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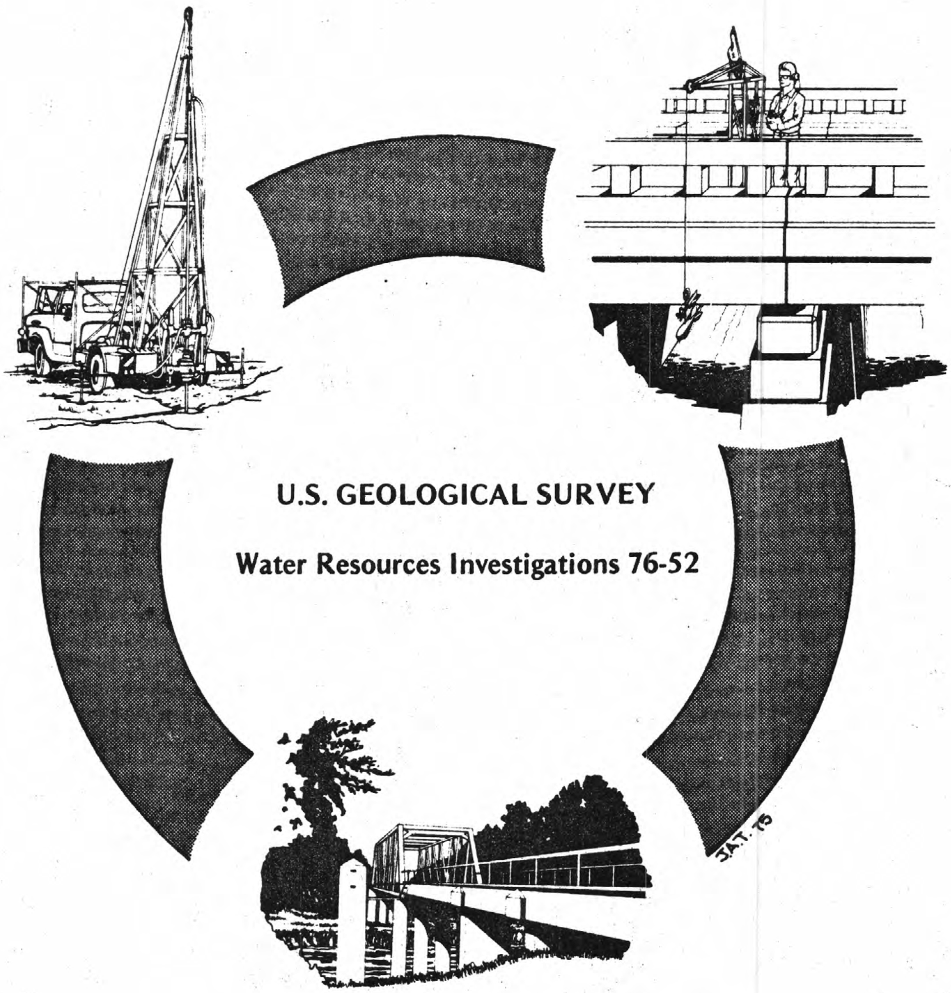
Analysis of Historical Water-Quality Data & a Network Plan for the Central & Southern Florida Flood Control District

Geological Survey

March 1976

ANALYSIS OF HISTORICAL WATER-QUALITY DATA AND A NETWORK PLAN FOR THE CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT



U.S. GEOLOGICAL SURVEY

Water Resources Investigations 76-52

Prepared in cooperation with
CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

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Report prepared in cooperation with Central and Southern Florida Flood Control District.

16. Abstracts Historical water quality data from about 100 sampling stations on streams, canals and lakes in central and southern Florida were analyzed for areal and temporal variations in water quality, statistical measures of the data, relationships between water quality variables and long term changes or trends in water quality. Included in the analysis were data on the major inorganic chemical constituents, temperature, nitrogen and phosphorus species, trace metals, pesticides, organic carbon and biochemical oxygen demand. Based on the results of the analysis, the characteristics of the hydrologic system in central and southern Florida and the need for water quality data, a network was designed which would provide data to meet six specific objectives. These are: (1) water quality accounting, (2) areal assessments (3) detection of gross long-term trends, (4) detection of toxic and deleterious substances, (5) establish a limnological data base on lakes and (6) furnish data on chemical inputs from the atmosphere.

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*Statistical methods, Regression analysis
*Network Design

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UNITED STATES DEPARTMENT OF THE INTERIOR

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GEOLOGICAL SURVEY

V. E. McKelvey, Director

For additional information write to:

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

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SUMMARY

This report presents the results of an analysis of historical water-quality data collected by the U.S. Geological Survey (USGS) from approximately 130 sites on streams, canals, and lakes in central and southern Florida and suggests a plan for a revised water-quality network in the area. The water-quality data analyzed were separated into the following six broad categories: (1) major inorganic chemical consituents, (2) daily measurements of specific conductance and temperature, (3) nutrients, (4) trace metals, (5) insecticides and (6) organic carbon and BOD. Some of the results of this analysis are summarized as follows:

(1) The available data on the major chemical constituents are generally adequate to describe the areal and temporal variations in the concentrations of chemical constituents and water composition in the area. Concentrations of constituents are highest along the main stem of the St. Johns River, in canals draining the Indian River County agricultural area and in the agricultural areas south of Lake Okeechobee. Concentrations of major constituents are lowest in the Kissimmee River and lakes of the Kissimmee River basin; however, concentrations have increased about 50 percent at several locations in the basin in the last 20 years.

(2) Specific conductance can be used in conjunction with regression equations developed for each site to provide reasonably good estimates of the concentrations of the major constituents. Dissolved solids were estimated within a standard error of about 10 percent, and hardness, calcium, magnesium, sodium and chloride were estimated within a standard error of about 15 percent at many stations.

(3) Daily measurements of specific conductance over the last 10 to 20 years show long-term increases for stations on the St. Johns River, the lower Kissimmee River and Fisheating Creek. These increases are probably associated with man's activities. Continued daily measurement of specific conductance at all the existing stations is unnecessary--most stations could be discontinued. After 3 to 5 years selected

stations could be reactivated and discharge-weighted specific conductance could be compared with existing data to look for long-term trends.

(4) The annual loads of dissolved solids discharged by streams and canals in the area were simulated from daily specific conductance and daily discharge measurements in conjunction with regression equations. The annual loads generally varied with average water discharge and ranged from less than 20,000 tons (18,000 tonnes) per year to more than 200,000 tons (180,000 tonnes) per year. Data from the simulation possibly could be used to develop a long-term input-output dissolved solids budget for Lake Okeechobee.

(5) Total nitrogen and total phosphorus concentrations for about 2,000 samples from the area averaged 1.82 and 0.15 mg/l respectively. About 77 percent of the nitrogen was organic in form, 14 percent was ammonia and 9 percent was nitrate. About 80 percent of the phosphorus was soluble orthophosphate. Concentrations of inorganic nitrogen and phosphorus are usually highest in early summer, the beginning of the wet season. Concentrations of phosphorus are highest in the water flowing into Lake Okeechobee and canals in the Indian River area; inorganic nitrogen concentrations are highest in canals draining the agricultural areas south of Lake Okeechobee. Based on the ratio of total nitrogen to total phosphorus, water entering Lake Okeechobee from tributary streams is enriched in phosphorus relative to water in the lake whereas water in areas south of the lake is enriched in nitrogen relative to the lake.

(6) Data on 12 trace metals from approximately 150 locations in central and southern Florida were summarized and compared with water-quality criteria for various water uses including agriculture, public water supplies, fresh-water and marine aquatic life. Except for mercury, trace metals concentrations were generally several times to an order of magnitude lower than the criteria for various water uses. Mercury concentrations averaged 0.35 microgram per litre in the area south of the Tamiami Canal and west of the conservation areas, exceeding the recommended criteria for fresh water aquatic life of 0.2 micrograms per litre total concentration. Future sampling for trace metals should place major emphasis on determining concentrations in suspended and bottom sediments rather than in solution.

(7) Of 11 insecticides for which analyses were made in about 360 water samples collected between 1968 and 1972, only 5 were detected. These were DDT, DDD, DDE, dieldrin and lindane and were detected in less than 12 percent of the samples. The frequency with which the DDT series was detected declined since 1968 and probably reflects the restrictions on agricultural application of these compounds.

(8) Five insecticides were commonly detected in south Florida bottom sediments. DDD, and DDE were detected in nearly 80 percent of the samples analyzed, dieldrin in about 50 percent, and chlordane and DDT in about 30 percent of the samples analyzed. DDD and DDT concentrations were highest in the Everglades agricultural area where they are applied directly to the soils. Dieldrin concentrations were highest in soils from the urban area reflecting greater urban use of this insecticide, possibly for termite eradication and other domestic uses.

(9) An analysis was made of organic carbon and 5-day BOD data for more than 1,600 samples. Both are measures of organic matter; however little or no correlation was found between measurements of the two. Average BOD ranged from 1.3 mg/l in the St. Johns and lower Kissimmee basin to 2.9 mg/l in the Taylor Creek basin and Hillsboro Canal system. Average organic carbon ranged from 14 mg/l in the Kissimmee River basin to 27 mg/l in the Hillsboro, North New River and Miami Canal systems. Organic material leached from soil and decaying vegetation undoubtedly constitutes the major source of organic carbon in the area.

A plan for a water-quality network was developed that would accomplish six main objectives: (1) provide for water quality accounting, (2) provide an areal assessment of water quality, (3) provide data to detect gross long-term trends, (4) provide reconnaissance information on toxic and deleterious substances, (5) provide limnological data on lakes and (6) provide information on the composition and loads of constituents in bulk precipitation. The network, as designed, includes 91 stations covering the major drainage systems, points of flow diversion and major lakes. In addition, bulk precipitation would be collected at eight of these stations. A list of constituents and characteristics to be measured are presented for the stations designed to accomplish each of the six objectives, and a plan for data analysis and network evaluation is suggested.

INTRODUCTION

Pressures from the public and legislation at all levels of government are focusing greater and greater attention on the protection, conservation, and wise use of our water resources. These pressures are especially great in the area of water quality where enormous sums of money are being spent for pollution control measures to maintain or improve the present quality of the Nation's waters. In connection with these efforts, large expenditures are also being made at all levels of government for water-quality monitoring networks and environmental studies to assess water-quality problems in relation to land use and development, to aid in water management decisions, to determine if waters meet specified water-quality criteria, to assess the effectiveness of water pollution control measures and to enforce legislation. Associated with these efforts is the critical need to develop a data base from which long-term changes in water quality can be determined.

These efforts and needs clearly point out the necessity for close coordination of water-quality-data collection activities among all agencies in a particular area. Through a coordinated effort costly duplication can be held to a minimum and an integrated network can be developed which will meet many needs including those of water-management agencies, local and state pollution control agencies, federal agencies, and the general public. It is also important that specific goals and objectives be defined for collection of the data and that data analysis and network evaluation be made an integral part of the network design.

With the need for close coordination in mind, the USGS, in cooperation with the FCD (Central and Southern Florida Flood Control District), has evaluated, based on historical data contained in USGS computer files, the existing USGS cooperative water quality networks in central and southern Florida. The results of the evaluation are presented in this report. This report also defines the goals and objectives which should be met by the water-quality network suggested for the FCD area, the operational design for a network to meet the objectives and a mechanism to analyze the data and evaluate the network on a continuing basis. The network design incorporates all current data collection programs in the FCD area, including five stations in the USGS national stream quality accounting network and the permanent station network of the Florida Department of Environmental Regulation.

Acknowledgments

The authors thank William V. Storch and David Hallett of FCD for their cooperation in this evaluation. The technical assistance and guidance provided by Timothy Steele and Richard O. Hawkinson, both of the USGS, Lakewood, Colo., and Reston, Va., respectively, in obtaining and setting up the sequence of computer programs used for data analysis and in participating in helpful discussions regarding the network evaluation, are gratefully acknowledged.

The authors also thank Michael E. Merritt of the USGS, Tallahassee, Florida for setting up and running the data analysis computer programs.

For use of those readers who may prefer to use metric units rather than English units, the conversion factors for the terms used in this report are listed below:

Multiply English units	By	To obtain Metric Units
	Length	
feet (ft)	.3048	metres (m)
miles (mi)	1.609	kilometres (km)
	Area	
square miles (mi^2)	2.59	square kilometres (km^2)
	Flow	
cubic feet per second (ft^3/s)	0.0353	litres per second (l/s)
	35.31	cubic metres per second (m^3/s)
	Mass	
ton (short)	0.9078	Tonne or metric ton (t)

Background

The first systematic collection of water-quality data in central and southern Florida was begun early in the 1940's by the USGS under a cooperative program with the Florida Geological Survey, Dade County, and the city of Miami, to investigate the water resources of southeastern Florida (Parker and others, 1955). These data, collected between 1940 and 1945, are valuable for comparison with data currently being collected. Very little additional data were collected from 1946 to 1955 except for salinity measurements in the Miami area. In the mid-1950's, after the FCD was created by the State Legislature a continuing water quality network was established in the area. This network, operated by the USGS in cooperation with FCD, provides a large part of the existing water-quality data base in the area and constitutes virtually all of the long-term data base. In recent years, data from this network has been supplemented by data collected under other programs including short-term studies of a localized nature conducted in cooperation with FCD, the U.S. Army Corps of Engineers, Broward and

Dade Counties, National Park Service, U.S. Environmental Protection Agency and numerous state and local agencies in the FCD area. Also, in 1974, the Florida Department of Environmental Regulation established a permanent station network which includes eighteen stations in the FCD area to monitor water quality.

When established in 1954, the USGS-FCD water quality network had two objectives: (1) determine the suitability of water for municipal, industrial or agricultural supply; (2) detect changes in chemical quality that may result from the use of water in the agricultural areas and the storage of water in the conservation areas. The network consisted of 14 stations on canals and streams in the Lake Okeechobee and south Florida area, 14 stations in the Kissimmee River basin (10 lakes, 3 canals, 1 site on the Kissimmee River), and 5 sites in the upper St. Johns River basin and Indian River area. Sampling frequency ranged from about once a month to twice a year and samples were analyzed for major inorganic chemical constituents.

This network has been examined from time to time with the result that specific stations have been added or deleted, and changes have been made in sampling frequency and in the water-quality variables measured. Significant modifications were made in 1964 and in 1970. In 1964, 10 stations were added for the daily measurement of specific conductance. In 1970, the number of water-quality variables being measured was expanded to include nitrogen and phosphorus species, selected trace metals, organic carbon, and pesticides. The addition of these parameters has made the data more environmentally relevant. However, until now no truly in-depth evaluation has been made of the water quality data network in the FCD area.

Objectives and Scope

This evaluation has three prime objectives. These are: (1) examine the existing surface-water-quality network and analyze the available data base in the FCD to determine areal patterns and temporal changes in water quality, and relations between water-quality variables based on statisitcal measures; (2) define specific objectives which should be met by a water-quality network in the FCD area and develop an operational design for a network to meet these objectives which, to the extent possible, will combine all regional and local networks in the area; and (3) develop a plan by which data will be analyzed and the network evaluated at least annually so that adjustments can be made in the network if objectives are not being accomplished or if new objectives for the network are defined.

Essentially all surface-water-quality data collected in Florida by the USGS have been placed in WATSTORE (National Water Data Storage and Retrieval System). The entire computer-stored data base for the FCD area was used in this evaluation. It includes data collected by the USGS in cooperation with FCD and in cooperation with numerous other agencies in the area as well. In all, more than 5,000 chemical analyses from about 100 stations in the area were used is some part of the evaluation. Data collected by agencies other than the USGS were not used.

PRESENT WATER QUALITY NETWORKS IN THE FCD AREA

The present (1975) surface water quality hydrologic records network operated by the USGS in cooperation with the FCD consists of 41 stations. An additional 12 stations are sampled as part of a separate cooperative network in the upper St. Johns River basin. The Survey operates additional networks in the area in cooperation with Broward, Collier, and Dade Counties, the U.S. Army Corps of Engineers, National Park Service, and the U.S. Environmental Protection Agency. The USGS has also recently initiated the National Stream Quality Accounting Network (NASQAN) which includes five sites in the FCD area. In addition to these networks the Florida Department of Environmental Regulation has recently implemented a Permanent Station Network which includes 18 sites in the area. Combined, these networks include 129 sampling sites in the FCD.

For the 53 stations in the present (1975) USGS-FCD networks including the upper St. Johns River basin network, the following type of measurements are being made; at the cited frequencies:

Measurement	Number of Sites	Frequency
Specific conductance and temperature	12	Daily
Nitrogen and phosphorus species	51	Bimonthly
Major constituents	47	Semiannually
Major constituents	4	Quarterly
Trace metals	22	Semiannually
Trace metals	4	Quarterly
Organic carbon and BOD	11	Bimonthly
Organic carbon and BOD	11	Semiannually
Pesticides	12	Semiannually
Pesticides (sediment only)	5	Annually
Phytoplankton	8	Bimonthly

A detailed list of 129 stations in the various networks is given in Table 1. The list includes station name, identification number, parameters measured and frequency of sampling. The locations of the stations are shown on figure 1.

DATA ANALYSIS TECHNIQUES

For purposes of this evaluation the water quality data were separated into 6 broad categories, each containing several variables, as follows:

1. Major inorganic chemical constituents (calcium, magnesium, sodium, potassium, bicarbonate, chloride, sulfate, fluoride, hardness, dissolved solids, and silica).
2. Daily measurements of specific conductance and temperature.
3. Nitrogen and phosphorus species (nitrate-N, nitrite-N, ammonia-N, organic-N, total orthophosphate-P and total phosphorus).
4. Trace metals (aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel and zinc).
5. Pesticides (DDT, DDD, DDE, aldrin, dieldrin, endrin, lindane, heptachlor, heptachlor epoxide, toxaphene, chlordane, 2,4-D, 2,4,5-T and silvex).
6. Organic carbon and BOD

Extensive use was made of the USGS IBM 370 computer system and available computer programs to analyze the existing water-quality data from the FCD area. First an index to the data (computer programs G164 and G165) was obtained to determine the locations of all sampling stations for which quality-of-water data were available in the FCD, the type of data available at each station, and the number of analyses made at each station each year for the period of record. An example of the output from these programs is shown in figure 2.

Data for selected stations were then retrieved from the water quality file and analyzed through the use of a sequence of computer programs including several programs in the USGS statistical package (STATPAC), (Sower, and others, 1971). A flow chart for the procedure and STATPAC programs used is shown in figure 3. This basic approach, developed by Steele (1970, 1972) for use with a similar statistical package (SYSLAB), has been used to analyze chemical-quality data in Arkansas (Steele, 1971) and Texas (Blakey, and others, 1972).

For this analysis, data for the major inorganic chemical constituents and nitrogen and phosphorus species for selected stations in the FCD area were retrieved from the water-quality file using program E771. These data were subsequently stored on a disc in the form of a two-dimensional (STATPAC) matrix using program C362 (see fig. 3). All data for trace

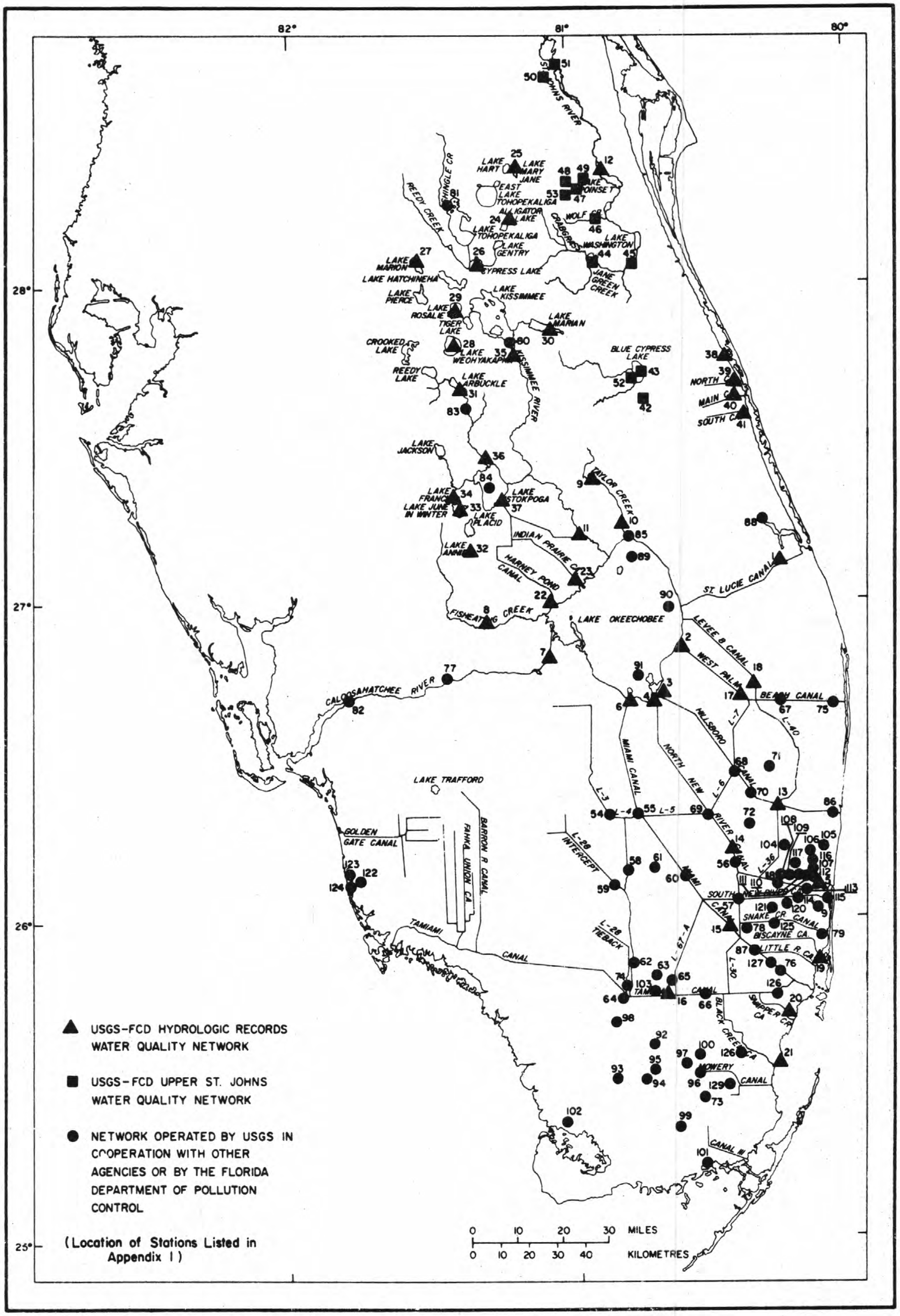


FIGURE 1.- LOCATION OF EXISTING (1975 FY) WATER-QUALITY NETWORK STATIONS.

