	499.00	2.11	1.03	.00
19940811	2.33	2.18	506.00	2.14	1.16	.00
19940812	2.47	2.35	772.00	2.32	1.13	.00
19940813	2.59	2.55	1080.00	2.50	.94	.00
19940814	2.57	2.53	992.00	2.49	.72	.00
19940815	2.47	2.46	734.00	2.41	.77	.00
19940816	2.31 E	2.33	536.00	2.30	.67	.00
19940817	2.25	2.27	461.00	2.24	.62	.00
19940818	2.22	2.25	418.00	2.21	.69	.00
19940819	2.14	2.17	357.00	2.15	.75	.00
19940820	2.11	2.15	342.00	2.11	.85	.00
19940821	2.09	2.14	345.00	2.12	.82	.00
19940822	2.08	2.11	324.00	2.10	.78	.00
19940823	2.15	2.17	416.00	2.16	.73	.00
19940824	2.15 E	2.18	370.00	2.16	.79	.00
19940825	2.18	2.21	404.00	2.20 E	.93	.00 E
19940826	2.17 E	2.20	369.00	2.19 E	.94	.00 E
19940827	2.19 E	2.22	373.00	2.21 E	.84	.00 E
19940828	2.26 E	2.29	418.00	2.28 E	.84	.00 E
19940829	2.31 E	2.34	572.00	2.33 E	.82	.00 E
19940830	2.41 E	2.42	698.00	2.39 E	.84	.00 E
19940831	2.37	2.38	578.00	2.35 E	.80	.00 E
19940901	2.27 E	2.30	412.00	2.28 E	.83	.00 E
19940902	2.25 E	2.26	406.00	2.26 E	.88	.00 E
19940903	2.24	2.24	396.00	2.25 E	.88	.00 E
19940904	2.25 E	2.25	433.00	2.27 E	.92	.00 E
19940905	2.38 E	2.35	571.00	2.36 E	.97	.00 E
19940906	2.69 E	2.63	1120.00	2.61 E	1.07	.00 E
19940907	2.63	2.59	911.00	2.58 E	1.09	.00 E
19940908	2.60	2.57	832.00	2.55 E	1.10	.00 E
19940909	2.52 E	2.51	678.00	2.50 E	1.14	.00 E
19940910	2.54	2.53	779.00	2.52 E	1.09	.00 E
19940911	2.55	2.54	755.00	2.53 E	1.12	.00 E
19940912	2.57	2.56	737.00	2.58 E	1.22	.00 E
19940913	2.63 E	2.62	805.00	2.64	1.37	.00
19940914	2.81	2.73	1130.00	2.72	1.28	211.03
19940915	2.92	2.78	1600.00	2.71	1.19	732.69
19940916	2.81	2.70	1400.00	2.66	1.24	705.84
19940917	2.69	2.62	1190.00	2.59	1.18	578.51
19940918	2.73	2.71	989.00	2.74	1.05	.00
19940919	2.69 E	2.67	828.00	2.68	.94	.00
19940920	2.69 E	2.67	808.00	2.66	1.03	.00
19940921	2.73 E	2.71	846.00	2.70	1.04	.00
19940922	2.75 E	2.71	797.00	2.70	1.21	.00
19940923	2.72	2.68	766.00	2.67	1.21	.00
19940924	2.66	2.63	644.00	2.63	1.35	.00
19940925	2.62	2.61	672.00	2.60	1.28	.00
19940926	2.65	2.64	739.00	2.64	1.13	.00
19940927	2.57	2.56	522.00	2.56	.99	.00
19940928	2.64	2.64	629.00	2.64	1.13	.00
19940929	2.64	2.63	587.00	2.63	1.15	.00
19940930	2.66	2.65	655.00	2.65	1.21	.00
19941001	2.97	2.86	1230.00	2.79	1.34	496.64
19941002	3.01	2.89	1500.00	2.79	1.30	724.33
19941003	2.83	2.75	1210.00	2.67	1.07	750.86
19941004	2.74	2.66	1130.00	2.60	1.13	717.67
19941005	2.75	2.70	969.00	2.68	1.31	272.61
19941006	2.78	2.76	814.00	2.75	1.45	.00
19941007	2.76 E	2.73	742.00	2.73	1.50	.00
19941008	2.75 E	2.73	726.00	2.72	1.52	.00
19941009	2.74	2.71	689.00	2.72	1.45	.00
19941010	2.76	2.74	714.00	2.74	1.36	.00
19941011	2.74	2.73	695.00	2.72	1.30	.00

19941012	2.74 E	2.73	735.00	2.72	1.33	.00
19941013	2.73 E	2.72	730.00	2.71	1.23	.00
19941014	2.72 E	2.70	696.00	2.70	1.26	.00
19941015	2.66 E	2.65	559.00	2.65	1.43	.00
19941016	2.57	2.56	403.00	2.57	1.86	.00
19941017	2.54	2.53	361.00	2.52	2.36	.00
19941018	2.50 E	2.49	359.00	2.48	2.07	.00
19941019	2.44 E	2.44	293.00	2.45	1.83	.00