WATER YEAR	NO. SAMPL	D.S.	HARD- NESS	MAJ- CR CAT- IONS	SIL- ICA	ALU- MI- NUM	IRON	MAN- GA- NESE	MAJ_ OR AN- IONS	FLU- O- RIDE	CAR- BON	NI_ TRO- GEN	PHOS_ PHO- ROUS	D.O.	BOD	COD	PH	PES- TI- CICES	RAC_ IC- CHEM- ICAL	BIO- LOG- IC	SEDMT SUS	BED
02272990 10B KISSIMMEE RIVER NEAR OKEECHOBEE FLA LAT=27 14 18 LONG=080 58 57 STREAM STATE=12 COUNTY=093 DIST.=12																						
1940	23	23	23	23	23	0	23	0	23	23	0	23	0	0	0	0	0	0	0	0	0	0
1941	15	15	15	15	15	0	15	0	15	15	0	15	0	0	0	0	0	0	0	0	0	0
1952	1	1	1	1	1	0	1	0	1	1	0	1	0	0	0	0	1	0	0	G	0	0
1953	3	3	3	3	3	0	3	0	3	3	0	3	0	0	0	0	3	0	0	0	0	0
1954	36	36	36	36	36	0	36	0	36	36	0	36	0	0	0	0	36	0	0	0	0	0
1955	36	36	36	36	36	0	36	0	36	36	0	35	0	0	0	0	36	0	0	0	0	0
1956	36	36	36	36	36	0	36	0	36	36	0	36	0	0	0	0	36	0	0	0	0	0
1957	38	38	38	38	38	0	38	0	38	38	0	38	0	0	0	0	38	0	0	0	0	0
1958	36	36	36	36	36	0	36	0	36	36	0	36	0	0	0	0	36	0	1	0	0	0
1959	37	36	36	36	36	0	36	0	37	36	0	36	0	0	0	0	37	0	0	0	0	0
1960	36	35	36	36	35	0	35	0	36	35	0	34	0	0	0	0	36	0	0	0	0	0
1961	40	36	40	40	36	0	36	0	40	36	0	35	0	0	0	0	40	0	0	0	0	0
1962	39	35	38	38	36	0	37	0	39	22	0	36	0	0	0	0	39	0	0	0	0	0
1963	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1965	1	1	1	1	1	0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0
1966	1	1	1	1	1	0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0
02272999 KISSIMMEE RIVER AB S-65E NR OKEECHOBEE FLA LAT=27 13 35 LONG=080 57 45 STREAM STATE=12 COUNTY= DIST.=12																						
1960	1	1	1	1	1	0	1	0	1	1	0	1	0	0	C	C	1	C	C	0	C	C
1968	12	4	4	4	4	0	4	2	4	4	0	11	10	1	0	0	4	0	0	G	C	0
02273000 10B KISSIMMEE RIVER AT S-65E NEAR OKEECHOB LAT=27 13 34 LONG=C80 57 44 STREAM STATE=12 CCUNTY= CIST.=12																						
1960	36	36	36	36	36	0	36	0	36	36	0	36	0	0	0	0	36	0	0	0	C	0
1961	45	36	42	45	39	0	39	0	42	36	0	36	0	0	0	0	41	C	C	0	0	0
1962	59	35	38	56	54	0	55	0	41	23	0	35	0	0	0	0	41	0	C	0	C	C
1967	1	1	1	1	1	0	1	1	1	1	0	1	1	0	0	C	1	0	0	0	0	0
1968	16	7	7	7	7	0	7	2	7	7	0	14	10	1	0	0	7	C	C	0	C	C
1969	2C	3	4	4	3	0	3	0	4	3	0	15	14	3	1	C	3	C	C	1	0	0
197C	28	9	9	9	9	0	8	2	14	9	1	18	12	7	6	0	8	1	C	5	C	C
1971	16	3	3	3	8	0	3	3	5	3	3	8	8	10	3	C	8	2	0	0	0	0
1972	47	13	4	4	22	3	5	5	15	4	8	22	22	22	7	C	17	2	11	1	C	C
1973	7	3	0	1	3	0	0	0	3	0	3	3	3	6	0	0	3	0	2	0	G	C
02273001 10B KISSIMMEE R BL S-65E NEAR OKEECHOBEE, LAT=27 13 34 LONG=080 57 44 STREAM STATE=12 CCUNTY=093 DIST.=12																						
1968	7	6	6	6	6	0	6	2	6	6	0	6	2	1	0	C	6	0	0	0	0	C
1969	2	2	2	2	2	0	2	0	2	2	0	2	0	0	0	C	2	C	C	0	0	C
1970	2	1	1	1	1	0	C	0	1	1	0	1	0	0	0	0	1	0	C	0	C	C
1971	3	1	1	1	1	0	1	1	1	1	1	1	1	2	1	C	1	C	C	0	0	0

FIGURE 2. EXAMPLE OF OUTPUT FROM PROGRAM G164--INDEX TO WATER-QUALITY DATA IN COMPUTER STORAGE.

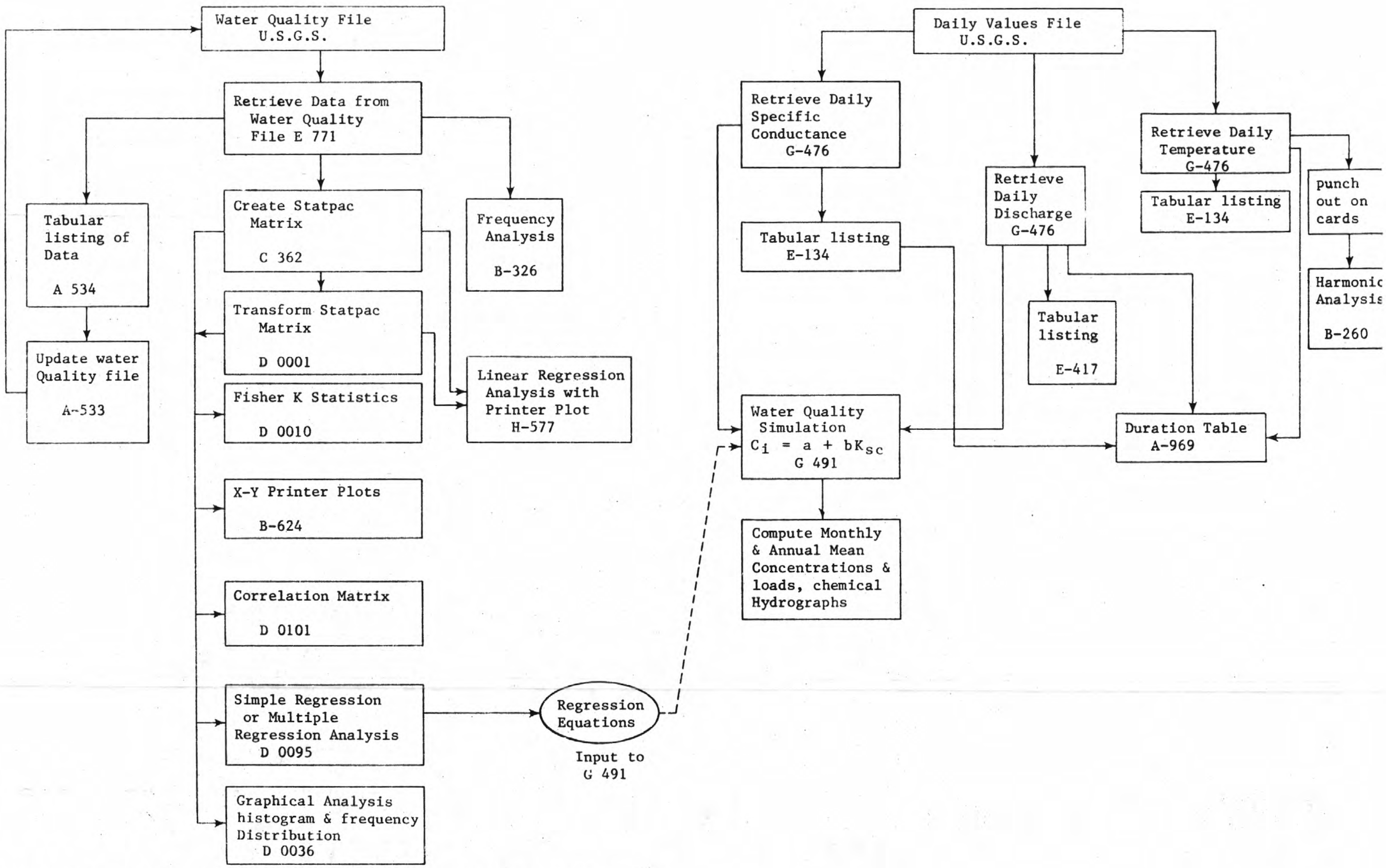


FIGURE 3.-FLOW CHART SHOWING PROCEDURES AND COMPUTER PROGRAMS USED IN DATA ANALYSIS.

metals, BOD and organic carbon in the FCD area were converted to the STATPAC matrix. Next a transformation program (D0001) was run to obtain logarithms of discharge and specific conductance and to obtain inorganic and total nitrogen by the summation of individual nitrogen species. X-Y plots were then obtained (program B624) for the major constituents, using cartesian coordinates to plot specific conductance versus each major constituent and logarithmic coordinates to plot specific conductance versus discharge. These plots provided a visual display of relation between variables and aided in detection of anomalous data storage errors. After the anomalous data storage errors were reviewed and necessary corrections made, basic statistics (program D0010) were obtained for all stations and parameters in the matrix. Statistical description of each parameter included documentation of sample size and the determination of range in concentration, mean and standard deviation. Regression equations were then computed (program D0095) for specific conductance (K_{sc}) versus each constituent (C_i) of interest. The form of the regression equation is $C_i = a_i + b_i K_{sc}$ where a_i and b_i are, respectively, the intercept and slope of the equation. In the latter stage of the analysis a computer program (H577) was used which produces all three, X-Y printer plots, basis statistics, and linear regression analysis.

For selected stations additional programs were used to aid in data analysis. These included a correlation matrix (program D0101) to determine correlation between all parameters in the matrix and histograms (program D0036) to examine the distribution of values for individual parameters. Another frequency analysis program (B-326), which does not require a STATPAC matrix, was also used selectively to aid in analyzing the data.

A water-quality simulation program (G491) was used at a few stations in conjunction with daily discharge, daily measurements of specific conductance data and regression equations from program D0095 to simulate monthly and annual loads of chemical constituents.

Daily temperature data were examined by using a harmonic analysis program (B260), (Steele, 1974). In this program a simple sine function is used to relate stream temperature to the time of the year. The sine function has the following form:

$$T(x) = A \sin (bx + C) + M$$

where $T(x)$ is the stream temperature on day x of the water year. For example on October 1, $x = 1$ and on September 30, $x = 365$.

A = amplitude of the harmonic in degrees Celsius
b = 0.0172 radian per day ($2\pi/365$ days)
x = day number in annual time increment
C = phase angle of the harmonic, in radians
M = mean of the harmonic, in degrees Celsius

Derivation of this function is given by Ward (1963) and Gilroy and Steele (1972).

The coefficients, A, C and M are determined by a least squares regression procedure utilizing daily temperature records.

DISCUSSION OF RESULTS

Major Inorganic Chemical Constituents

Data on the major inorganic chemical constituents were analyzed for 31 stream sites and 19 lakes in the FCD area. The sites selected for analysis included all stations where daily specific conductance data were collected, all stations with long-term data and all lakes currently being sampled in the USGS-FCD cooperative program. The data were analyzed to (1) obtain basic statistics including the mean, standard deviation, and range in concentration for each constituent at each station, (2) determine if specific conductance can be used as an index variable to estimate concentrations of major constituents, (3) determine areal variations in concentrations and, (4) detect long-term trends.

The results of linear regression analyses between specific conductance (K_{sc}) and each major constituent (C_i) for the 50 selected stations are given in Table 2 at the end of the report. For a few stations with long-term records regression analyses were made for different parts of the period of record. These analyses give the equation of a linear least squares relation between specific conductance and each constituent, the standard error of estimate of the regression equation, the standard error expressed as a percent of the mean of the dependent variable, and the correlation coefficient. The mean, standard deviation, and range in concentration for each constituent are also given in table 2.

As has long been recognized in water chemistry, the regression analyses showed that specific conductance can be used an an index variable to obtain reasonable estimates of the concentrations of most major constituents and related properties at a given station. The best estimates were obtained for dissolved solids and hardness. Dissolved solids residue (residue on evaporation at 180°C) can be estimated from specific conductance within a standard error of 5 percent at some stations and within 20 percent at most stations. Dissolved solids sum (calculated from the sum of the concentrations of dissolved chemical constituents) can be estimated at most stations within 10 percent. Hardness can be estimated at most stations within a standard error of 20 percent and within 10 percent at some stations. Calcium, magnesium, sodium, and chloride can be estimated within 25 percent at most stations and within 15 percent at many stations. Bicarbonate can be estimated within about 25 percent. The relation between specific conductance and sulfate is well defined for a few stations but is poorly defined for many others. The standard error of estimate as a percent of the mean for sulfate ranges from about 10 percent to more than 50 percent.

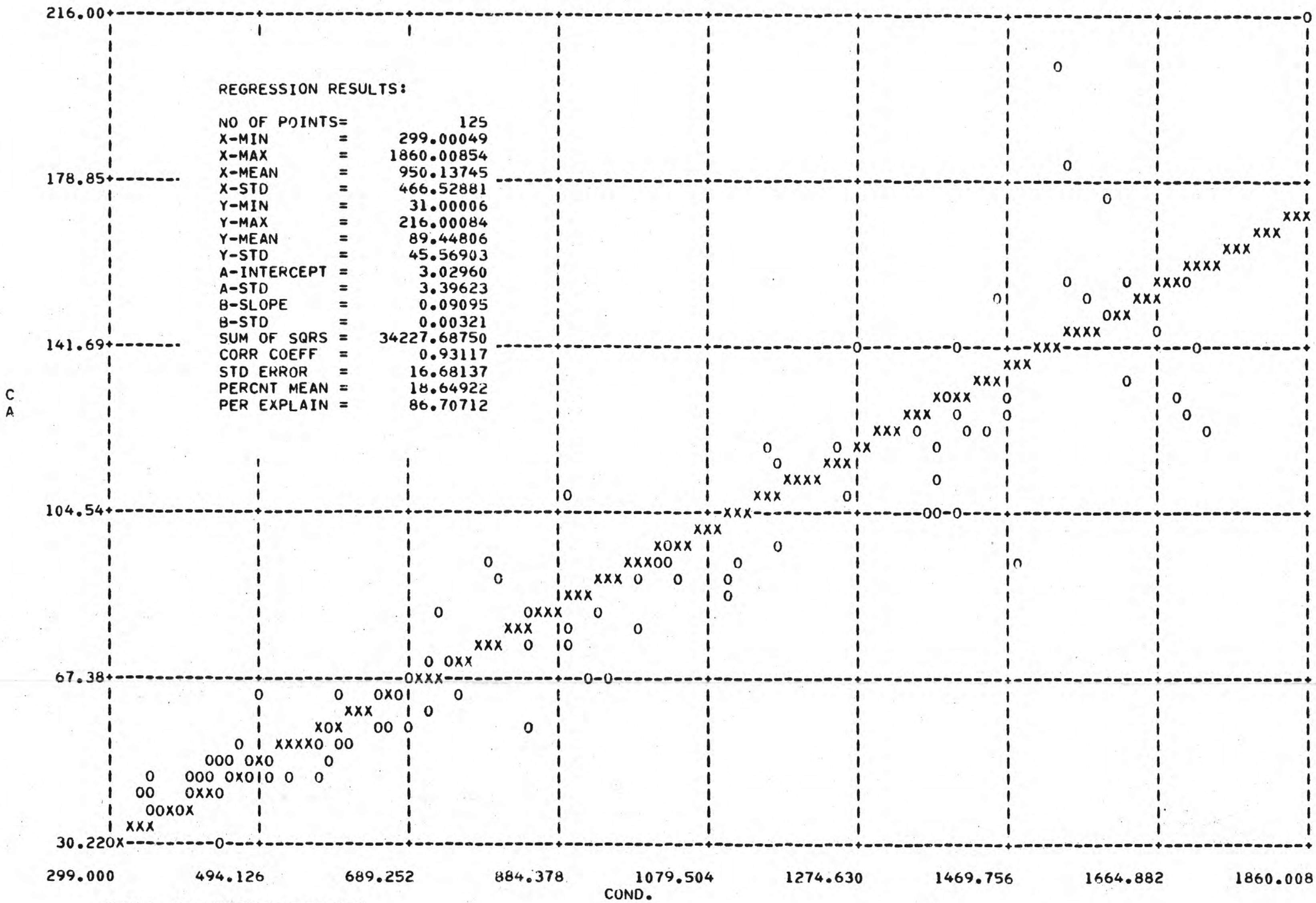
Potassium and silica cannot be estimated from specific conductance. However, average potassium concentrations are generally less than 3 mg/l (milligrams per litre) throughout the FCD area except where salt water intrusion occurs. Silica does not ionize at the pH of most natural waters and no correlation with specific conductance would be expected. A correlation was observed, however, at several stations on canals in the agricultural area south of Lake Okeechobee. This correlation is due to a secondary effect in that silica has a wide range of concentration and the concentration varies directly with dissolved solids concentrations.

Computer plots illustrating the relation between specific conductance and the major constituents for Hillsboro Canal at HGS-4 (site 3 on fig. 1) are shown in figures 4-14. At some stations the relation between specific conductance and certain constituents was non-linear. An example of this is shown in figure 15 for specific conductance versus bicarbonate at the station Taylor Creek above Okeechobee (site 10 on fig. 1). The relation between specific conductance and calcium, sodium and chloride at this station are also slightly non-linear. The non-linearity is due to a shift in water composition from a calcium bicarbonate type at low specific conductance to a more concentrated sodium chloride type at high specific conductance produced by the inflow of ground water. Estimates for bicarbonate at this station could be improved by developing a pair of regression equations one of which would be used below a specific conductance of 2,000 umhos/cm at 25°C and a second set to be used above 2,000 umhos/cm.

Index variables other than specific conductance could be used to estimate concentrations of the major constituents. Figure 16 shows a matrix of correlation coefficients between all major constituents for the Kissimmee River at S-65E. A correlation coefficient of 1.00 (or -1.00) indicates perfect correlation whereas a correlation coefficient of 0.00 indicates no correlation. The figure shows that several variables are highly correlated with the major constituents. Hardness and dissolved solids in particular could be used as index variables. In general terms, however, specific conductance will give the best overall estimate and specific conductance has the additional advantage that it can be quickly and inexpensively measured in the field or in the laboratory.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 3(CA) OVER ROWS 1 TO 126

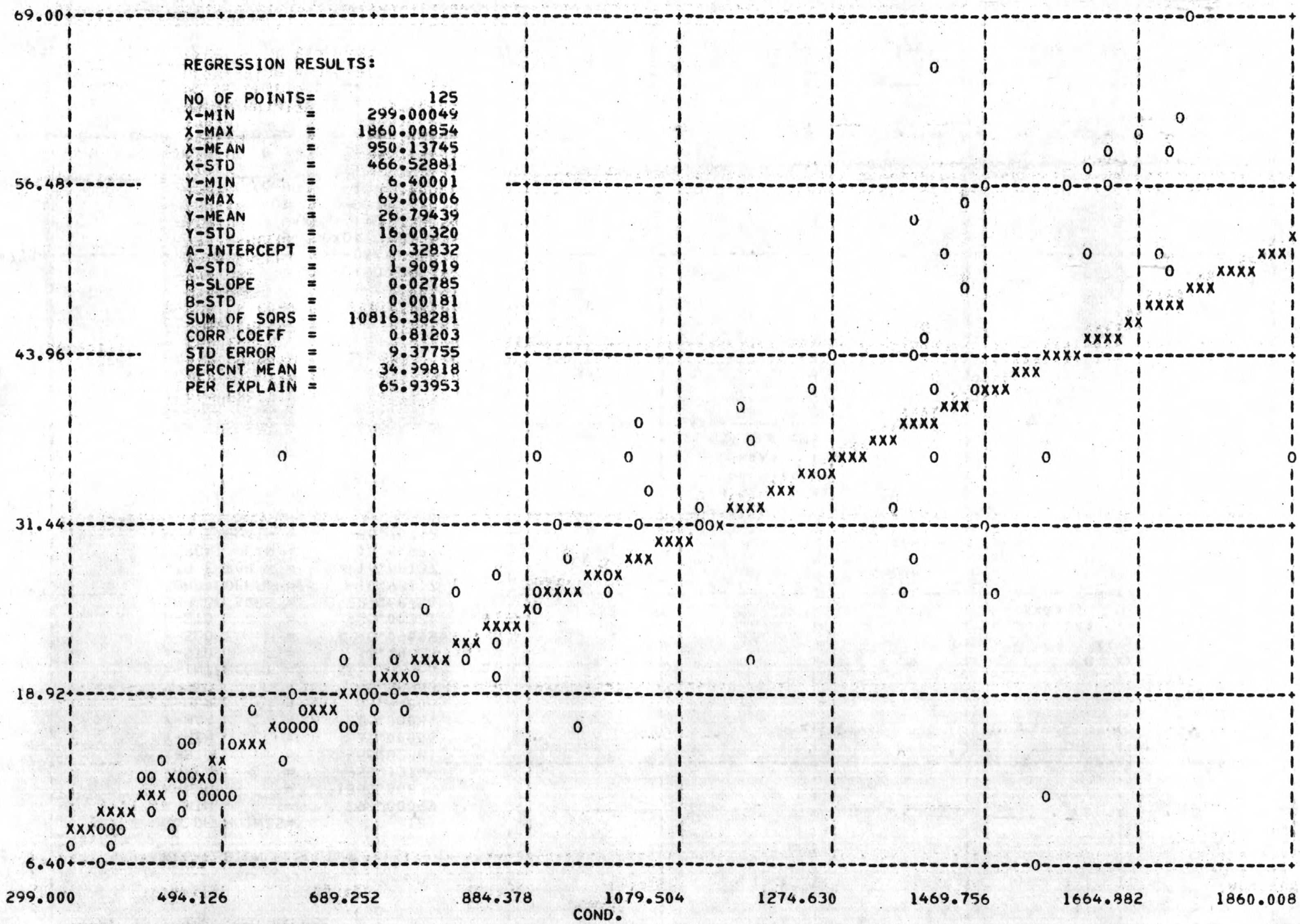


WHERE O = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 4.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND CALCIUM FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 4(MG) OVER ROWS 1 TO 126

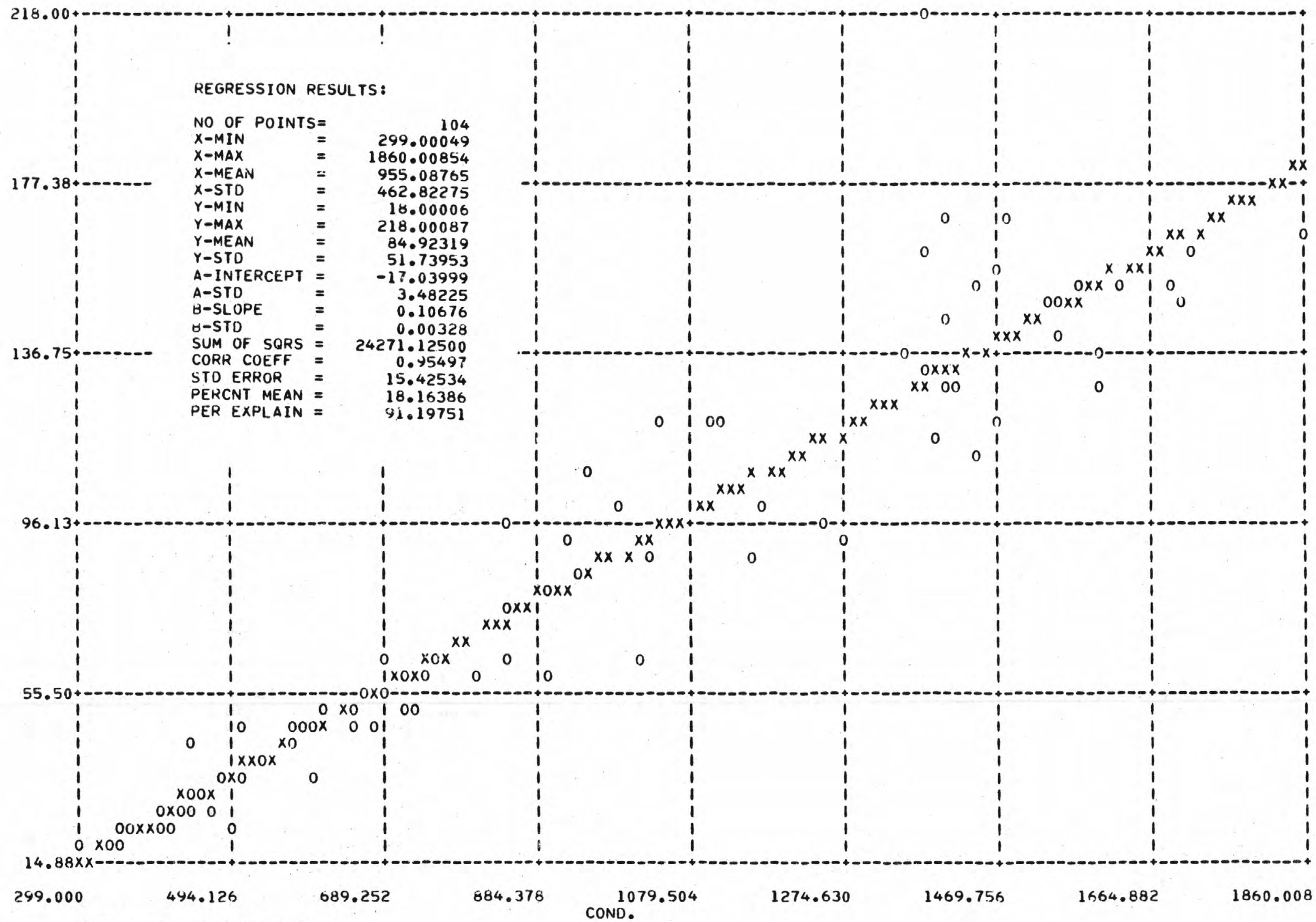


WHERE O = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 5.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND MAGNESIUM FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 5(NA) OVER ROWS 1 TO 126

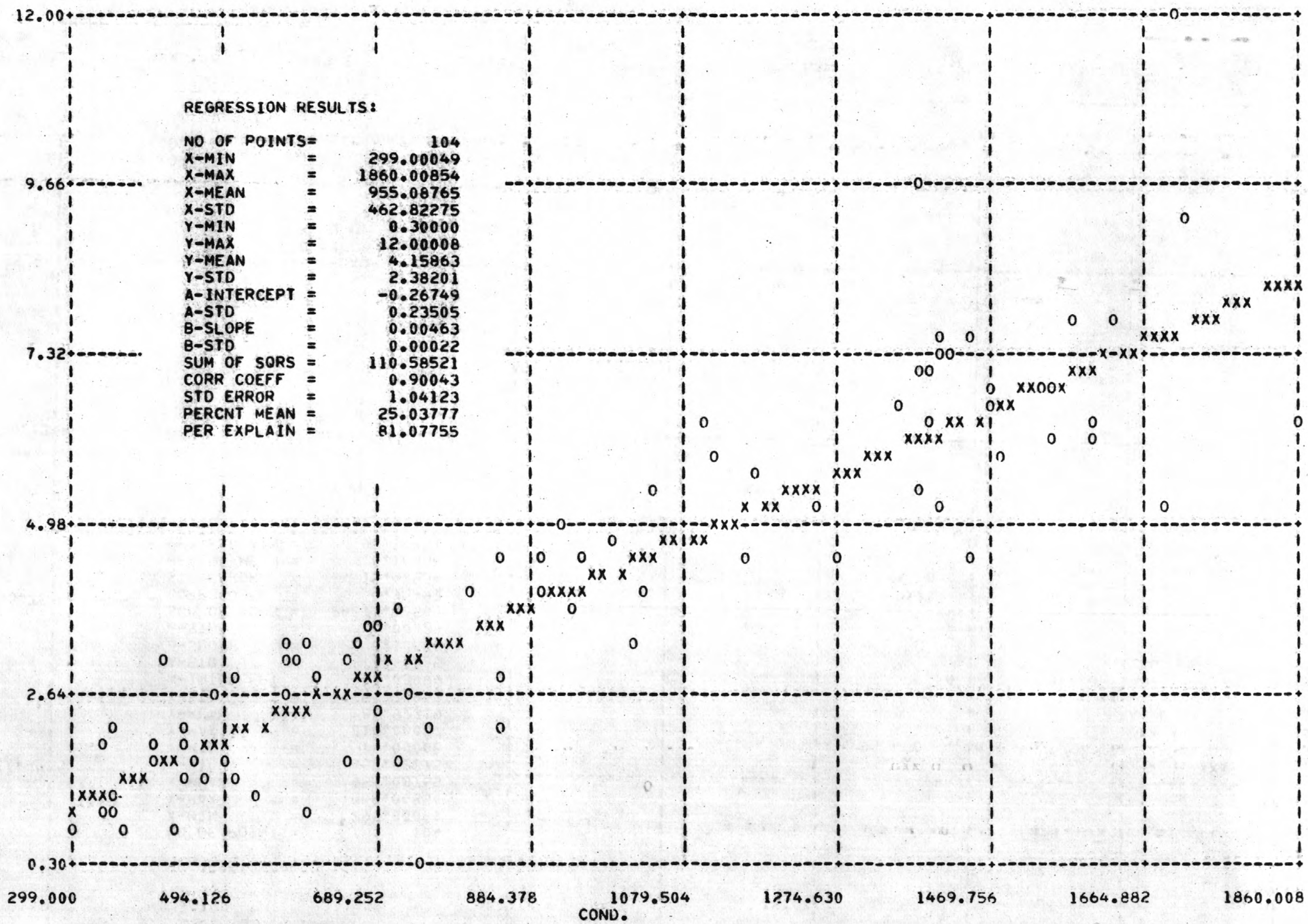


WHERE 0 = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 6 RELATION BETWEEN SPECIFIC CONDUCTANCE AND SODIUM FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 6(K) OVER ROWS 1 TO 126

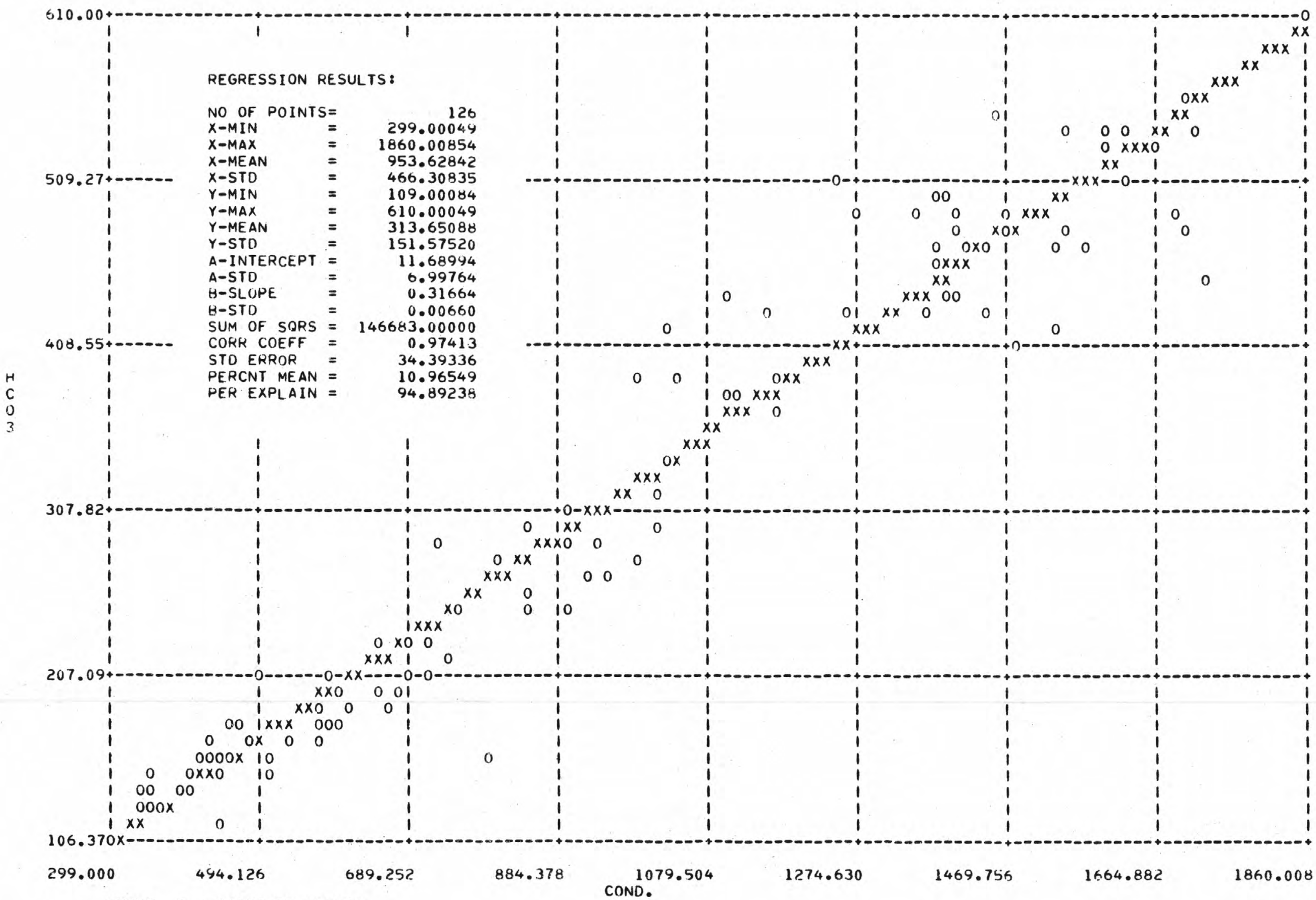


WHERE O = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 7.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND POTASSIUM FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 7(HCO3) OVER ROWS 1 TO 126

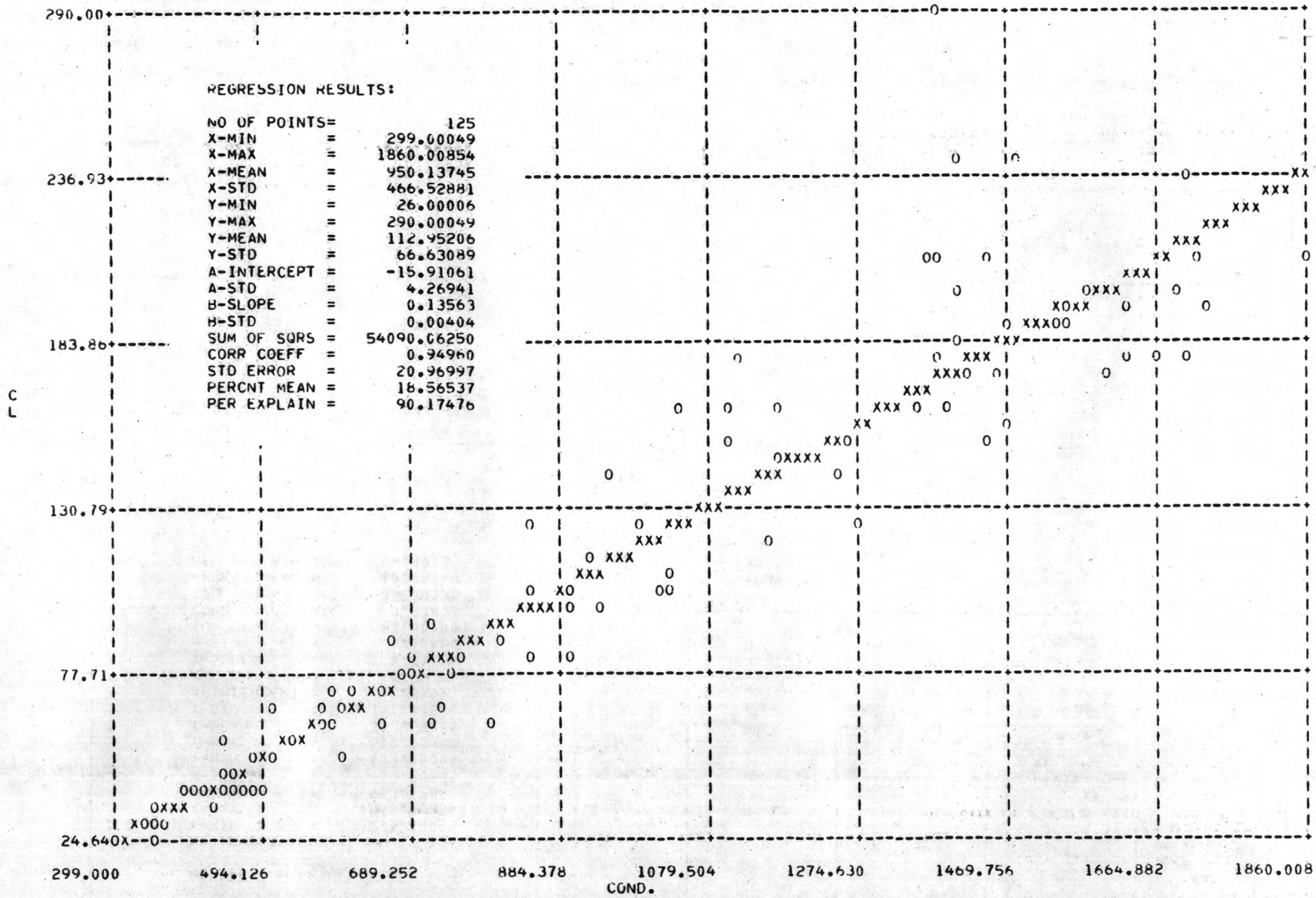


WHERE O = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 8.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND BICARBONATE FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 8(CL) OVER ROWS 1 TO 126

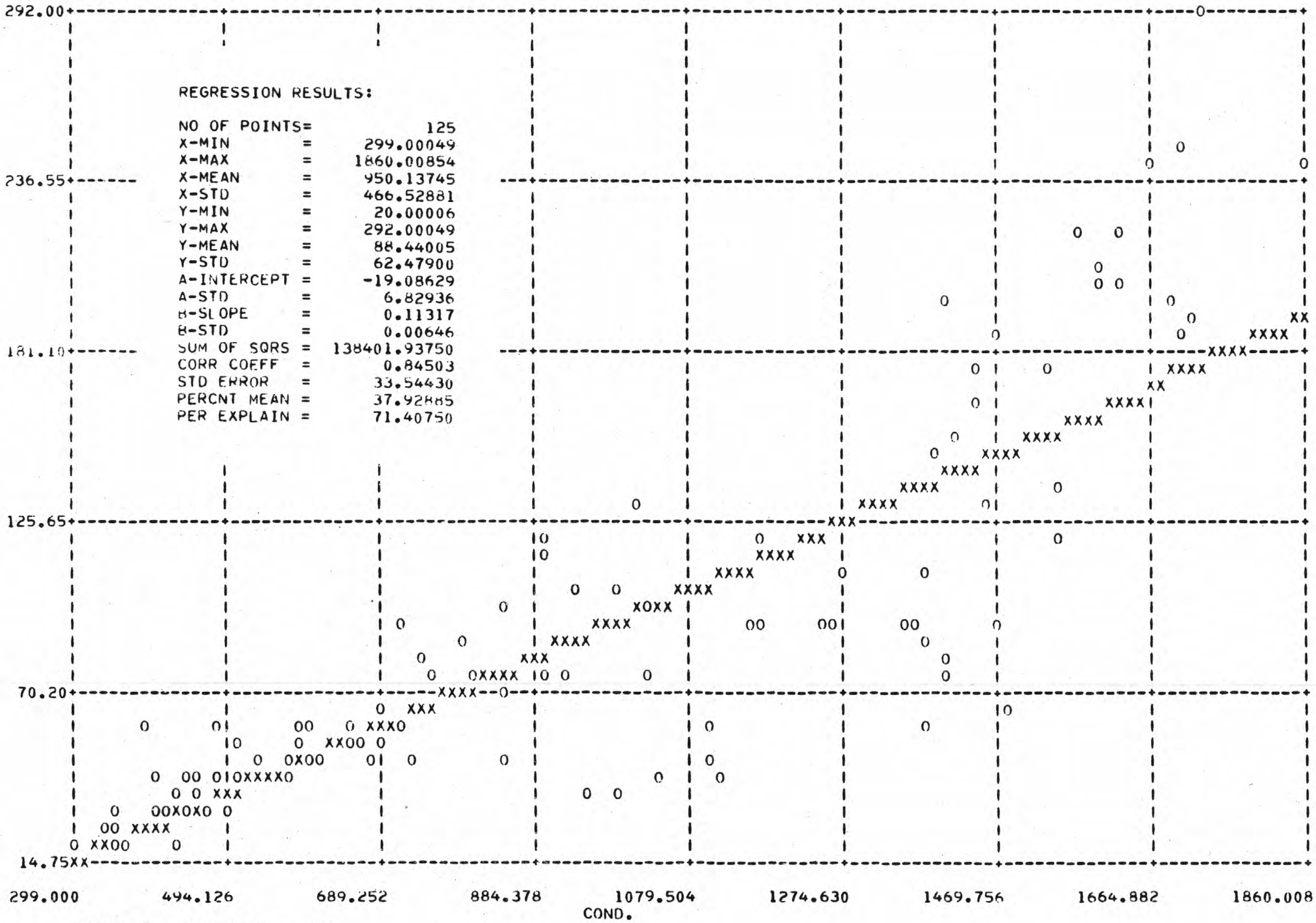


WHERE 0 = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 9.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND CHLORIDE FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 9(SO4) OVER ROWS 1 TO 126

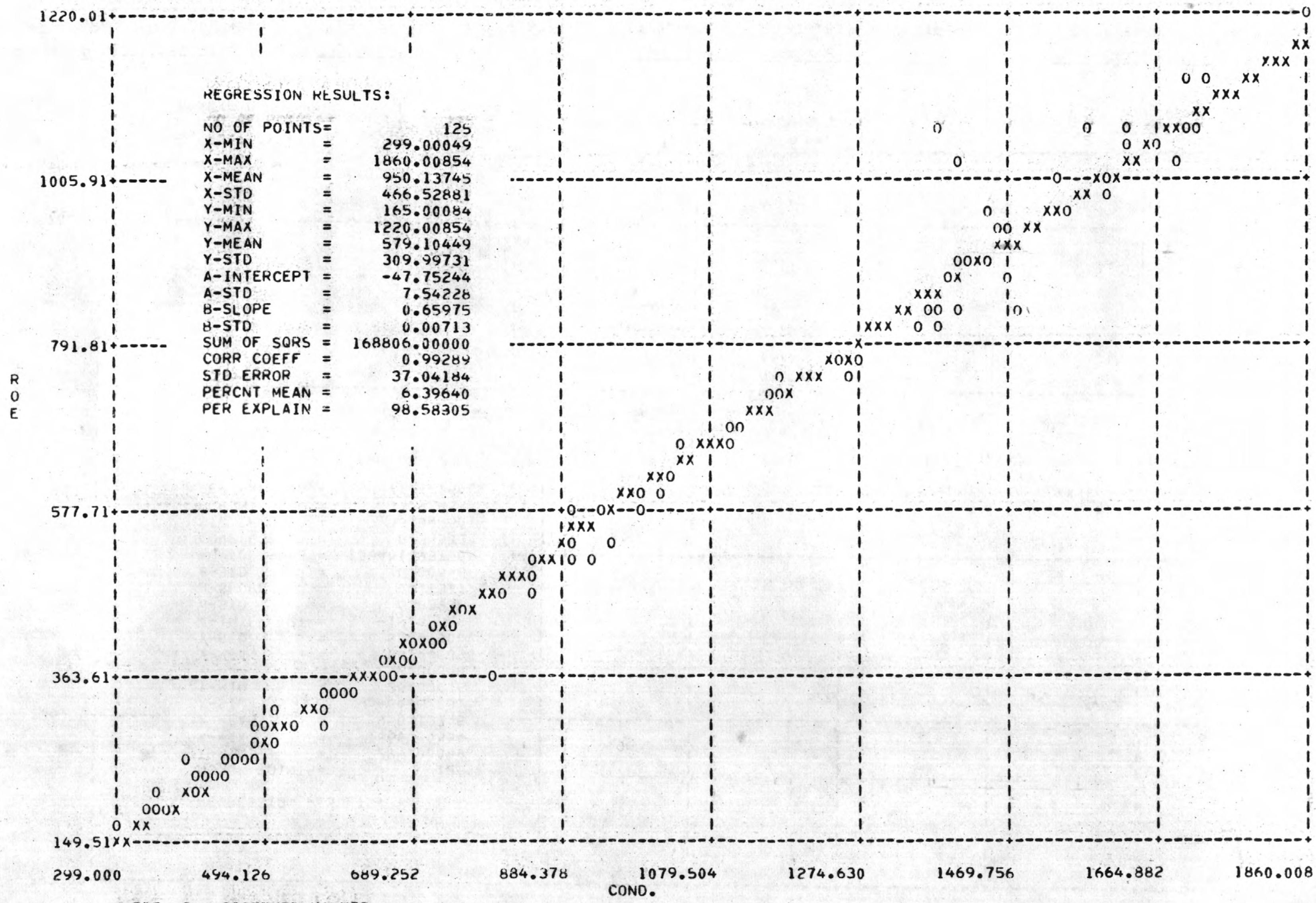


WHERE 0 = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 10.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND SULFATE FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 12(ROE) OVER ROWS 1 TO 126



REGRESSION RESULTS:

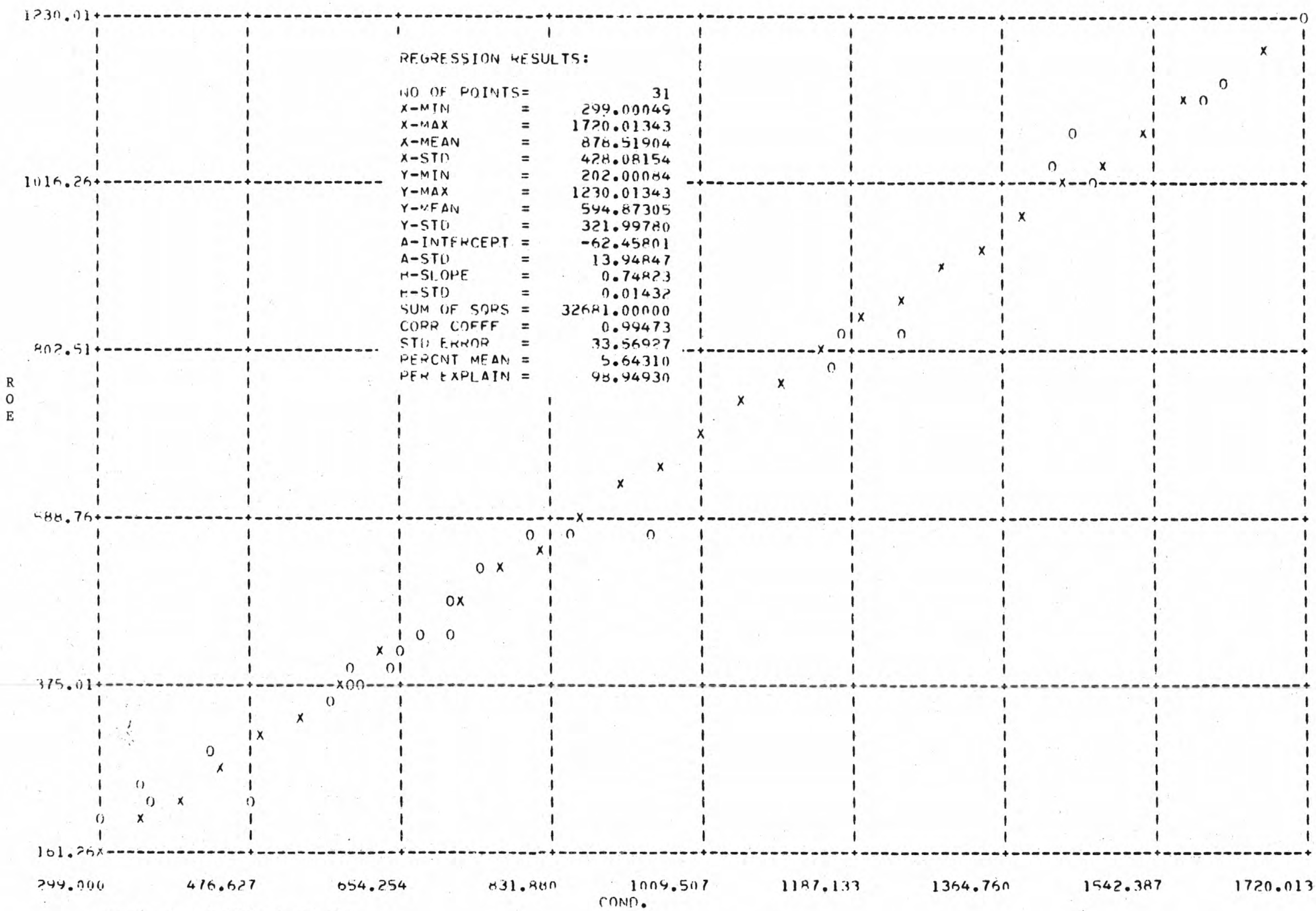
NO OF POINTS	=	125
X-MIN	=	299.00049
X-MAX	=	1860.00854
X-MEAN	=	950.13745
X-STD	=	466.52881
Y-MIN	=	165.00084
Y-MAX	=	1220.00854
Y-MEAN	=	579.10449
Y-STD	=	309.99731
A-INTERCEPT	=	-47.75244
A-STD	=	7.54228
B-SLOPE	=	0.65975
B-STD	=	0.00713
SUM OF SQRS	=	168806.00000
CORR COEFF	=	0.99289
STD ERROR	=	37.04184
PERCNT MEAN	=	6.39640
PER EXPLAIN	=	98.58305