19941020	2.41	2.40	279.00	2.41	1.52	.00
19941021	2.40 E	2.37	274.00	2.39	1.38	.00
19941022	2.36	2.35	306.00	2.36	1.38	.00
19941023	2.32	2.32	268.00	2.33	1.29	.00
19941024	2.30 E	2.30	243.00	2.31	1.31	.00
19941025	2.28 E	2.28	248.00	2.29	1.35	.00
19941026	2.26 E	2.26	294.00	2.26	1.19	.00
19941027	2.26 E	2.26	273.00	2.27	1.05	.00
19941028	2.28	2.28	278.00	2.28	1.22	.00
19941029	2.28	2.25	296.00	2.25	1.19	.00
19941030	2.28	2.25	291.00	2.25	1.17	.00
19941031	2.35	2.32	212.00	2.33	1.29	.00
19941101	2.35	2.30	251.00	2.32	1.13	.00
19941102	2.31	2.27	213.00	2.29	1.14	.00
19941103	2.28	2.25	201.00	2.26	1.23	.00
19941104	2.26	2.23	213.00	2.23	1.30	.00
19941105	2.24	2.20	204.00	2.21	1.19	.00
19941106	2.22	2.19	199.00	2.20	1.13	.00
19941107	2.21	2.18	197.00	2.19	1.03	.00
19941108	2.20 E	2.16	197.00	2.17	1.12	.00
19941109	2.20 E	2.15	237.00	2.15	1.12	.00
19941110	2.18 E	2.13	252.00	2.14	1.15	.00
19941111	2.15 E	2.12	224.00	2.13	1.16	.00
19941112	2.13	2.11	179.00	2.13	1.29	.00
19941113	2.20 E	2.18	207.00	2.20	1.67	.00
19941114	2.38	2.36	413.00	2.35	3.02	.00
19941115	3.02 E	2.92	1360.00	2.79	2.99	169.66
19941116	3.20 E	3.01	1830.00	2.73	1.55	1724.48
19941117	3.07	2.87	1820.00	2.50	1.82	2407.65
19941118	2.87 E	2.67	1760.00	2.34	1.85	2041.70
19941119	2.75	2.61	1600.00	2.39	1.63	1525.81
19941120	2.86	2.77	1330.00	2.70	1.75	576.21
19941121	2.85	2.76	1320.00	2.68	1.72	576.83
19941122	2.74	2.67	1100.00	2.60	1.59	596.88
19941123	2.71	2.66	982.00	2.63	1.62	368.27
19941124	2.73	2.72	756.00	2.70	2.00	.00
19941125	2.70	2.68	673.00	2.66	1.68	.00
19941126	2.66	2.64	603.00	2.63	1.42	.00
19941127	2.62	2.60	533.00	2.58	1.40	.00
19941128	2.57 E	2.56	498.00	2.54	1.22	.00
19941129	2.53 E	2.53	472.00	2.51	1.06	.00
19941130	2.52 E	2.52	469.00	2.50	.93	.00
19941201	2.50 E	2.49	425.00	2.49	1.04	.00
19941202	2.51 E	2.52	498.00	2.52	1.09	.00
19941203	2.58 E	2.59	593.00	2.56	1.13	.00
19941204	2.56 E	2.56	493.00	2.52	1.22	.00
19941205	2.54 E	2.53	514.00	2.52	.98	.00
19941206	2.55 E	2.56	554.00	2.55	.96	.00
19941207	2.55 E	2.54	500.00	2.53	.85	.00
19941208	2.54 E	2.54	537.00	2.53	.72	.00
19941209	2.53	2.53	518.00	2.51	.82	.00
19941210	2.53	2.52	510.00	2.50	.94	.00
19941211	2.52	2.50	503.00	2.51	.77	.00
19941212	2.51 E	2.49	483.00	2.49	.91	.00
19941213	2.49	2.47	469.00	2.47	.79	.00
19941214	2.45	2.46	444.00	2.47	1.07	.00
19941215	2.44	2.44	437.00	2.45	1.16	.00
19941216	2.44 E	2.43	417.00	2.44	1.50	.00
19941217	2.43	2.42	410.00	2.42	1.55	.00
19941218	2.42	2.41	403.00	2.42	1.42	.00
19941219	2.41	2.40	370.00	2.40	1.55	.00
19941220	2.37	2.37	334.00	2.36	1.71	.00
19941221	2.55	2.54	620.00	2.52	1.66	.00
19941222	2.64	2.62	717.00	2.62	1.41	.00
19941223	2.61	2.59	670.00	2.61	1.28	.00
19941224	2.60	2.59	657.00	2.58	1.38	.00
19941225	2.58	2.57	615.00	2.56	1.46	.00
19941226	2.53	2.51	481.00	2.51	1.52	.00
19941227	2.49	2.49	479.00	2.49	1.48	.00
19941228	2.49	2.49	494.00	2.49	1.51	.00
19941229	2.49	2.49	505.00	2.49	1.54	.00
19941230	2.49	2.50	517.00	2.50	1.48	.00
19941231	2.51	2.53	576.00	2.51	1.35	.00