WHERE 0 = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 11.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND DISSOLVED SOLIDS (SUM) FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL AT HGS-4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 11(ROE) OVER ROWS 286 TO 412

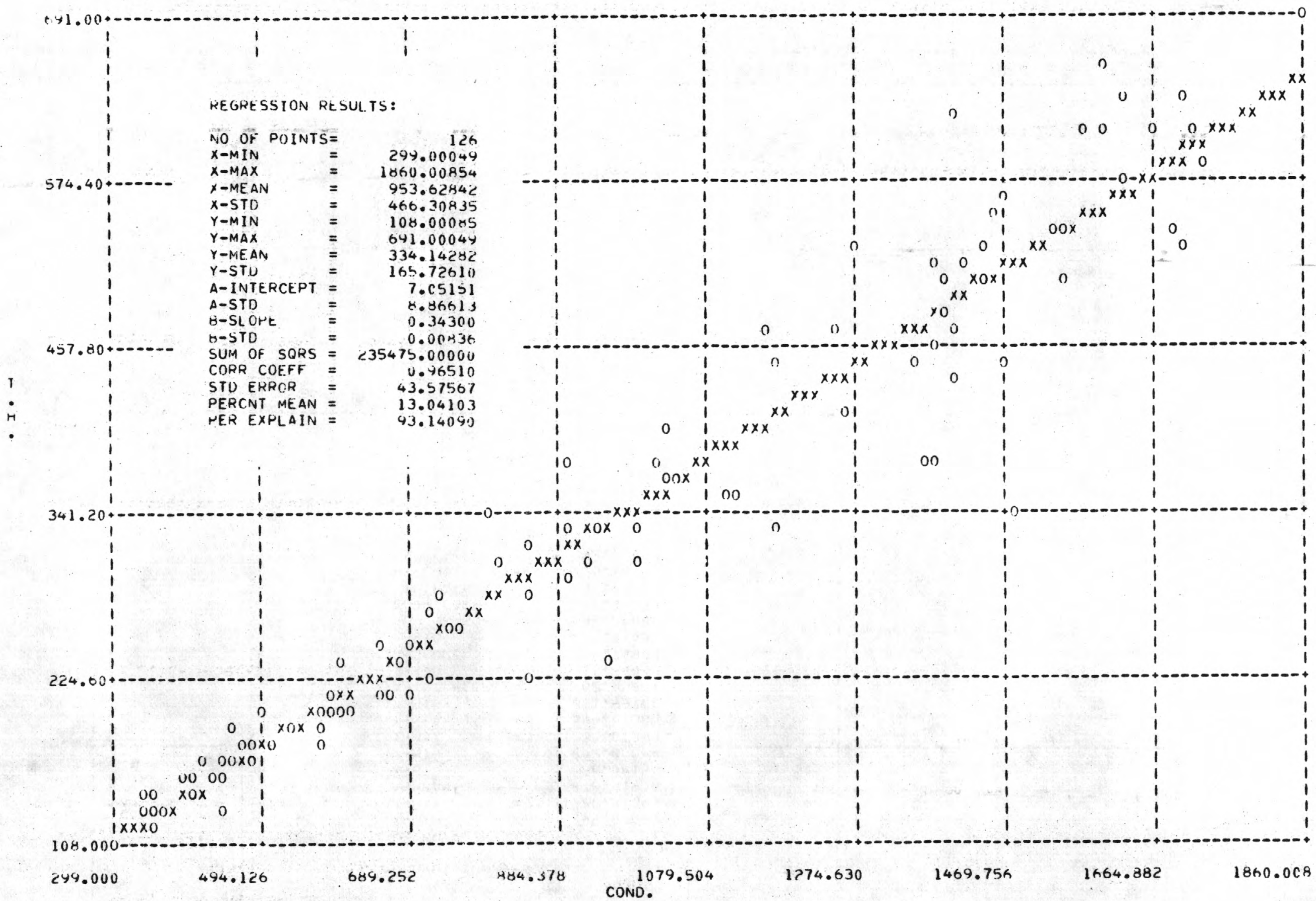


WHERE 0 = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 12.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND DISSOLVED SOLIDS (RESIDUE @ 180 C) FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

HILLSBORO CANAL BELOW HGS4

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 13(T.H.) OVER ROWS 1 TO 126



WHERE 0 = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 13.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND HARDNESS AS $CACO_3$ FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

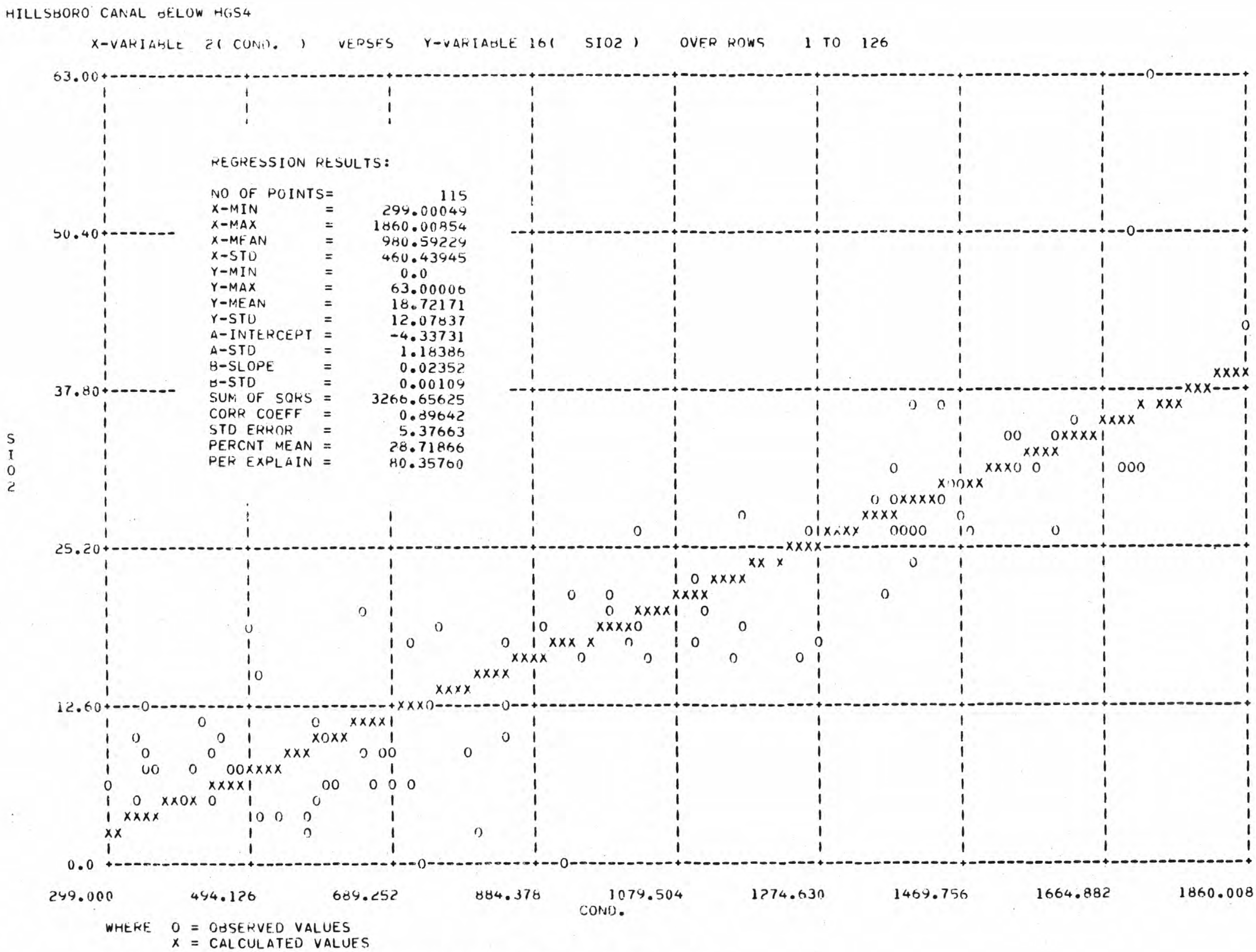


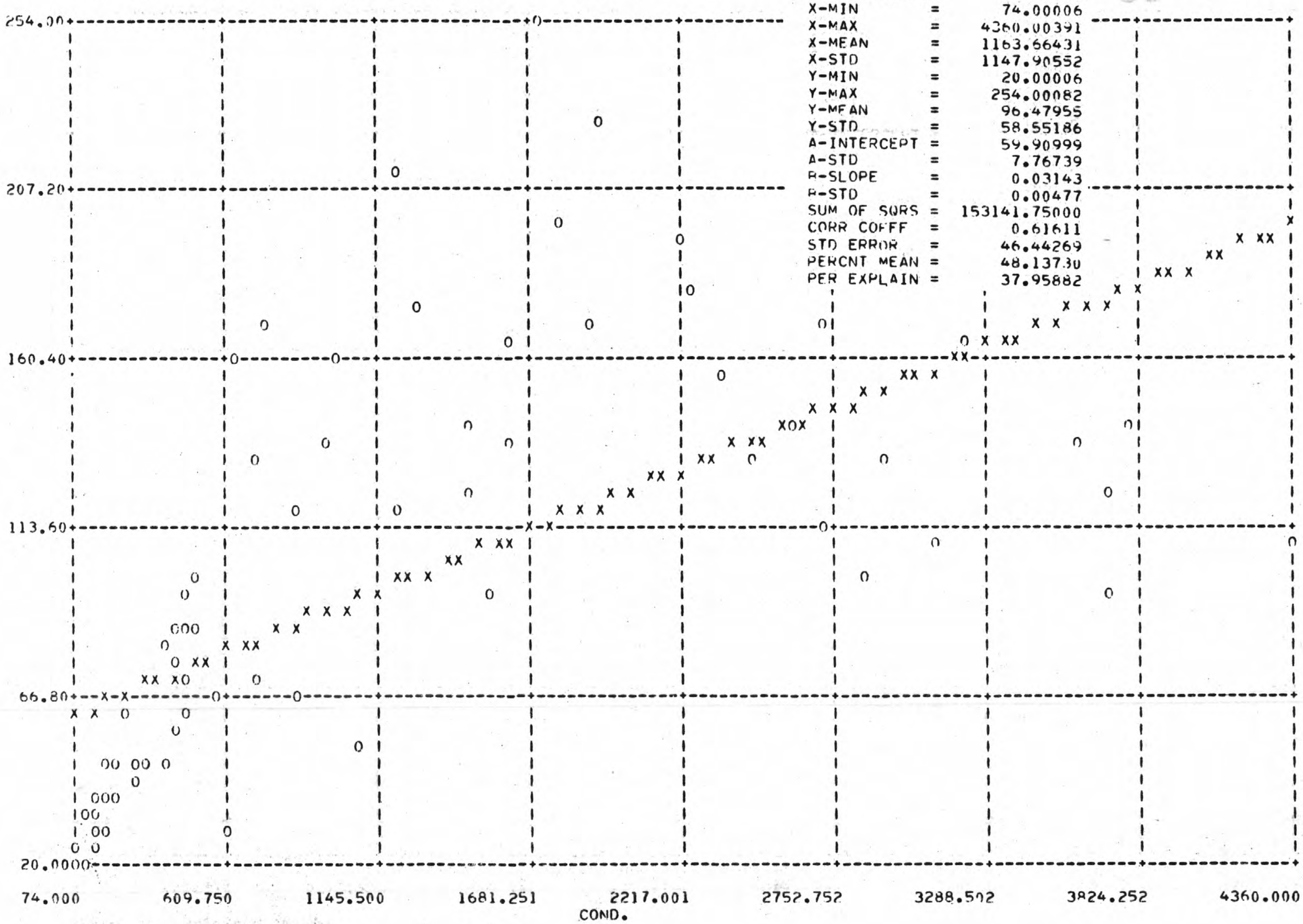
FIGURE 14.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND SILICA FOR HILLSBORO CANAL AT HGS-4 NEAR SOUTH BAY.

TAYLOR CR AB. OKEECHOB.

X-VARIABLE 2(COND.) VERSES Y-VARIABLE 7(HCO3)

REGRESSION RESULTS:

NO OF POINTS	=	73
X-MIN	=	74.00006
X-MAX	=	4360.00391
X-MEAN	=	1163.66431
X-STD	=	1147.90552
Y-MIN	=	20.00006
Y-MAX	=	254.00082
Y-MEAN	=	96.47955
Y-STD	=	58.55186
A-INTERCEPT	=	59.90999
A-STD	=	7.76739
B-SLOPE	=	0.03143
B-STD	=	0.00477
SUM OF SQRS	=	153141.75000
CORR COFFF	=	0.61611
STD ERROR	=	46.44269
PERCNT MEAN	=	48.13730
PER EXPLAIN	=	37.95882



WHERE O = OBSERVED VALUES
X = CALCULATED VALUES

FIGURE 15.-RELATION BETWEEN SPECIFIC CONDUCTANCE AND BICARBONATE FOR TAYLOR CREEK ABOVE OKEECHOBEE.

ARRAY OF NUMBER OF PAIRS AND CORRELATION COEFFICIENTS -

		1 Q	2 COND.	3 CA	4 MG	5 NA	6 K	7 HCO3	8 CL	9 SO4	10 F
1	Q	1.0000	-0.4603	-0.3699	-0.4261	-0.5066	-0.5617	-0.3366	-0.5797	-0.4793	-0.1933
2	COND.	132	1.0000	0.8582	0.7454	0.9194	0.5853	0.9500	0.8649	0.9439	0.4700
3	CA	156	143	1.0000	0.7444	0.7580	0.4424	0.7911	0.7280	0.8474	0.4482
4	MG	156	143	170	1.0000	0.9070	0.6150	0.5488	0.8708	0.9041	0.4640
5	NA	130	139	143	143	1.0000	0.5891	0.7846	0.9546	0.9216	0.4558
6	K	130	139	143	143	144	1.0000	0.4517	0.6677	0.6055	0.1298
7	HCO3	132	140	140	140	135	135	1.0000	0.6951	0.8632	0.4170
8	CL	130	137	142	142	140	140	135	1.0000	0.8838	0.4743
9	SO4	127	134	139	139	139	139	132	139	1.0000	0.4494
10	F	115	124	129	129	129	129	120	126	125	1.0000
11	TDS	127	143	141	141	141	141	132	139	138	127
12	ROE	18	26	29	29	29	29	25	29	29	29
13	T.H.	136	144	149	149	144	144	141	142	139	129
14	NCH	133	141	143	143	139	139	140	139	136	124
15	SR	11	19	19	19	19	19	17	17	17	19
16	SIO2	149	144	164	163	142	142	133	140	139	128
17	LOG Q	154	130	153	153	127	127	130	127	124	112
18	LOG SC	132	151	143	143	139	139	140	137	134	124
19	COND/TDS	124	143	136	136	136	136	132	134	133	122
20	CA/MG	156	143	170	170	143	143	140	142	139	129
21	SO4/CL	127	134	139	139	139	139	132	139	139	125
22	SR/CA	11	19	19	19	19	19	17	17	17	19

ARRAY OF NUMBER OF PAIRS AND CORRELATION COEFFICIENTS -CONT.

		11 TDS	12 ROE	13 T.H.	14 NCH	15 SR	16 SIO2	17 LOG Q	18 LOG SC	19 COND/TDS	20 CA/MG
1	Q	-0.4749	-0.5403	-0.4103	-0.4111	-0.2541	-0.1378	0.8072	-0.6067	-0.3565	0.1331
2	COND.	0.9576	0.9872	0.8743	0.7674	0.4007	0.5144	-0.6014	0.9519	0.5296	0.1225
3	CA	0.9476	0.9152	0.9810	0.7980	0.4149	0.5891	-0.5325	0.7893	0.4079	0.1825
4	MG	0.7538	0.6747	0.8276	0.8182	0.0530	0.6800	-0.6910	0.7043	0.5927	-0.3526
5	NA	0.8383	0.5284	0.8425	0.7967	0.1543	0.4902	-0.7557	0.8930	0.5587	-0.1673
6	K	0.5113	0.6544	0.5148	0.5472	0.1859	0.4756	-0.6344	0.6623	0.4936	-0.1494
7	HCO3	0.9365	0.8861	0.7664	0.5873	0.3663	0.5462	-0.4210	0.8700	0.4266	0.3247
8	CL	0.8202	0.5410	0.8087	0.7884	-0.1509	0.4679	-0.8037	0.8943	0.5593	-0.1806
9	SO4	0.8975	0.8142	0.9123	0.8375	0.2454	0.6435	-0.6588	0.8553	0.4689	-0.0457
10	F	0.4667	0.2535	0.4762	0.4561	-0.0494	0.0977	-0.2171	0.4402	0.3127	0.0169
11	TDS	1.0000	0.9547	0.9539	0.8065	0.3664	0.4591	-0.6167	0.8977	0.2814	0.1701
12	ROE	29	1.0000	0.9591	0.4235	0.3162	0.3779	-0.5038	0.9700	0.2817	0.4921
13	T.H.	141	29	1.0000	0.8484	0.3976	0.5639	-0.5901	0.8111	0.4828	0.1031
14	NCH	136	29	144	1.0000	0.0463	0.5816	-0.5689	0.7259	0.5567	-0.0834
15	SR	19	17	19	17	1.0000	0.1202	-0.0610	0.3911	0.1441	0.3964
16	SIO2	149	29	142	137	19	1.0000	-0.2308	0.3810	0.2853	-0.1077
17	LOG Q	124	16	133	131	9	146	1.0000	-0.7357	-0.5104	0.2879
18	LOG SC	143	26	144	141	19	144	130	1.0000	0.6043	0.0640
19	COND/TDS	143	26	136	133	19	143	122	143	1.0000	-0.2416
20	CA/MG	141	29	149	143	19	163	153	143	136	1.0000
21	SO4/CL	138	29	139	136	17	139	124	134	133	139
22	SR/CA	19	17	19	17	19	19	9	19	19	19

(Q, Discharge; TDS, Dissolved Solids Sum; ROE, Residue on Evaporation; T.H., Total Hardness; NCH, Noncarbonate Hardness; SR, Strontium; S102, Silica; Log SC, Log Specific Conductance)

FIGURE 16.-CORRELATION MATRIX FOR MAJOR CONSTITUENTS IN KISSIMMEE RIVER NEAR OKEECHOBEE.

Reasonable estimates of the loads of dissolved solids (residue on evaporation at 180°C) transported by streams and canals in the FCD area can be estimated from streamflow using regression equations. Equations of the form, Load = aQ^b where Q is discharge in cubic feet per second and a and b are the intercept and slope, respectively, can be used to estimate dissolved solids loads in tons per day. Estimates of dissolved solids loads at the average annual discharge rate are shown in table 3 for several sites in the FCD area. The loads are proportional to discharge ranging from less than 20,000 tons (18,000 tonnes) per year for sites with low mean discharge to more than 200,000 tons (180,000 tonnes) per year for sites with high mean discharge.

Areal variations in the concentrations of major inorganic constituents throughout the FCD area are illustrated by the mean and standard deviation of specific conductance values at stations listed in table 4. These data are also shown graphically in figure 17 by geographic area and in order of increasing mean concentration within each geographic area. Concentrations of the major inorganic constituents are lowest and least variable in the Kissimmee River and the lakes of the Kissimmee River basin. Concentrations are highest in the agricultural areas south and east of Lake Okeechobee, in the St. Johns River, Taylor Creek and in canals draining Indian River County.

On the basis of this analysis it appears that drainage of agricultural land, irrigation return flow and use of ground water of relatively high dissolved solids concentration are the major manmade factors influencing the spatial and temporal variations of the major inorganic chemical constituents in the FCD area. The effects of agricultural drainage on specific conductance in West Palm Beach Canal is shown in figure 18. Measurements at HGS-5 (site 2, fig. 1) largely reflect the better quality of the water flowing out of Lake Okeechobee whereas the much higher values at S5-A (site 17, fig. 1) show the influence of agricultural drainage. A similar pattern is observed for Hillsboro, North New River and Miami canals. Slack and Kaufman (1973) noted increased specific conductance with increased discharge into Lake Okeechobee from the Hillsboro Canal, which they atrributed to backpumpage of water from agricultural lands.

Long-term increases in the concentrations of major inorganic constituents are apparent at many locations and are particularly noticeable in the Kissimmee River basin. Again using specific conductance as the indicator variable, figures 19 and 20 show the long-term increase observed in Cypress Lake, Lake Arbuckle, at the outlet of Lake Kissimmee (sites 26, 31, 80, fig. 1) and in Lake Tohopekaliga (site not numbered on fig. 1). Both specific conductance and major constituents have increased

TABLE 3.--Dissolved solids loads at average discharge estimated from regression equations between streamflow and dissolved solids loads for selected stations in the Flood Control District.

Station Name and Location	Number of data Points	Regression Equation	Correlation Coefficient (r)	Standard error of estimate as percent of mean	Average Annual Discharge (Q), (ft^3/s) [1]	Dissolved solids load at average annual Q from regression, (tons/year, thousands)
St. Johns River nr Cocoa	41	$13.8Q^{0.57}$	.84	49	1,094	270
North Canal nr Vero Beach	79	$1.1Q^{0.93}$	.96	31	31	9.8
Main Canal at Vero Beach	84	$2.6Q^{0.84}$	.91	37	79	37
South Canal nr Vero Beach	83	$0.9Q^{1.01}$	.96	36	42	14
Fisheating Creek at Palmdale	44	$0.3Q^{0.85}$	.96	58	265	13
Kissimmee River at S65-E	19	$0.59Q^{0.87}$	.98	25	2,188	177
Taylor Creek above Okeechobee	59	$5.6Q^{0.51}$	.82	61	106	20
St. Lucie Canal nr Stuart	41	$1.2Q^{0.89}$	.99		1,105	220
W. Palm Beach Canal at HGS-5	50	$.7Q^{1.00}$	.92	32	171	43
W. Palm Beach Canal at S5-A	34	$1.1Q^{1.01}$	.89	63	453	190
Levee 8 Canal at W. Palm Beach Canal	25	$11.4Q^{0.45}$	.62	44	177	43
Hillsboro Canal at HGS-4	17	$2.4Q^{0.82}$	.82	49	-40	-18[2]
Hillsboro Canal at S-39	22	$2.1Q^{0.89}$	.96	43	104	48
Hillsboro Canal at Deerfield Beach	6	$1.16Q^{1.00}$	.99+	12	339	140
North New River Canal at HGS-4	55	$8.0Q^{0.65}$	.56	60	61	42
North New River Canal at Ft. Lauderdale	17	$1.1Q^{0.98}$	.99+	14	451	160
Miami Canal at HGS-3	29	$.6Q^{1.04}$	.99+	30	-2.6	-0.6[2]
Tamiami Canal L-30 to L67A	14	$0.8Q^{0.89}$	.99+	36	252	40
Golden Gate Canal nr Naples	21	$2.6Q^{0.86}$	.99+	16	356	150
Caloosahatchee Canal at Moore Haven	26	$.79Q^{0.953}$	.99	33	1,026	214
Caloosahatchee River at S-79	8	$1.5Q^{0.92}$	.99	25	2,188	647

1 Average discharge for period of record.
2 Net discharge is into Lake Okeechobee.

Table 4.--MEAN AND STANDARD DEVIATION OF SPECIFIC CONDUCTANCE FOR LAKES, STREAMS AND CANALS IN THE CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT.

Station Number	Station Name and Location	Period of Record	Number of Samples	Specific Conductance Mean	Specific Conductance Std. Dev.
	(LAKES)				
02260800	Alligator Lake near Ashton	1954-73	27	73	22
02261900	Lake Mary Jane near Narcoossee	1960-74	12	90	25
02262200	Lake Hart near Narcoossee	1954-69	22	85	46
02263400	East Lake Tohopekaliga at St. Cloud	1954-68	23	90	26
02264900	Lake Tohopekaliga at Kissimmee	1954-73	29	134	49
02266600	Cypress Lake near St. Cloud	1954-74	35	95	33
02266650	Lake Marion near Haines City	1966-74	13	129	15
02267400	Lake Hatchineha near Lake Wales	1954-68	22	90	26
02268400	Lake Weohyakpka at Indian Lake Estates	1966-74	13	87	12
02268600	Lake Rosalie near Lake Wales	1966-74	14	96	16
02268800	Lake Marian near Kennansville	1966-73	12	109	13
02268900	Lake Kissimmee near Lake Wales	1954-69	26	92	24
02269600	Lake Arbuckle near Avon Park	1954-74	25	121	33
02270700	Lake Annie near Lake Placid	1966-74	9	32	2
02270950	Lake June in Winter near Lake Placid	1965-74	11	107	7
02271200	Lake Francis near Lake Placid	1966-74	11	98	7
02273200	Lake Istokpoga near Lake Placid	1963-74	52	108	21
-	Lake Okeechobee (18 stations)	1964-73	268	517	84
02291200	Lake Trafford near Immokalee	1965-73	12	256	68

Table 4.--MEAN AND STANDARD DEVIATION OF SPECIFIC CONDUCTANCE FOR LAKES, STREAMS AND CANALS IN THE CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT.--Continued

Station number	Station Name and Location	Period of Record	Number of Samples	Specific Conductance Mean	Specific Conductance Std. Dev.
	(STREAMS AND CANALS)				
02232400	St. Johns River near Cocoa	1953-60	276	430	282
02232400	St. Johns River near Cocoa	1962-73	49	1044	823
02234000	St. Johns River near Geneva	1954-74	61	1433	862
02252500	North Canal near Vero Beach	1954-74	87	641	205
02253000	Main Canal at Vero Beach	1954-74	88	970	314
02253500	South Canal near Vero Beach	1954-74	88	700	256
02256500	Fisheating Creek near Palmdale	1963-73	56	204	156
02257800	Harney Pond Canal near Okeechobee	1954-74	98	273	144
02259200	Indian Prairie Canal near Okeechobee	1954-74	96	304	138
02268903	Kissimmee River at S-65 near Lake Wales	1952-74	28	115	26
02272500	Kissimmee River near Bassinger	1962-67	79	113	19
02272990	Kissimmee River near Okeechobee	1940-41	40	81	11
02272990	Kissimmee River near Okeechobee	1952-62	337	90	43
02272990	Kissimmee River near Okeechobee	1959-62	115	97	65
02273000	Kissimmee River at S-65E near Okeechobee	1967-74	36	185	52
02274000	Taylor Creek near Bassinger	1966-74	11	232	100
02274500	Taylor Creek above Okeechobee	1958-73	75	1144	1138
02277000	St. Lucie Canal near Stuart	1954-73	111	658	383
02278000	West Palm Beach Canal at Canal Point	1954-72	167	556	362

Table 4.--MEAN AND STANDARD DEVIATION OF SPECIFIC CONDUCTANCE FOR LAKES, STREAMS AND CANALS IN THE CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT.--Continued

Station number	Station Name and Location	Period of Record	Number of Samples	Specific Conductance Mean	Specific Conductance Std. Dev.
	(STREAMS AND CANALS)				
02278450	West Palm Beach Canal near Loxahatchee	1959-73	68	917	456
02278550	Levee 8 Canal near Loxahatchee	1960-70	38	619	293
02288005	Hillsboro Canal near South Bay	1950-71	129	946	472
02281200	Hillsboro Canal at S-6 near Shawno	1945-73	80	808	265
02281294	Everglades Station 1-9 near Delray Beach	1955-64	60	99	48
02281300	Hillsboro Canal at S-39 near Deerfield Beach	1957-73	78	849	322
02281500	Hillsboro Canal near Deerfield Beach	1943-73	41	784	209
02283500	North New River Canal near South Bay	1957-74	114	897	411
02285000	North New River Canal near Ft. Lauderdale	1951-73	54	630	190
02286400	Miami Canal at Lake Harbor	1950-74	100	632	290
02287395	Miami Canal East of L-30 near Miami	1958-74	338	536	71
02288600	Miami Canal at NW 36th St. at Miami	1966-73	19	596	65
02289060	Tamiami Canal at Bridge 45 near Miami	1950-74	123	350	131
-	Tamiami Canal (5 stations)	1962-74	70	451	148
02291300	Golden Gate Canal at Naples	1965-74	42	781	132
02292000	Caloosahatchee Canal at Moore Haven	1941-73	126	426	125
02292900	Caloosahatchee Canal near Olga	1966-74	42	967	969

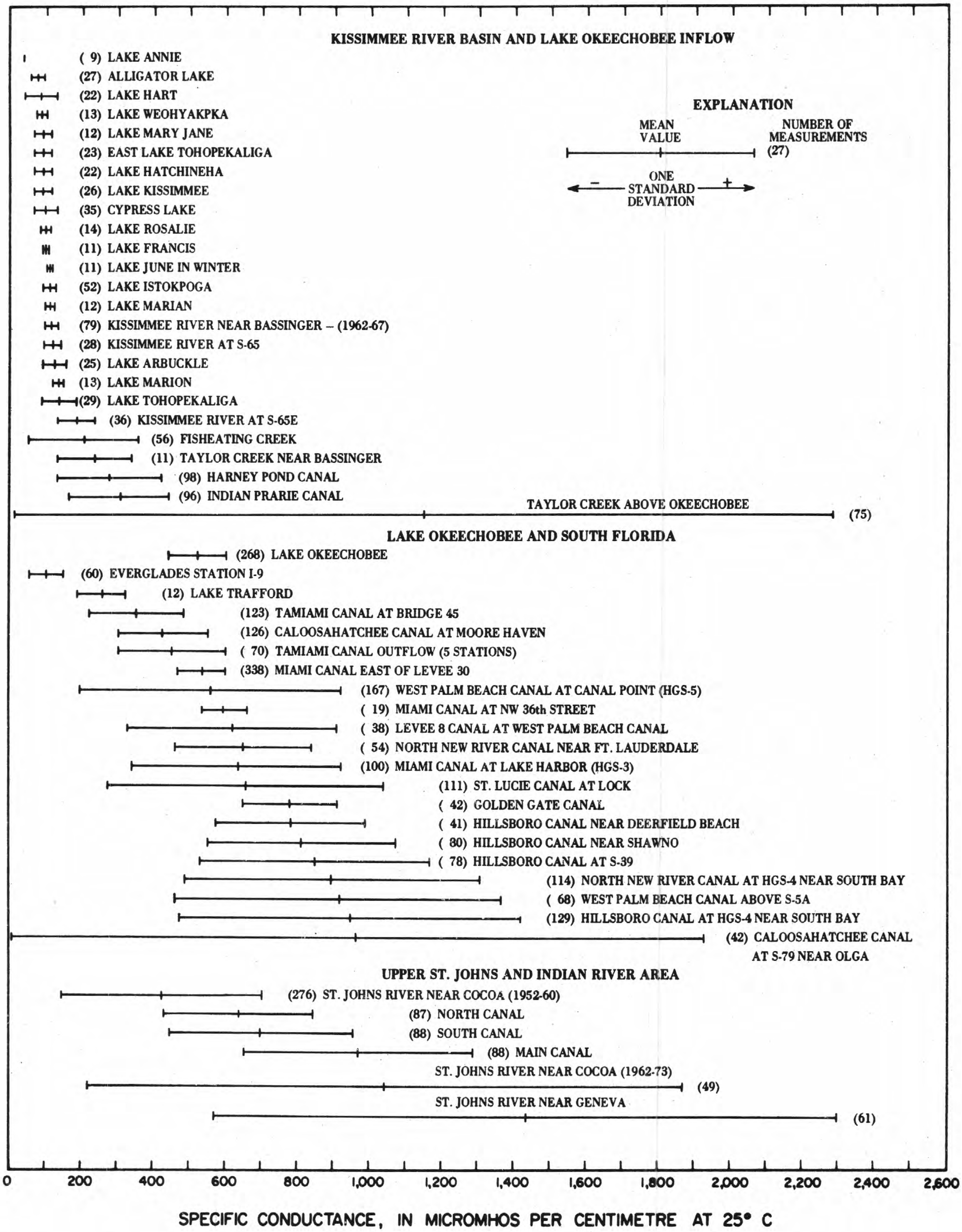


FIGURE 17.–MEAN SPECIFIC CONDUCTANCE AND STANDARD DEVIATION FOR STATIONS IN THE FCD AREA, ARRANGED IN ORDER OF INCREASING MEAN VALUES.

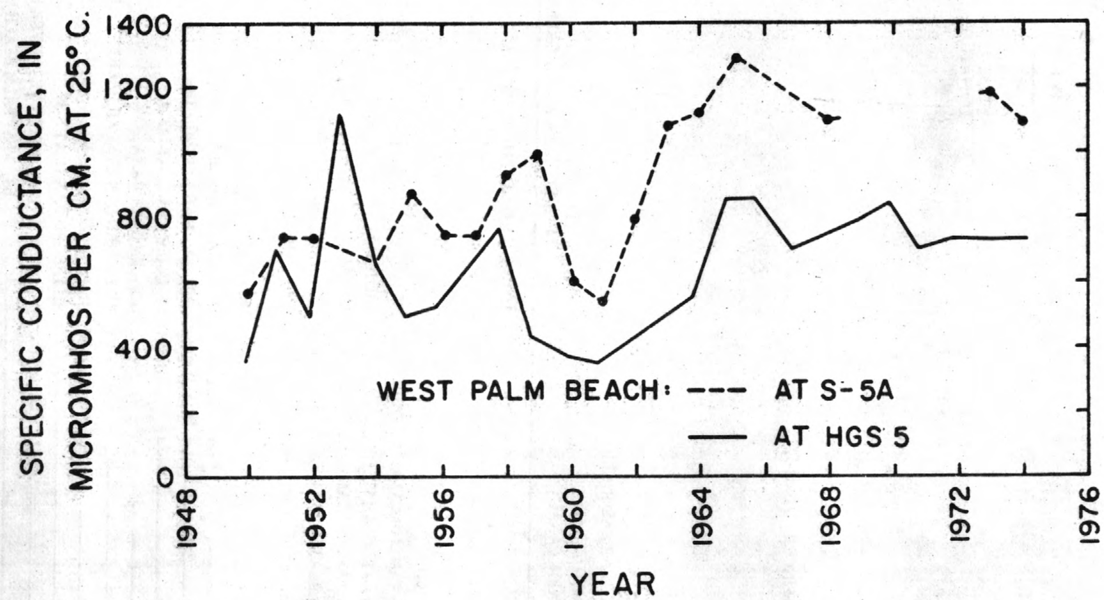


FIGURE 18.-SPECIFIC CONDUCTANCE IN WEST PALM BEACH CANAL AT HGS-5 AND S-5A.

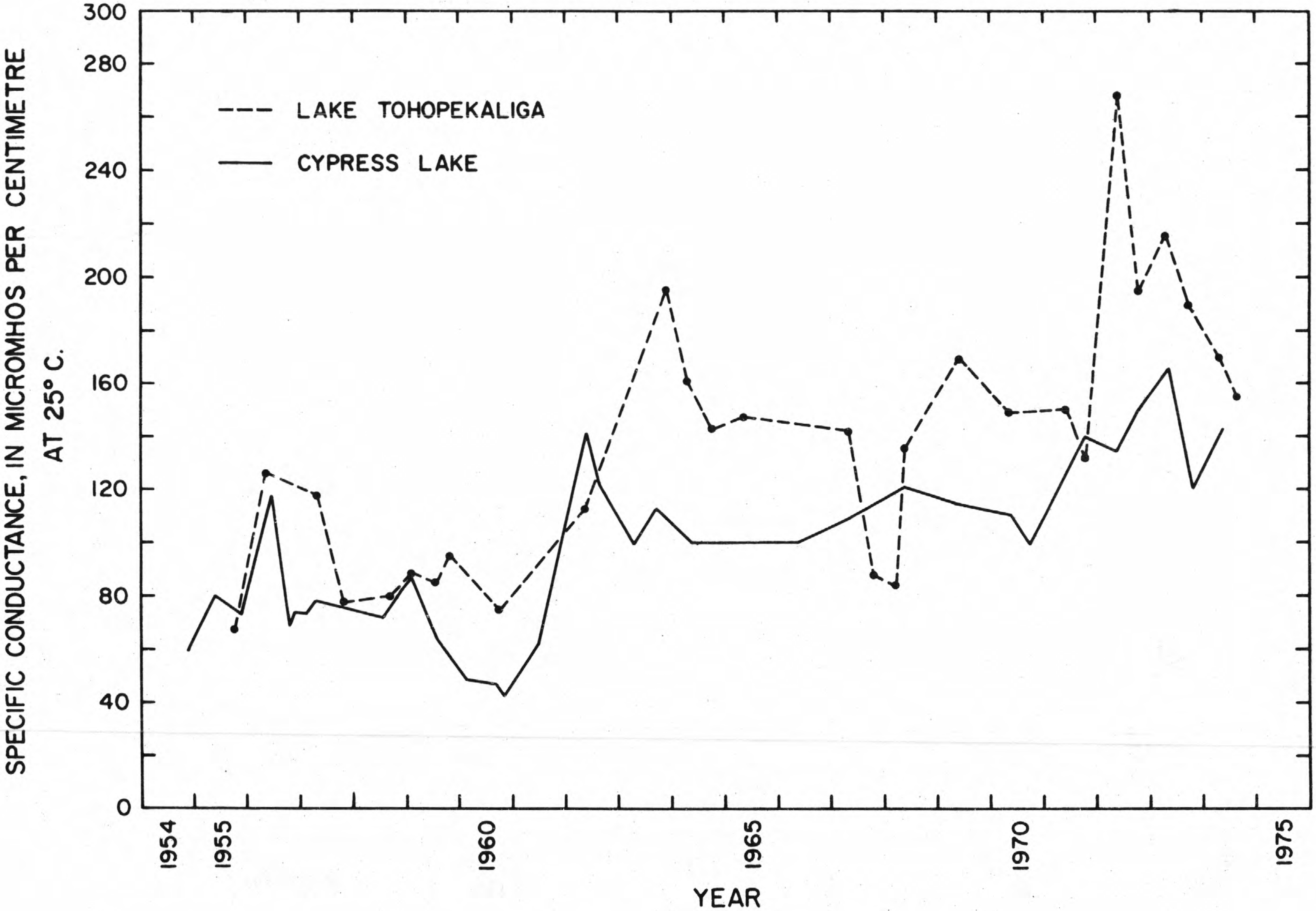


FIGURE 19.--SPECIFIC CONDUCTANCE IN CYPRESS LAKE AND LAKE TOHOPEKALIGA.

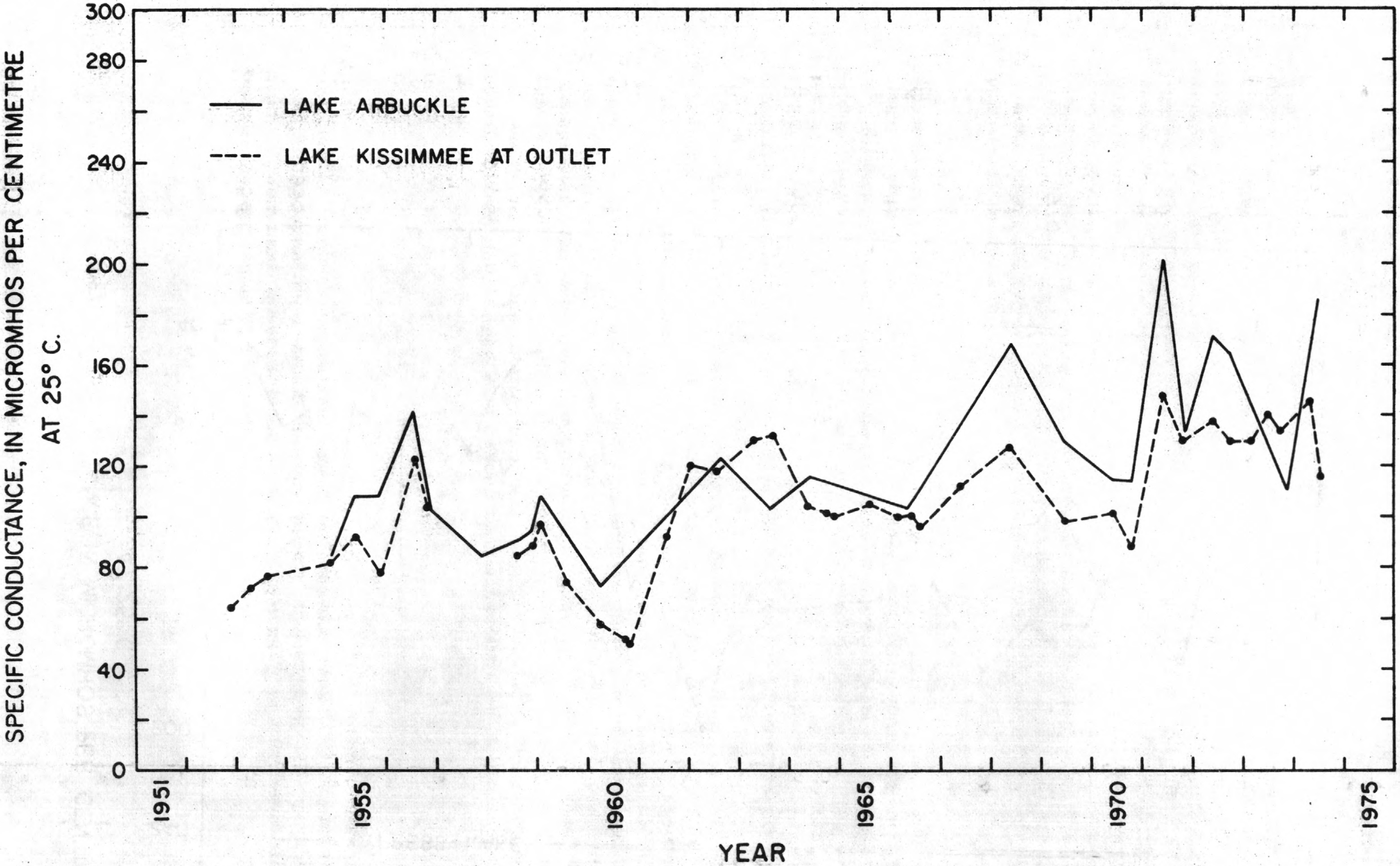


FIGURE 20.--SPECIFIC CONDUCTANCE IN LAKE ARBUCKLE AND AT OUTLET OF LAKE KISSIMMEE.

more than 50 percent at these sites in the last 20 years. Long-term increases were also observed in the St. Johns River, Kissimmee River at S65E, and Fisheating Creek at Palmdale. These will be discussed in more detail in the section on daily specific conductance and temperature.

In summary, this analysis of data on the major constituents shows that the available data are generally adequate to describe the areal and temporal variations in concentrations and water composition in the FCD area. Further analysis of the existing data in relation to streamflow and climatic conditions and in relation to cultural development in the area would help to quantify the variations and observed changes in water quality. Specific conductance used with regression equations developed from available data can provide reasonably good estimates of the concentration of most major constituents. In addition specific conductance measured on a frequent and systematic basis (1-2 month intervals) can be used to monitor for gross long-term changes in water quality. For most stations, two chemical analyses per year to provide a check on the regression equations supplemented by frequent specific conductance measurements should be adequate for the major constituents. The flow condition sampled should be varied so that checks can be made over the entire range of concentration. Where very precise data are needed on individual constituents such as for water quality accounting purposes and load computations, or where data are not adequate to define regression relations, more frequent sampling would be necessary.

Daily Specific Conductance and Temperature

Daily Specific Conductance

Specific conductance is measured once daily at 17 stations in the FCD area. Twelve of these stations are in the USGS-FCD cooperative network (table 1), one is maintained in cooperation with Dade County and four have recently been implemented as part of the USGS National Stream Quality Accounting Network. The samples are collected daily by an observer and sent to a USGS laboratory for analysis. Ten of the stations have been in operation since 1965 and two since 1954. These 10 years or more of daily specific conductance records are adequate to give a good picture of average and extreme values of specific conductance and variations with streamflow. When used in conjunction with the regression equations in table 2 the daily specific conductance data also give additional information about the variations and range in concentration of the major chemical constituents.

Daily specific conductance, the corresponding daily discharge and the regression equations from table 2 were used in conjunction with a computer program (G491) to simulate the monthly and annual concentrations and loads of major chemical constituents at most of the daily stations. The results of this simulation program for the St. Johns River near Cocoa for the 1967 water year are shown in figure 21. The annual dissolved solids loads (sum of constituents) obtained from the simulation program for 11 stations are summarized in table 5. This table also gives the average annual discharge and specific conductance (time-weighted), average annual discharge-weighted specific conductance and averages for the period of record. It should be noted that the average annual loads shown in table 5 do not necessarily agree with the annual load shown in table 3. The differences may be largely due to the computation procedure. Loads shown in table 3 were estimated from a load-discharge relation using the average annual discharge for the period of record. The result is not the average annual load. Loads in table 5 were simulated from a specific conductance-concentration procedure discussed above.

Data for dissolved solids loads in table 5 essentially represent an average of daily loads for a 10-year period and could possibly be used to develop a fairly accurate long-term dissolved solids input-output budget for Lake Okeechobee. Examination of the 10-year average loads suggests that the dissolved solids output from the lake is significantly larger than the dissolved solids input from tributaries. Joyner (1974) in developing a budget for the lake for 1969-70 also noted more dissolved solids leaving the lake than entering from tributary inflow.

Because of the inverse relation between specific conductance and discharge it is difficult to determine time trends in specific conductance from hydrograph plots or time series plots alone. Apparent trends in specific conductance may actually be caused by changes in streamflow. True changes or trends in specific conductance can be more easily detected from the relation between mean annual discharge and mean annual discharge-weighted specific conductance. This approach was used by Steele and others (1974) in evaluating long-term changes in chemical quality at numerous stations throughout the United States. The average annual discharge-weighted specific conductance is computed as follows:

$$\frac{\Sigma Q_i \times K_{sci}}{\Sigma Q_i}$$

Where Q_i and K_{sci} are the discharge and specific conductance respectively on day i. Expressed another way, the average annual discharge-weighted specific conductance would be equivalent to catching all of the water that flowed past a station in a year, thoroughly mixing this water and measuring its specific conductance.

MONTHLY DISCHARGE-WEIGHTED AVERAGES FOR 1967 WATER YEAR ---COMPUTED FROM CONDUCTANCE

(Results in mg/l except specific conductance -- S.C.)

PARAMETER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
CALCIUM	21.18	21.94	25.67	33.50	46.59	57.26	74.11	88.15	68.88	61.88	33.28	27.84
MAGNESIUM	4.60	4.93	6.57	10.01	15.75	20.44	27.84	34.00	34.32	22.47	9.91	7.52
SODIUM	20.41	22.94	35.42	61.59	105.31	140.97	197.28	244.18	246.63	156.43	60.84	42.66
POTASSIUM	1.37	1.43	1.70	2.27	3.23	4.01	5.24	6.27	6.33	4.35	2.26	1.86
BICARBONTE	44.50	45.04	47.68	53.22	62.47	70.02	81.94	91.87	92.39	73.29	53.06	49.21
SULFATE	16.40	17.42	22.43	32.93	50.49	64.80	87.41	106.24	107.22	71.01	32.63	25.33
CHLORIDE	44.03	49.06	73.83	125.78	212.59	283.39	395.19	488.31	493.17	314.08	124.30	88.20
D.S.(CALC)	140.64	150.45	198.70	299.93	469.07	607.03	824.89	1006.33	1015.79	666.84	297.05	226.70
S.C.(OBS)	243.87	262.37	353.42	544.42	863.55	1123.86	1534.90	1877.22	1895.10	1236.69	538.98	406.25
DAYS/MONTH	31	30	31	31	28	31	30	31	30	31	31	30

02232400 - ST JOHNS RIVER NR COCOA FLA

MONTHLY TIME-WEIGHTED AVERAGES FOR 1967 WATER YEAR ---COMPUTED FROM CONDUCTANCE

(Results in mg/l except specific conductance -- S.C.)

PARAMETER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
CALCIUM	21.19	22.06	26.05	33.90	46.28	57.85	75.18	90.52	94.66	65.14	33.39	27.90
MAGNESIUM	4.60	4.99	6.74	10.19	15.62	20.70	28.31	35.04	36.86	23.90	9.96	7.55
SODIUM	20.45	23.36	36.69	62.92	104.28	142.96	200.86	252.12	265.93	167.31	61.21	42.86
POTASSIUM	1.37	1.44	1.73	2.30	3.21	4.06	5.32	6.45	6.75	4.59	2.27	1.86
BICARBONTE	44.51	45.13	47.95	53.50	62.26	70.44	82.70	93.55	96.47	75.60	53.14	49.26
SULFATE	16.42	17.59	22.94	33.47	50.07	65.60	88.84	109.42	114.97	75.38	32.78	25.42
CHLORIDE	44.10	49.90	76.36	128.44	210.55	287.34	402.29	504.06	531.49	335.69	125.04	88.61
D.S.(CALC)	140.78	152.07	203.63	305.11	465.11	614.73	838.72	1037.02	1090.47	708.94	298.48	227.51
S.C.(OBS)	244.13	265.43	362.71	554.19	856.07	1138.38	1561.00	1935.16	2036.00	1316.13	541.67	407.76
DAYS/MONTH	31	30	31	31	28	31	30	31	30	31	31	30

02232400 - ST JOHNS RIVER NR COCOA FLA

MONTHLY MEAN LOADS IN TONS/DAY FOR 1967 WATER YEAR ---COMPUTED FROM CONDUCTANCE

PARAMETER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER
CALCIUM	132.4	83.4	49.8	37.8	38.6	38.3	20.6	7.3	19.4	141.9	157.7	111.8
MAGNESIUM	28.8	18.8	12.7	11.3	13.0	13.7	7.8	2.8	7.5	51.5	47.0	30.2
SODIUM	127.6	87.2	68.7	69.5	87.2	94.4	54.9	20.4	53.7	358.6	288.3	171.4
POTASSIUM	8.6	5.4	3.3	2.6	2.7	2.7	1.5	0.5	1.4	10.0	10.7	7.5
BICARBONTE	278.2	171.3	92.5	60.1	51.7	46.9	22.8	7.7	20.1	168.0	251.4	197.7
SULFATE	102.6	66.2	43.5	37.2	41.8	43.4	24.3	8.9	23.3	162.8	154.6	101.8
CHLORIDE	275.3	186.6	143.2	142.0	176.1	189.7	110.1	40.7	107.4	720.0	588.9	354.3
D.S.(CALC)	879.3	572.1	385.5	338.7	388.5	406.3	229.7	83.9	221.2	1528.7	1407.4	910.8
DAYS/MONTH	31	30	31	31	28	31	30	31	30	31	31	30

02232400 - ST JOHNS RIVER NR COCOA FLA

1967 WATER YEAR ANNUAL AVERAGES COMPUTED FROM DISCHARGE

PARAMETER	TIME-WGHTD	Q_WGHTD	LOAD T/D
DISCHARGE	817.3 cfs		

1967WATER YEAR ANNUAL AVERAGES COMPUTED FROM CONDUCTANCE

CALCIUM	49.5 mg/l	32.0 mg/l	70.3 ton/day
MAGNESIUM	17.0 "	9.3 "	20.5 "
SODIUM	115.0 "	56.4 "	124.1 "
POTASSIUM	3.4 "	2.2 "	4.8 "
BICARBONTE	64.5 "	52.1 "	114.7 "
SULFATE	54.4 "	30.9 "	67.9 "
CHLORIDE	231.8 "	115.6 "	254.2 "
D.S.(CALC)	506.5 "	280.0 "	615.9 "
S.C.(OBS)	934.1 umho	506.8 umho	

FIGURE 21.-CONCENTRATIONS AND LOADS OF CHEMICAL CONSTITUENTS SIMULATED FROM DAILY SPECIFIC CONDUCTANCE, DISCHARGE AND REGRESSION EQUATIONS FROM TABLE 2.

Table 5.--Average annual time-weighted (K_{sc}-tw) and discharge-weighted (K_{sc}-qw) specific conductance and estimated dissolved solids loads for selected daily stations in the FCD area

(Footnotes are at end of table)

	St. Johns River near Cocoa				Kissimmee River near Okeechobee			
Year	Discharge (ft^3/s)	K_{sc}-tw (umhos/cm)	K_{sc}-qw (umhos/cm)	Diss. Solids (tons/day)	Discharge (ft^3/s)	K_{sc}-tw (umhos/cm)	K_{sc}-qw (umhos/cm)	Diss. Solids (tons/day)
1941	-	-	-		1637	82	78	188
1954	2182	241	170	542	4449	66	64	419
1955	1022	327	262	380	1232	92	118	214
1956	451	825	403	254	326	122	136	65
1957	1558	427	351	766	2249	90	84	278
1958	1192	413	352	588	2545	76	75	281
1959	1146	545	445	708	2752	87	75	304
1960	2462	296	254	890	5584	61	59	485
1961	1266	573	266	477	-		-	-
1962	305	1792	918	383	-		-	-
1963	786	691	547	637	564	112	106	88
1964	1484	613	385	855	1290	107	104	198
1965	661	766	529	521	1174	110	103	178
1966	1427	437	398	853	2043	121	122	367
1967	817	934	507	616	700	186	159	164
1968	1094	1070	404	665	1679	143	120	297
1969	1010	498	464	696	1544	201	188	427
1970	1344	561	362	732	2683	189	155	605
1971	222	1392	1244	403	654	242	197	189
1972	566	798	711	594	589	211	166	144
1973	684	659	624	629	1595	179	148	347
1974	-	(1)	(1)	(1)	2109	184	132	411
Average	1083	692	479	609	1781	126	112	269

Average annual diss. solids load = 222,000 tons/yr

Average annual diss. solids load = 95,300 tons/yr

Table 5.--Average annual time-weighted (K_{sc}-tw) and discharge-weighted (K_{sc}-qw) specific conductance and estimated dissolved solids loads for selected daily stations in the FCD area.--Continued

Fisheating Creek at Palmdale

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos/cm)	K_{sc}-qw (umhos/cm)	Diss. Solids (tons/day)
1965	153	233	110	24
1966	328	220	93	43
1967	157	247	142	31
1968	283	278	99	40
1969	220	189	118	36
1970	494	120	90	62
1971	159	586	134	30
1972	116	301	206	36
1973	213	275	153	49
1974	422	511	127	76
Average	254	296	127	43

Average annual diss. solids load = 16,000 tons/yr

Taylor Creek above Okeechobee

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos/cm)	K_{sc}-qw (umhos/cm)	Diss. Solids (tons/day)
1965	16	1236	851	21
1966	110	895	332	52
1967	98	1412	364	52
1968	139	1067	251	49
1969	171	636	398	109
1970	176	610	288	77
1971	105	1387	365	51
1972	50	1054	465	37
1973	73	988	450	45
1974	113	973	300	48
Average	105	1026	406	54

Average annual diss. solids load = 20,000 tons/yr

St. Lucie Canal near Stuart

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos/cm)	K_{sc}-qw (umhos/cm)	Diss. Solids (tons/day)
1965	46	552	560	41
1966	1330	505	434	938
1967	36	643	663	37
1968	1235	629	398	808
1969	652	544	554	577
1970	2453	432	421	1656
1971	30	561	597	29
1972	20	585	590	18
1973	16	1030	1091	27
1974	356	716	380	222
Average	617	620	569	435

Average annual diss. solids load = 159,000 tons/yr

Caloosahatchee Canal at Moore Haven

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos/cm)	K_{sc}-qw (umhos/cm)	Diss. Solids (tons/day)
1965	172	562	432	173
1966	1395	517	479	1031
1967	325	494	437	221
1968	794	585	487	597
1969	974	558	487	732
1970	3715	406	384	2243
1971	107	510	534	87
1972	134	586	654	134
1973	74	608	610	68
1974	1012	603	516	802
Average	870	543	502	609

Average annual diss. solids load = 222,000 tons/yr

Table 5.--Average annual time-weighted (K_{sc}-tw) and discharge-weighted (K_{sc}-qw) specific conductance and estimated dissolved solids loads for selected daily stations in the FCD area.--Continued.

West Palm Beach Canal at HGS-5

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos)	K_{sc}-qw (umhos)	Diss. Solids (tons/day)
1965	221	849	-	187
1966	138	862	-	114
1967	245	708	-	156
1968	186	762	-	154
1969	208	795	-	189
1970	160	813	-	114
1971	97	715	-	-52
1972	112	739	-	114
1973	164	748	-	169
1974	234	761	-	171
Average	176	775	(2)	131

Average annual diss. solids load = 48,000 tons/yr

Hillsboro Canal below HGS-4

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos)	K_{sc}-qw (umhos)	Diss. Solids (tons/day)
1965	-50 (3)	1226	-	-238
1966	13	1166	-	-146
1967	113	941	-	61
1968	-107	1123	-	-393
1969	-84	1371	-	-299
1970	-81	1386	-	-291
1971	1.2	898	-	-125
1972	-59	1187	-	-193
1973	-23	1166	-	-139
1974	50	1062	-	-2.7
Average	-22.7	1042	(2)	-176[4]

Average annual diss. solids load = -64,000 tons/yr

North New River Canal below HGS-4

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos)	K_{sc}-qw (umhos)	Diss. Solids (tons/day)
1965	139	1192	-	56
1966	142	1133	-	-23
1967	270	950	-	190
1968	-38	1099	-	-295
1969	165	1123	-	158
1970	-112	1206	-	-332
1971	50	843	-	-138
1972	-107	1046	-	-284
1973	61	1035	-	-9.7
1974	144	976	-	69
Average	71.4	1060	(2)	-61

Average annual diss. solids load = -22,000 tons/yr

North New River Canal at Ft. Lauderdale

Year	Discharge (ft^3/s)	K_{sc}-tw (umhos)	K_{sc}-qw (umhos)	Diss. Solids (tons/day)
1965	195	627	573	166
1966	310	639	609	269
1967	254	662	585	222
1968	356	597	563	300
1969	266	624	638	250
1970	721	655	680	678
1971	59	683	643	57
1972	162	645	632	149
1973	84	664	650	81
1974	80	743	693	81
Average	248	654	627	225

Average annual diss. solids load = 82,000 tons/yr

Table 5.--Average annual time-weighted (K_{sc}-tw) and discharge-weighted (K_{sc}-qw) specific conductance and estimated dissolved solids loads for selected daily stations in the FCD area.--Continued.

	Miami Canal at HGS-3				Miami Canal East of Levee-30			
Year	Discharge (ft^3/s)	K_{sc}-tw (umhos)	K_{sc}-qw (umhos)	Diss. Solids (tons/day)	Discharge (ft^3/s)	K_{sc}-tw (umhos)	K_{sc}-qw (umhos)	Diss. Solids (tons/day)
1965	29	841	-	7.6[4]	-	558	-	-
1966	101	-	-	-	-	573	-	-
1967	-61	719	-	-276	-	612	-	-
1968	-32	855	-	-217	284	568	568	244
1969	269	914	-	235	316	620	619	290
1970	-76	869	-	-170	476	589	607	420
1971	76	692	-	-22.6	219	627	624	203
1972	-58	883	-	-110	216	597	594	196
1973	122	885	-	116	211	638	639	199
1974	231	862	-	236	247	663	672	243
Average	50	835	(2)	-24	281	604	618	256

Miami Canal at HGS-3: Average annual diss. solids load = -8,800 tons/yr

Miami Canal East of Levee-30: Average annual diss. solids load = 94,000 tons/yr

(1) Insufficient data for calculations.
(2) Discharge-weighted specific conductance not computed because of negative discharges.
(3) Net discharge is into Lake Okeechobee.
(4) Based on 7 months of record.

Using this approach, definite changes in the discharge-conductance relations were detected at three stations, the St. Johns River near Cocoa, the Kissimmee River near Okeechobee and Fisheating Creek near Palmdale. These relations are shown in figure 22. Specific conductance at these locations has increased about 50 percent for a given discharge. The increase at the St. Johns River stations occurred rather abruptly in 1957 and may be associated with increased irrigation use of ground water whose dissolved solids concentration is greater than that of surface water. On the other hand, the increase in specific conductance may be related more closely to water regulation and diversion in the headwaters area of the basin. The increase in specific conductance in the Kissimmee River occurred around 1966 and could be partly related to channelization of the river which was completed about that time. However long-term increases in specific conductance have also been observed in the upper Kissimmee basin; these were discussed in a previous section of this report. No explanation is offered for the specific conductance increase in Fisheating Creek, however the composition of major chemical constituents in a sample collected at low-flow in May 1974 suggests input of ground water from the Floridan aquifer. No change in the discharge-conductance relation was observed for Taylor Creek above Okeechobee. That relation is also shown on figure 22.

No apparent increase or decrease in specific conductance was detected during the last 10 years at any of the other daily specific conductance stations using this analysis approach. Because of negative discharges (flow into Lake Okeechobee) at the canal stations south of Lake Okeechobee a meaningful discharge-weighted specific conductance relation could not be obtained. Therefore an attempt to define trends at these stations was made by plotting mean annual discharge versus annual dissolved solids loads computed from the simulation program (G491), (figure 23). The coordinates of the plotted data for the three stations at the outlets of Lake Okeechobee have been shifted to eliminate negative values so that the data could be displayed on log-log graph paper. Annual loads versus discharge for North New River Canal near Ft. Lauderdale are also shown in figure 23 and a similar plot for the Caloosahatchee Canal at Moore Haven is shown in figure 24.

In summary, the data show that increases in the average annual discharge weighted specific conductance of about 50 percent have occurred at three stations, the St. Johns River near Cocoa, Kissimmee River near Okeechobee (presently S65-E) and Fisheating Creek near Palmdale. This analysis also shows that annual dissolved solids loads computed from daily discharge, specific conductance, and regression equations could probably be used in developing a long-term input-output dissolved solids budget for Lake Okeechobee.

Continued collection of specific conductance data is necessary to provide information on water quality. However continued daily measurements at all of the existing stations are not necessary unless data on annual dissolved solids loads are needed. Most of these daily stations could be discontinued. After a period of 3 to 5 years, selected stations could be reactivated for several years and discharge-weighted data could be compared with existing data to look for long-term changes.

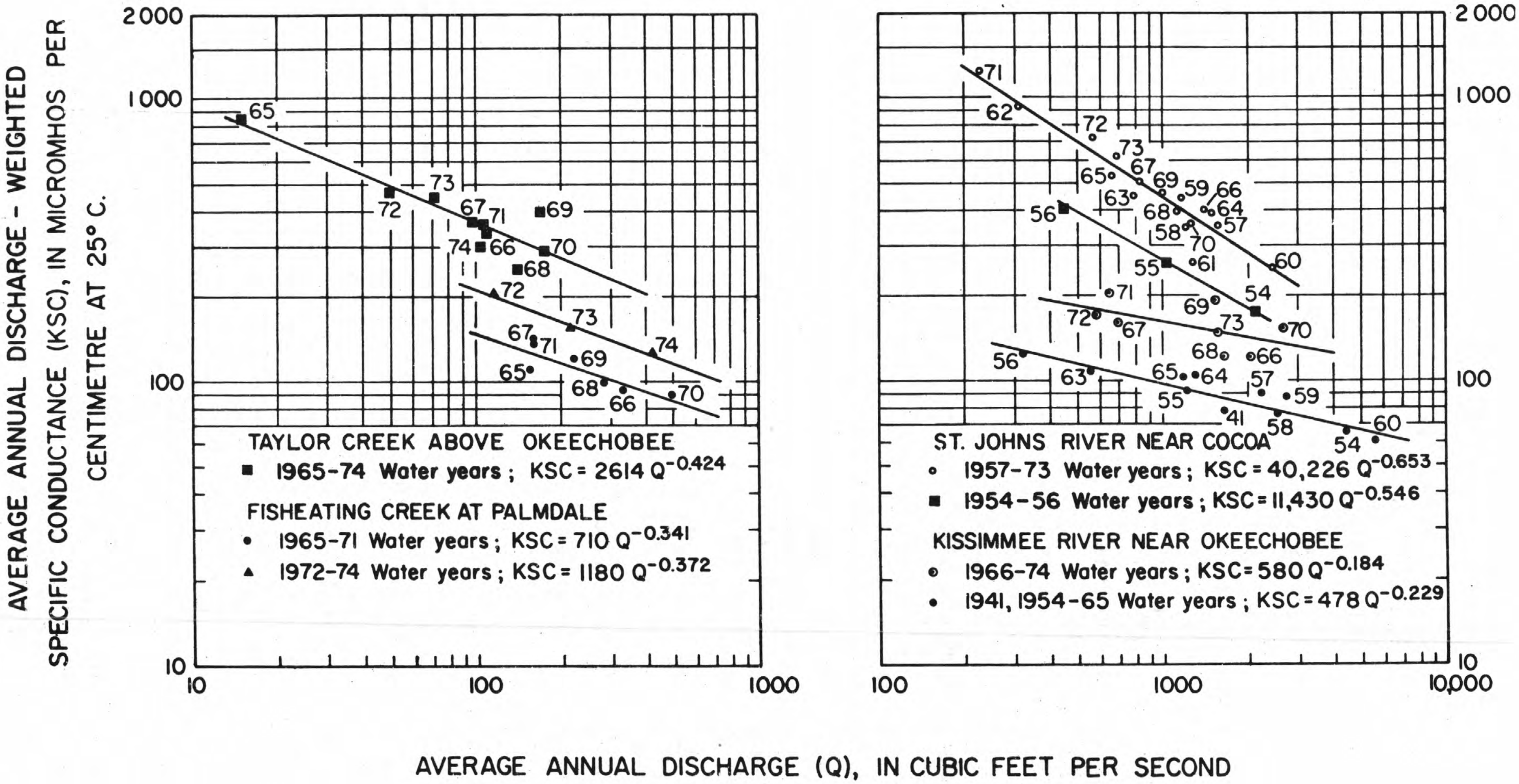


FIGURE 22.-AVERAGE ANNUAL DISCHARGE VERSUS AVERAGE ANNUAL DISCHARGE-WEIGHTED SPECIFIC CONDUCTANCE.

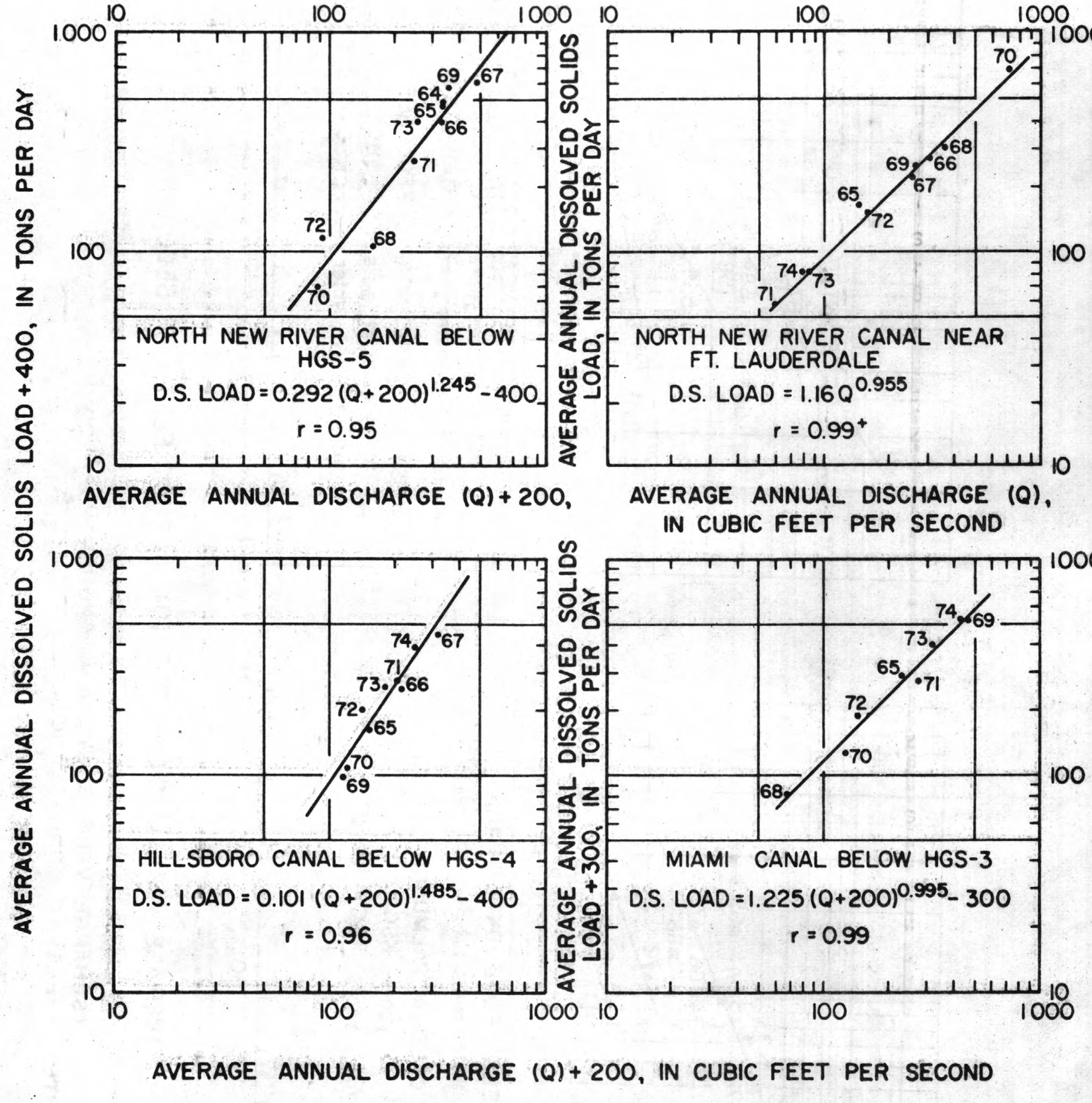


FIGURE 23.—AVERAGE ANNUAL DISCHARGE VERSUS AVERAGE ANNUAL SOLIDS LOADS.

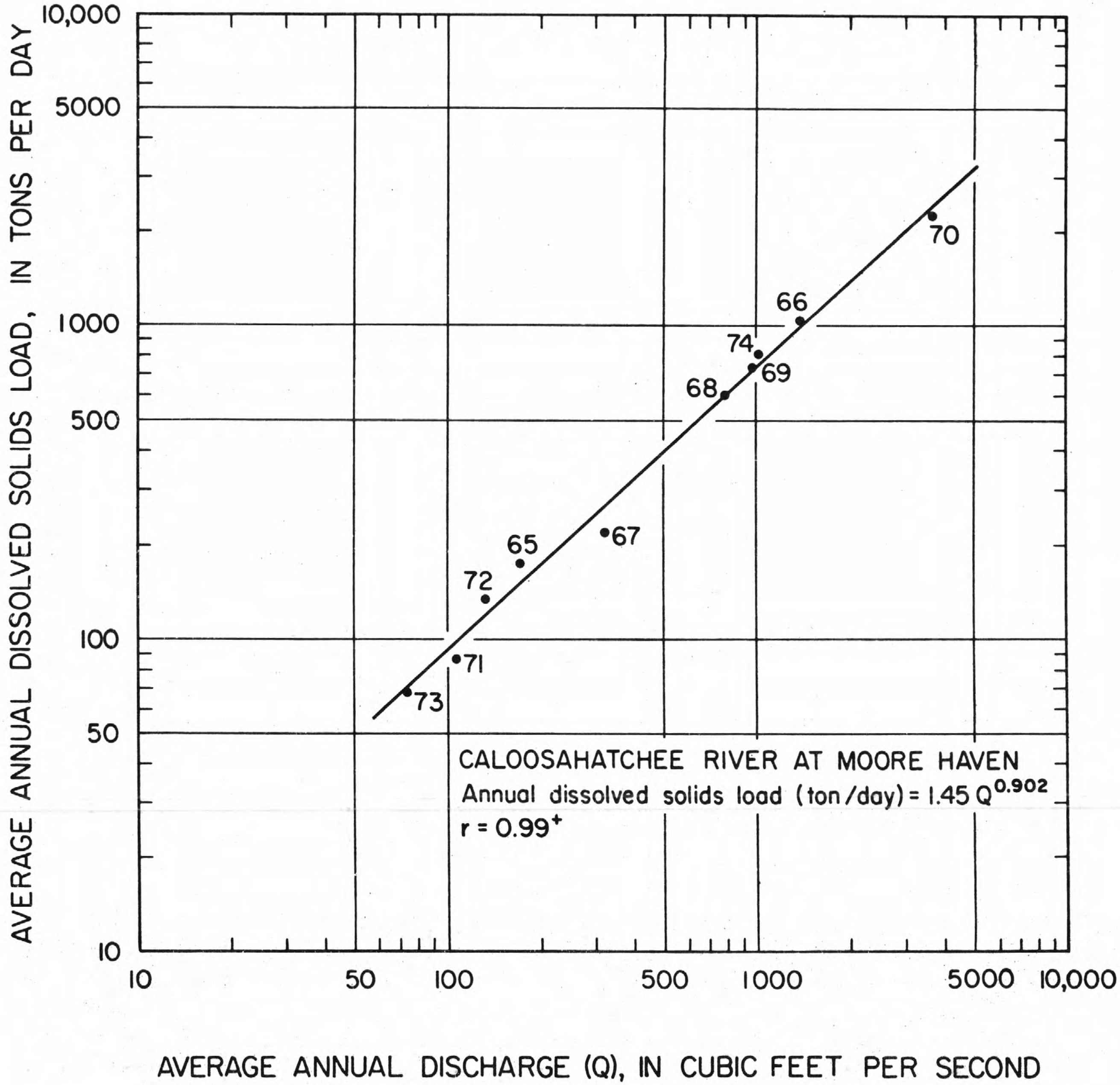


FIGURE 24.-AVERAGE ANNUAL DISCHARGE VERSUS AVERAGE ANNUAL DISSOLVED SOLIDS LOADS.

Daily Temperature

Daily temperature measurements are made at all sites where daily samples are collected for specific conductance measurements. These temperature data were analyzed using the harmonic function discussed in a previous section of this report. The function has the form:

$$T(x) = A \sin (bx + C) + M$$

A computer program (B260) was used to determine the three harmonic coefficients, A, M, and C for the daily stations (table 6). The computer program uses a least-squares curve fitting procedure to determine the coefficients. The results of the harmonic analysis have been averaged to produce a set of regionalized harmonic coefficients:

$M = 24.1^{\circ}C$	Mean of the harmonic
$A = 5.8^{\circ}C$	Amplitude of the harmonic
$C = 2.7$ radians	Phase angle of the harmonic

An example of observed temperatures and temperatures simulated by the harmonic analysis is shown in figure 25 for the Kissimmee River at S65-E. Results using the harmonic function indicate a maximum temperature of about 30°C and a minimum of about 18°C. Extremes 5-10 degrees higher and lower than these temperatures have been recorded at the daily stations.

TABLE 6.--Harmonic coefficients for daily temperature stations. (Harmonic mean (M), amplitude (A), and phase angle (C) are coefficients in the harmonic equation, $T(x) = A \sin (bx + C) + M$. $T(x)$ is the temperature on day x, x is the day of the water year beginning on October 1, and b is $2\pi/365$.)

	Map site No. (fig. 1)	Harmonic mean (M)°C	Amplitude (A)°C	Phase Angle (C) radians
St. Johns River	12	23.8	6.67	2.76
Fisheating Creek	8	23.4	5.30	2.74
Kissimmee River	11	23.0	6.29	2.70
Taylor Creek	10	24.7	5.48	2.79
St. Lucie Canal	1	23.7	5.56	2.68
West Palm Beach Canal	2	24.2	5.92	2.71
Hillsboro Canal	3	25.6	5.90	2.62
North New River Canal	4	25.5	5.98	2.63
Miami Canal	6	23.2	5.42	2.68
Caloosahatchee Canal	7	24.2	5.67	2.74

The results of this analysis indicate that for most purposes a daily temperature measurement is unnecessary and that a reduced sampling frequency would be adequate if combined with results of the harmonic analysis. Most of the stations for which daily temperature data are being collected are also visited periodically to collect other types of hydrologic and water-quality data and a temperature measured on these visits should be adequate for most purposes. If information on extreme temperatures, heat

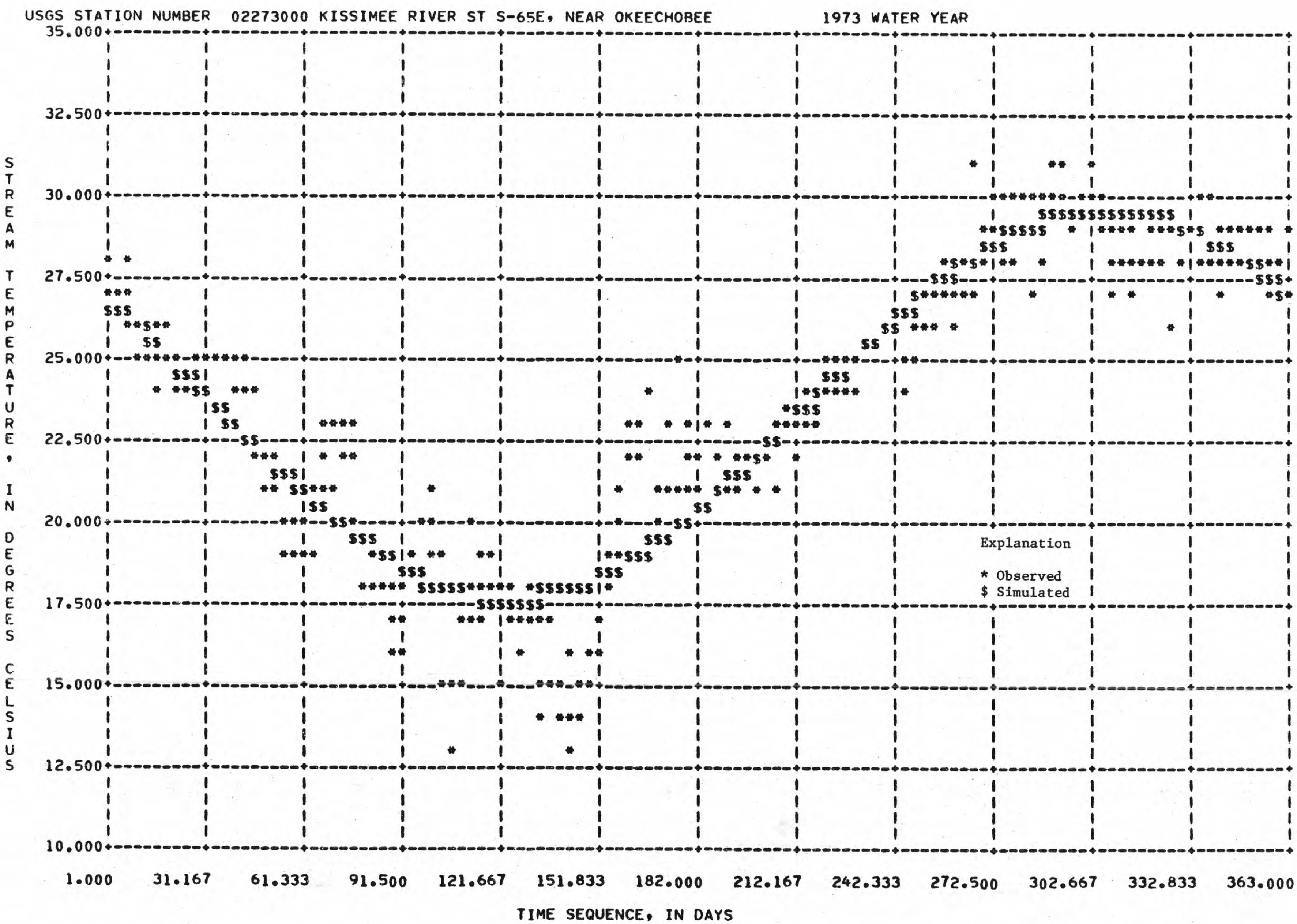


FIGURE 25.-OBSERVED AND SIMULATED TEMPERATURES FOR KISSIMMEE RIVER AT S-65E.

loads, or short-term variations is needed, daily or preferably continuously recorded temperature measurements will be needed.

Nutrients

The plant nutrients, nitrogen and phosphorus, are important to the biological communities in south Florida's lakes, streams and marshes. However, excessive concentrations of these nutrients frequently result in very rapid and excessive growth of algae and other aquatic plants. For this reason, concentrations of these nutrients are often used to assess the overall trophic state of water bodies when biological data are not available.

Before the late 1960's the emphasis in water-quality monitoring was on the major chemical constituents and very little data on nitrogen and phosphorus were collected. However, beginning about 1969, the emphasis in water-quality data shifted and considerable data on nitrogen and phosphorus species have since been collected at many sites on lakes and streams in central and southern Florida.

An analysis of the existing data shows that the average concentration of total nitrogen and phosphorus for about 2,000 water samples collected in the FCD area since 1972 is 1.82 mg/l and 0.15 mg/l respectively. Organic nitrogen is the major nitrogen species accounting for 77 percent (1.4 mg/l). Ammonia nitrogen is the second most abundant nitrogen species accounting for 14 percent (0.26 mg/l). Nitrate nitrogen accounts for the remaining 9 percent (0.16 mg/l). About 80 percent of the total phosphorus is soluble, inorganic orthophosphate. The distribution of total phosphorus and organic and inorganic nitrogen (NH_3-N + NO_2-N + NO_3-N) concentrations in the approximately 2,000 samples is shown in figure 26.

The mean and standard deviation for inorganic and organic nitrogen and total phosphorus for selected stations in the FCD area are shown in table 7. Inorganic nitrogen concentrations are highest in the Everglades and agricultural areas south of Lake Okeechobee. The highest mean concentrations of phosphorus occur in Taylor Creek, Fisheating Creek, Harney Pond, and Indian Prarie Canals and in North, Main and South Canals in Indian River County. The generalized distribution of orthophosphate-phosphorus for 1970-71 for part of the FCD area is shown in figure 27.

The observed patterns in the distribution of nitrogen and phosphorus appear to be closely related to land use and soil type. The highest phosphorus concentrations generally occur in agricultural areas north of Lake Okeechobee. The lower phosphorus concentrations in the Everglades south of Lake Okeechobee are probably due to the strong tendency for orthophosphate to be adsorbed on organic matter. Studies of nutrient uptake in the Everglades being made by the U.S. Geological Survey in cooperation with the U.S. Army Corps of Engineers show that

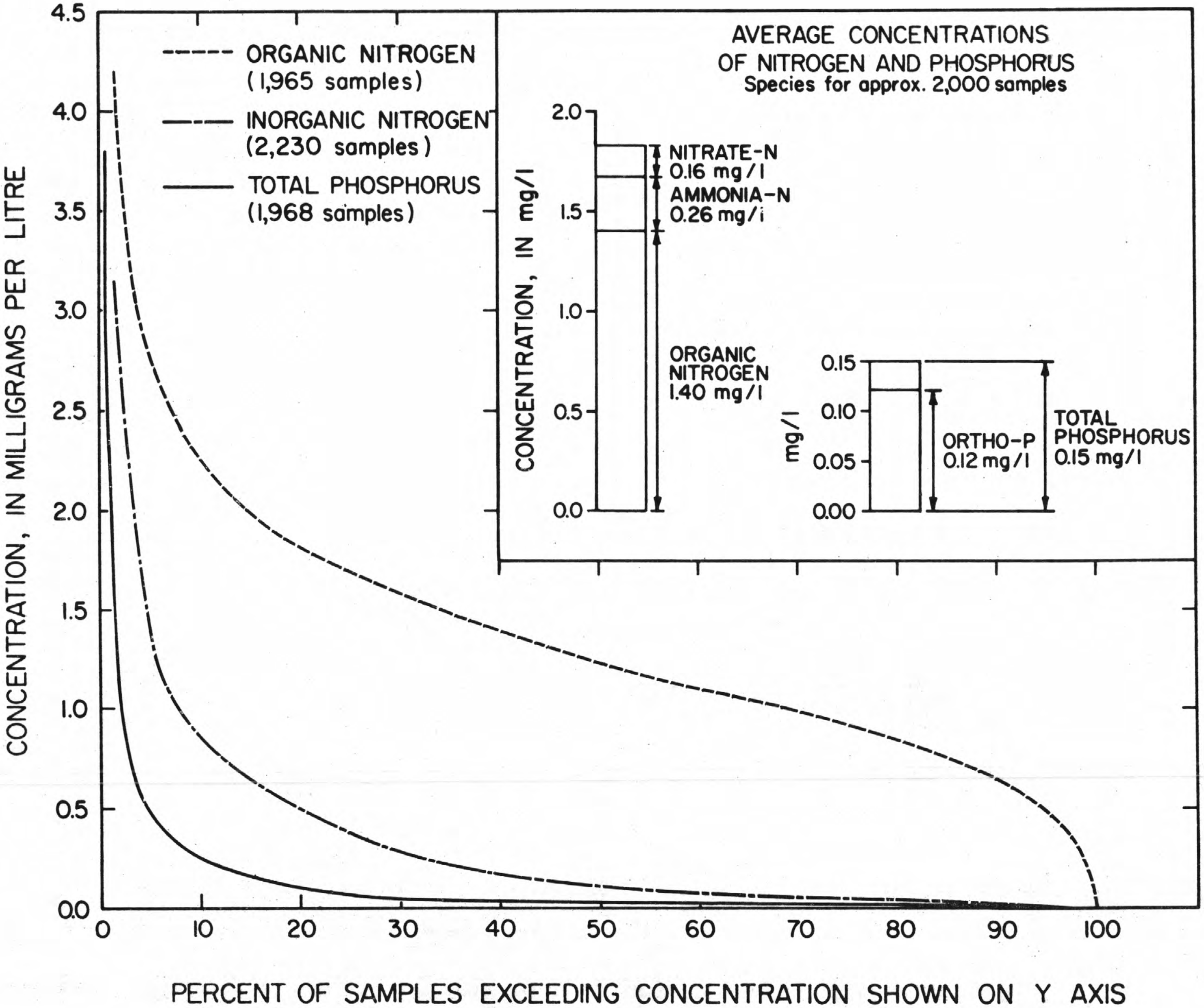


FIGURE 26.-DISTRIBUTION OF NITROGEN AND PHOSPHORUS CONCENTRATIONS IN APPROXIMATELY 2,000 SAMPLES FROM THE FCD AREA.

TABLE 7.--MEAN AND STANDARD DEVIATION OF NITROGEN AND PHOSPHORUS CONCENTRATIONS AT SELECTED STATIONS ON LAKES AND STREAMS IN THE CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

(Mean and standard deviation in milligrams per litre)

Station Name and Location	INORGANIC NITROGEN			ORGANIC NITROGEN			TOTAL PHOSPHORUS			TOTAL N/P RATIO
	No.	Mean	Std. Dev.	No.	Mean	Std. Dev.	No.	Mean	Std. Dev.	
Jane Green Creek near Deer Park	31	0.09	0.07	31	1.12	0.57	30	0.048	0.017	25.2
St. Johns River near Cocoa	40	0.11	0.08	42	1.33	0.62	52	0.055	0.024	26.2
St. Johns River above Lake Harney	30	0.41	0.36	30	1.30	0.69	33	0.315	0.265	5.4
Main Canal at Vero Beach	25	0.27	0.26	25	0.72	0.36	27	0.152	0.112	6.5
Fisheating Creek at Palmdale	31	0.10	0.05	29	1.35	0.58	51	0.164	0.098	8.8
Harney Pond Canal at S-71 near Okeechobee	30	0.38	0.28	30	1.06	0.92	40	0.147	0.146	9.8
Indian Prairie Canal at S-72 near Okeechobee	30	0.28	0.25	31	1.40	0.97	42	0.147	0.143	11.4
Alligator Lake near Ashton	28	0.04	0.03	28	.74	0.32	30	0.028	0.022	27.9
Lake Marian near Kenansville	25	0.07	0.06	25	1.72	0.85	26	0.081	0.063	22.1
Kissimmee River below S-65	34	0.17	0.18	34	1.33	0.55	38	0.038	0.035	39.5
Kissimmee River at S-65-E	62	0.17	0.13	62	1.06	0.47	86	0.076	0.061	16.2
Taylor Creek above Okeechobee	27	0.38	0.47	26	1.33	0.74	43	0.777	0.530	2.2
St. Lucie Canal near Stuart	12	0.18	0.09	12	0.72	0.25	30	0.075	0.053	12.0
West Palm Beach Canal at HGS-5	34	0.56	0.91	33	1.79	1.34	57	0.060	0.046	39.2
Hillsboro Canal at Deerfield Beach	20	0.37	0.28	19	1.08	0.48	19	0.150	0.130	9.7
North New River Canal at Ft. Lauderdale	19	0.51	0.28	18	1.39	0.81	20	0.020	0.012	95.0
Miami Canal at HGS-3 and S-3	52	0.57	1.02	50	1.81	.97	75	0.042	0.052	56.7
Miami Canal at NW 36th Street	28	0.48	0.32	27	1.12	0.54	29	0.019	0.012	84.2
Tamiami Canal Outlets - Levee 67-A to 40-mile-bend	26	0.21	0.20	27	1.40	0.37	27	0.019	0.010	84.7
Tamiami Canal Outlets - Levee 30 to Levee 67	23	0.64	.21	25	1.05	0.27	23	.008	.008	211.2

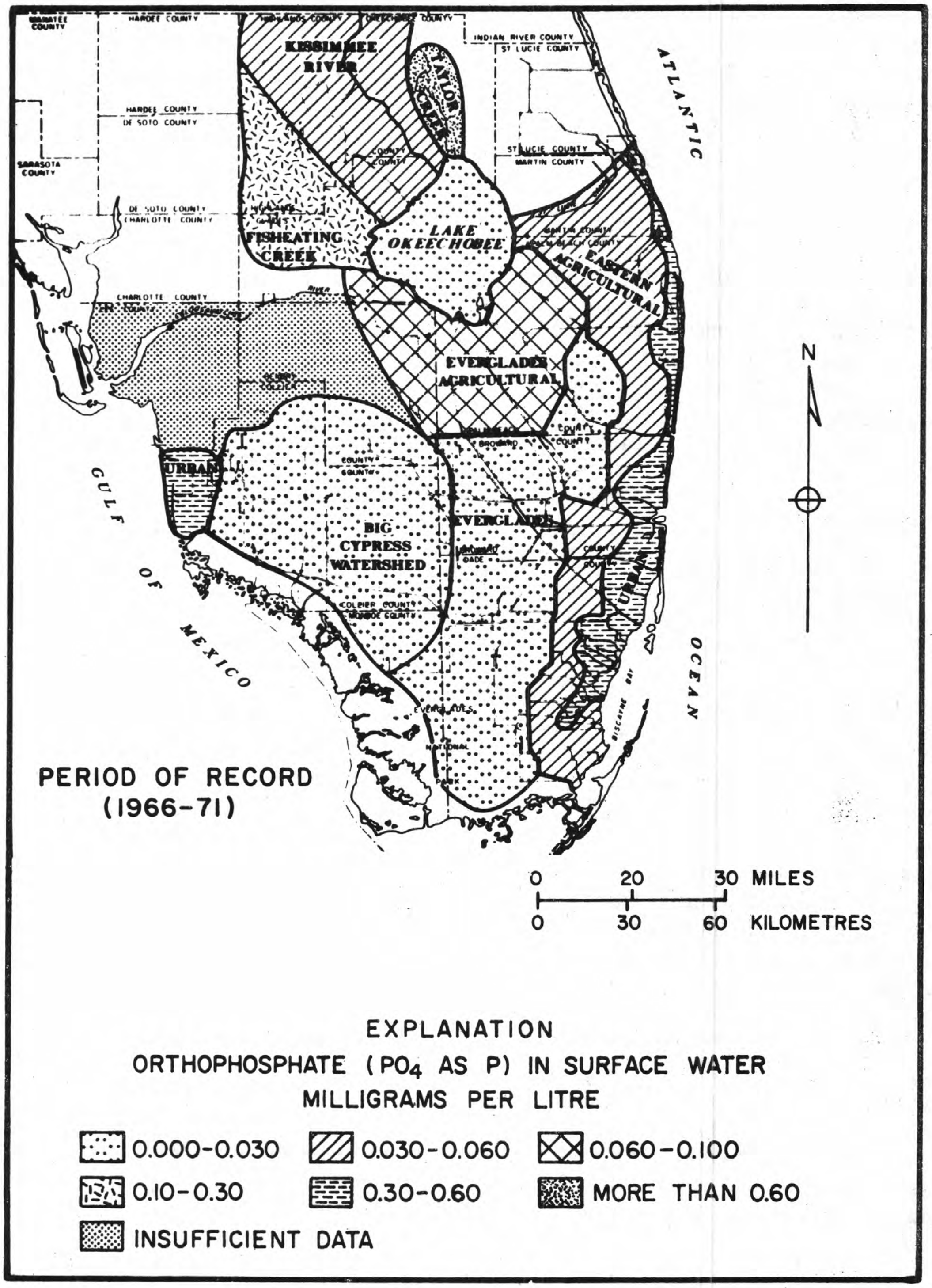


FIGURE 27.-ORTHOPHOSPHATE DISTRIBUTION IN SOUTH FLORIDA.

Everglades bottom sediments are rich in phosphorus. The highest inorganic nitrogen concentrations appear to be associated with the organic rich Everglades soil. Inorganic nitrogen concentrations are at times extremely high in the agricultural area south of Lake Okeechobee where the organic soils are drained and subjected to more rapid oxidation than elsewhere in the Everglades.

The areal distribution pattern of nitrogen and phosphorus is also illustrated by the total nitrogen to total phosphorus ratio (table 7). Lake Okeechobee (data not shown in table 6) has a ratio of about 45, indicating 45 milligrams of nitrogen for each milligram of phosphorus in the water column. Areas tributary to the lake have nitrogen to phosphorus ratios less than 45, indicating that they are "phosphorus rich" relative to Lake Okeechobee. Areas south of Lake Okeechobee on the other hand generally have ratios greater than 45, indicating that they are "nitrogen rich" relative to the lake.

The period of record is not adequate to determine long-term trends but seasonal patterns are apparent. The concentrations of both nitrogen and phosphorus usually are highest during the summer coincident with the beginning of the wet season. Seasonal variations in nitrogen and phosphorus concentrations in Main Canal at Vero Beach are shown in figure 28. Concentrations of phosphorus and inorganic nitrogen generally are highest during months of highest discharge, indicating that these nutrients are being flushed from the nearby agricultural (chiefly citrus) areas. Seasonal variations in nitrogen for West Palm Beach Canal near Loxahatchee are also shown in figure 28. The concentrations are highest during wet season when water is backpumped from the organic rich soils of the surrounding agricultural area to the water conservation areas. Stations on the Hillsboro, North New River and Miami Canals south of Lake Okeechobee show a similar seasonal pattern. Ammonia, the dominant form of inorganic nitrogen, is generally highest during the summer coincident with the beginning of the wet season and characteristically low dissolved oxygen concentrations. Nitrate concentrations are highest during winter.

Data collected by Waller, (1975) show that bulk precipitation (rainfall plus dry fallout) is a major source of nitrogen and phosphorus for the water conservation areas. For example, he found that from July 1972 to June 1973, 78 percent of the total nitrogen and 90 percent of the total phosphorus input to the conservation areas was from the atmosphere. The study also showed a definite retention of these nutrients by the conservation areas.

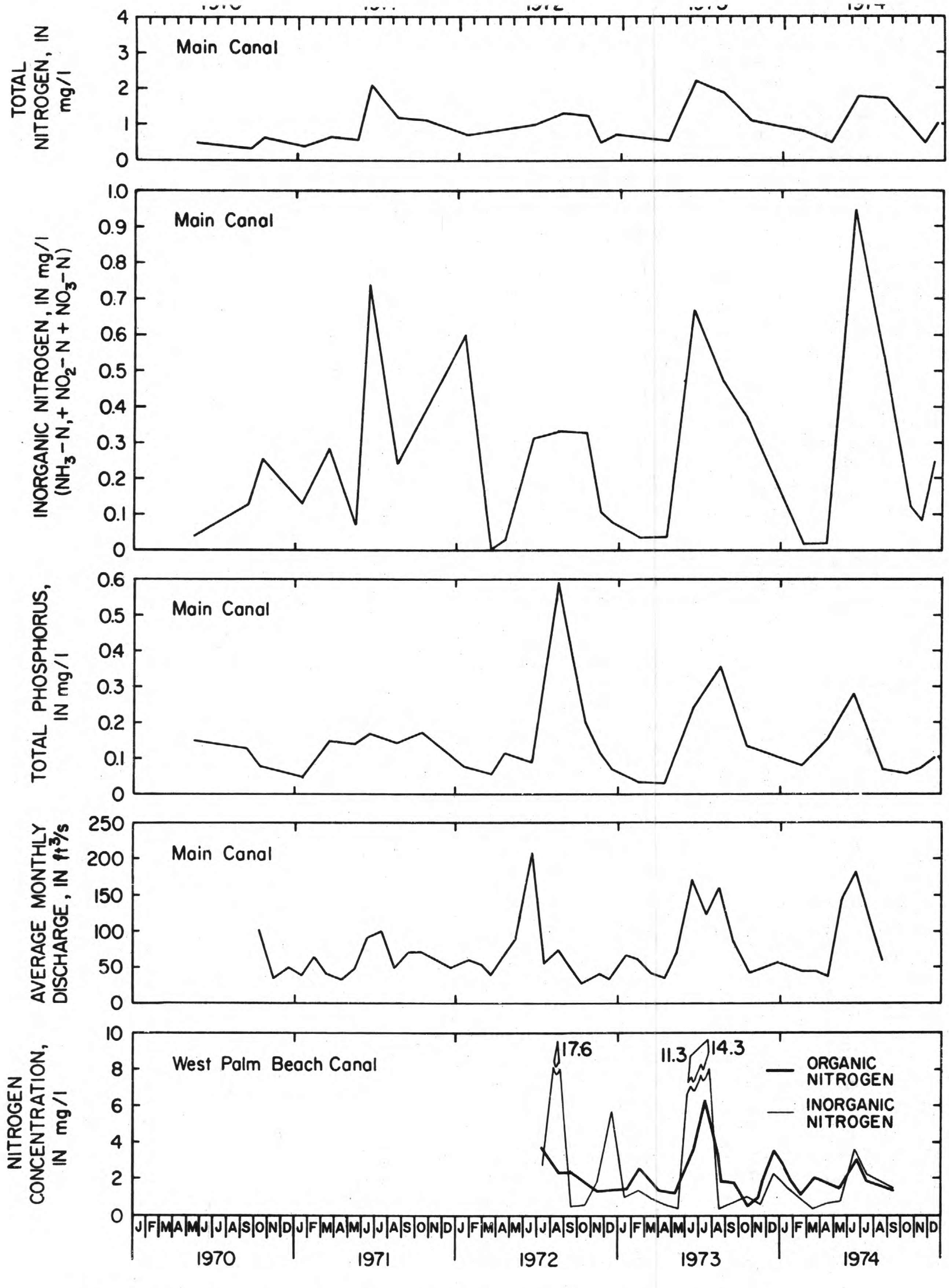


FIGURE 28.--SEASONAL VARIATIONS IN NITROGEN AND PHOSPHORUS IN MAIN CANAL AT VERO BEACH AND WEST PALM BEACH CANAL ABOVE S-5A NEAR LOXAHATCHEE.

The existing data on nitrogen and phosphorus provide considerable information on the distribution of nitrogen and phosphorus species in the FCD area, average concentrations and seasonal and areal variations. A major shortcoming, however, is that much of the data were not collected with well defined regional objectives in mind. Also, in collecting the data adequate attention was not given to the biological systems which nitrogen and phosphorus affect. The nutrients, nitrogen and phosphorus, are important indicators of water quality and trophic status. Sampling for these nutrients should be continued, but only with a systematic collection strategy and well defined objectives.

Trace Metals

Data on 12 trace metals have been collected at approximately 150 stations in the FCD area since 1969. Sampling frequency has ranged from one-time reconnaissance sampling to four samples per year. A statistical summary of this data for dissolved and total metal concentrations is given in Table 8 for four separate geographic areas in central and southern Florida and for the entire FCD area. Concentrations of dissolved trace metals were determined on samples that were filtered through a 0.45 micrometre membrane filter and acidified at the time of collection. Total concentrations are for unfiltered samples and include the dissolved fraction plus metals associated with sediment or other suspended material.

Water quality criteria (National Academy of Sciences, National Academy of Engineering, 1973) concerning these 12 trace metals for various water uses including agriculture, public supply, fresh-water and marine water aquatic life are summarized in Table 9. The data show that, except for mercury, trace metals concentrations rarely exceed these criteria and that concentrations are generally several times to an order of magnitude lower than the criteria. As shown in table 8 the average mercury concentrations in the area from the Tamiami Canal through the Caloosahatchee Canal is twice that of the other areas and exceeds the EPA criteria for freshwater aquatic life.

Twenty-two of the 126 mercury values (17 percent) from this area exceed 0.5 microgram per litre (fig. 29). Some additional, more intensive sampling may be warranted.

Arsenic, cadmium, chromium, lead, and nickel are highly toxic, nonessential to life processes. Concentrations of these metals rarely exceed recommended criteria in the surface waters of the area and average concentrations are about an order of magnitude lower than the recommended criteria. These metals should pose problems only in the highly urbanized areas of south Florida where they would be released to the aquatic environment through vehicular traffic, storm runoff and domestic and industrial wastes.

TABLE 8.--Summary of data on trace metals in central and south Florida
(micrograms per litre)

Metal	Phase	Upper St. Johns River Basin			Kissimmee River Basin and Lake Okeechobee inflow			South Fla. Basin from St. Lucie Canal thru Miami Canal			South Fla. Basin Tamiami Canal thru Caloosahatchee Canal			Entire FCD Area		
		No.	Mean	Std Dev	No.	Mean	Std Dev	No.	Mean	Std Dev	No.	Mean	Std Dev	No.	Mean	Std Dev
Aluminum	(1)	3	70	88	39	59	88	41	56	43	23	56	37	106	57	63
	(2)	54	82	95	22	300	74	84	130	212	101	240	426	261	180	369
Arsenic	(1)	52	11.1	9.6	158	11.1	9.1	212	9.6	9.2	168	7.2	9.0	590	9.5	9.3
	(2)	31	9.7	7.7	64	13	8.7	181	9.4	5.1	107	8.1	5.5	383	9.6	6.3
Cadmium	(1)	59	.72	2.5	55	.11	.31	90	.74	1.9	43	.56	1.7	247	.56	1.9
	(2)	30	.20	.48	39	.23	.58	116	.66	2.0	94	1.5	4.4	279	.84	2.9
Chromium	(1)	7	1.4	3.8	10	1.1	3.1	61	1.8	4.6	275	3.2	7.2	100	2.0	5.1
	(3)	21	.10	.44	149	0.35	1.4	119	.05	.22	214	.08	.47	372	.18	.9[illegible]
	(2)	54	.37	1.9	40	3.4	5.7	200	4.1	9.8	173	5.7	13	418	4.0	10
Cobalt	(1)	17	.11	.33	24	.38	.58	47	.89	1.4	33	.48	.97	121	.57	1.1
	(2)	15	.00	.00	22	.22	.53	86	.63	1.2	71	.53	1.3	194	.50	1.1
Copper	(1)	113	9.3	56	202	9.6	11	239	7.3	16	189	8.9	15	743	8.6	25
	(2)	24	2.1	4.1	21	8.7	13	166	5.0	10	68	6.3	18	279	5.4	12
Iron	(1)	166	210	137	296	220	195	239	99	96	210	120	151	911	160	163
	(2)	60	390	311	50	660	1051	225	230	296	150	370	412	485	340	483
Lead	(1)	80	2.7	5.0	214	3.6	5.4	248	7.5	16	210	5.1	8.5	752	5.2	11
	(2)	42	6.1	12	34	6.6	6.5	177	7.0	8.7	97	8.1	17	350	7.2	12
Manganese	(1)	137	14	25	194	13	20	206	12	21	156	18	26	693	14	23
	(2)	58	15	8.9	33	21	19	203	16	15	140	22	29	434	18	21
Mercury	(1)	0	-	-	0	-	-	0	-	-	0	-	-	0	-	-
	(2)	37	.14	.43	53	.16	.35	126	.17	.37	126	.35	.91	342	.23	.63
Nickel	(1)	0	-	-	24	.00	.00	1	-	-	3	2.0	1.0	28	.25	.70
	(2)	19	10	9.1	16	1.4	1.9	11	5.1	6.4	39	7.9	12	85	6.9	10
Zinc	(1)	109	24	16	202	36	41	239	43	75	191	47	115	741	39	76
	(2)	24	23	40	20	18	9.5	152	28	46	77	30	46	271	28	44

1 Dissolved trace metals determined on filtered samples.
2 Dissolved plus suspended trace metals determined on unfiltered samples after digestion.
3 Hexavalent chromium.

TABLE 9.--Tabular summary of water-quality criteria (National Academy of Sciences, National Academy of Engineering, 1973)

Constituent	Agriculture (Irrigation)	Agriculture (Livestock)	Freshwater (Aquatic Life)	Freshwater (Wildlife)	Freshwater (Public Supply)	Marine Water (Aquatic Life)
Aluminum	5.0 mg/l 20.0 mg/l (20 yrs.)	5.0 mg/l	--	--	--	1/100 (0.01) 96-hr. LC_{50} 1.5 mg/l 1/10 LD_{50}
Arsenic	0.10 mg/l 2.0 mg/l (20 yrs.)	0.2 mg/l	--	--	0.1 mg/l	1/100 (0.01) 96-hr. LC_{50} 0.05 mg/l
Cadmium	0.01 mg/l 0.05 mg/l (20 yrs.)	50 ug/l	0.03 mg/l hard H_2O 0.004 mg/l soft H_2O	--	0.01 mg/l	1/100 (0.01) 96-hr. LC_{50} 0.01 mg/l
Chromium	0.1 mg/l 1.0 mg/l (20 yrs.)	1.0 mg/l	0.05 mg/l	--	0.05 mg/l	1/100 (0.01) 96-hr. LC_{50} 0.1 mg/l
Cobalt	0.05 mg/l 5.0 mg/l (20 yrs.)	1.0 mg/l	--	--	--	--
Copper	0.20 mg/l 5.0 mg/l	0.5 mg/l	1/10 (0.1) 96-hr. LC_{50}	--	1 mg/l	1/100 (0.01) 96-hr. LC_{50} 0.05 mg/l
Iron	5.0 mg/l 20.0 mg/l (20 yrs.)	No limit	--	--	0.3 mg/l	0.3 mg/l
Lead	5.0 mg/l 10.0 mg/l	0.1 mg/l	0.03 mg/l	--	0.05 mg/l	1/50 (0.02) 96-hr. LC_{50} 0.01 LD_{50}
Manganese	0.20 mg/l 10.0 mg/l (20 yrs.)	No limit	--	--	0.05 mg/l	1/50 (0.02) 96-hr. LC_{50} 0.01 mg/l
Mercury Inorganic		1.0 ug/l	0.2 ug/l totl conc. 0.5 ug/g body burden conc. tot. hg	0.5 ug/l in fish	0.002 mg/l total	1/100 (0.01) 96-hr. IC_{50}
Mercury Organic	--	--	0.2 ug/l total conc. 0.05 ug/l avg. conc. 0.5 ug/g body burden conc. tot. hg	--	--	--
Nickel	0.2 mg/l 2.0 mg/l (20 yrs.)	--	1/50 (0.02) 96-hr. LC_{50}	--	--	1/50 (0.02) 96-hr. LC_{50} 0.1 mg/l
Zinc	--	25 mg/l	5/1000 (0.005) 96-hr. LC_{50}	--	5 mg/l	1/100 (0.01) 96-hr. LC_{50} 0.1 mg/l

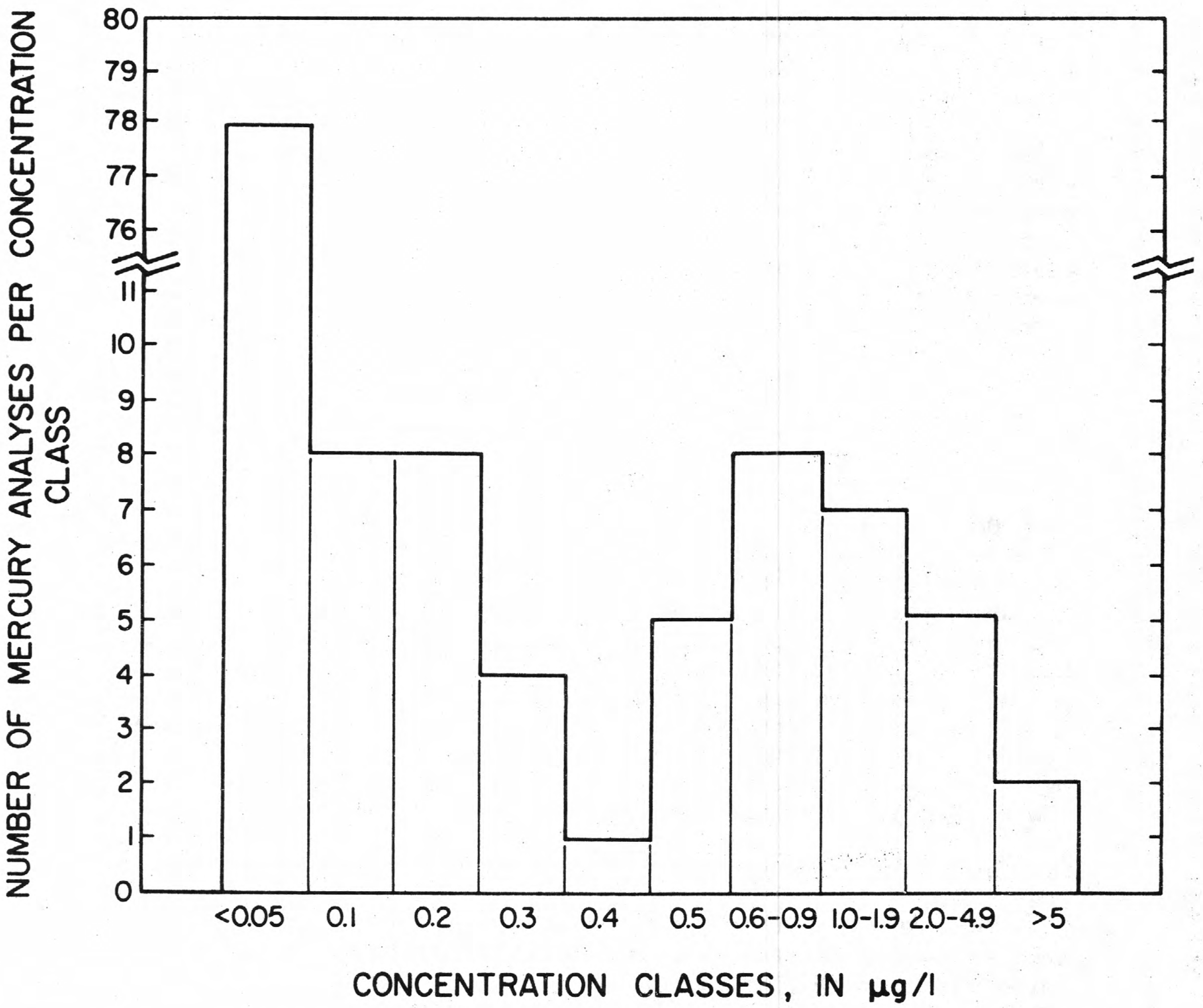


FIGURE 29.-DISTRIBUTION OF MERCURY CONCENTRATIONS IN SAMPLES FROM SOUTH OF TAMIAMI CANAL AND WEST OF THE CONSERVATION AREA.

Although aluminum, cobalt, copper, iron, manganese, and zinc are essential to normal life processes, these elements can be toxic in high concentrations. The average concentrations of these elements in surface water in the FCD area are about an order of magnitude lower than recommended criteria. It should be noted that because these elements are essential to life processes, deficiencies in any one of them could be a limiting factor in aquatic productivity. Organic compounds, through their ability to form complexes with these transition metals, may further reduce their effective concentrations in the surface waters.

The general physical-chemical characteristics of trace metals tend to limit their solubility in water and to concentrate the metals in bottom sediments. Buildup of these metals in the organic-rich sediment in urban and agricultural areas is likely to have a much more profound impact on aquatic ecosystems than the low concentrations in surface waters. In future sampling for trace metals in the area it would be advantageous to place the major emphasis on determining concentrations in suspended and bottom sediments rather than in solution. Bottom sediment sampling could be accomplished through an areal reconnaissance approach which would be conducted once every 3 to 5 years. If the reconnaissance pointed to a problem additional sampling could then be conducted.

Insecticides[1]

In Water

Only a small amount of data on insecticides have been collected through the USGS-FCD water-quality network program; however, considerable data have been collected as part of investigative studies conducted in the area in cooperation with FCD and other agencies. Water samples were routinely analyzed for aldrin, chlordane, DDD, DDE, DDT, dieldrin, endrin, heptachlor, heptachlor epoxide, lindane, and toxaphene. Of the 11 compounds analyzed in water only five were detected (fig. 30). The majority of these detections were at the detection limit of the analytical technique and may be due to insecticides adsorbed on suspended organic matter. The analyses show that the chlorinated hydrocarbons are very low in concentration and are infrequently detected in water.

[1]The analysis of insecticide data in this section is condensed from Mattraw (1975).

The frequency of detection of chlorinated hydrocarbons in water samples declined between 1968 and 1972 (table 10). Rainfall samples collected in south Florida during the same time decreased in frequency of detection. The decrease in frequency of detection of insecticide residues in south Florida probably reflects the restrictions of agricultural applications of these chemical compounds. Annual synoptic sur-

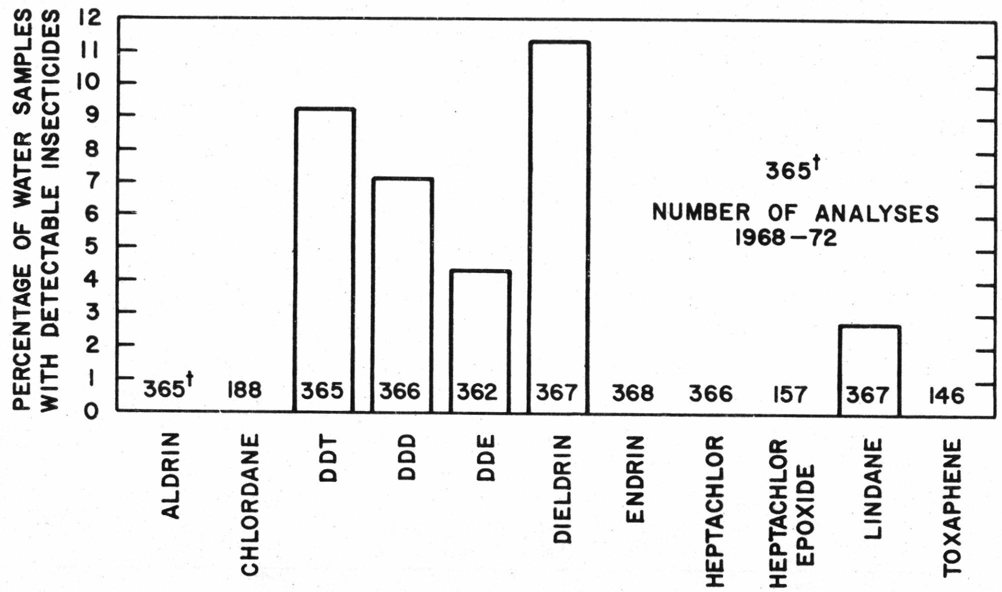


FIGURE 30.-CHLORINATED HYDROCARBONS IN SOUTH FLORIDA SURFACE WATERS.

TABLE 10.--Insecticide detections in South Florida surface waters.

Constituents	1968 Detections	1968 Samples Analyzed	1968 Percentage	1969 Detections	1969 Samples Analyzed	1969 Percentage	1970 Detections	1970 Samples Analyzed	1970 Percentage	1971 Detections	1971 Samples Analyzed	1971 Percentage	1972 Detections	1972 Samples Analyzed	1972 Percentage
DDT	17	21	81	7	26	27	11	47	23	4	109	3.7	2	166	1.2
DDD	9	22	41	4	26	15	6	49	12	7	122	5.7	6	163	3.8
DDE	5	22	23	3	26	12	1	45	2.2	6	122	4.9	5	163	3.1
Dieldrin	5	23	22	0	26	0	0	48	0	11	110	10	24	161	15

veys of surface waters of the United States indicated a peak occurrence of chlorinated hydrocarbon insecticides in 1966 (Lichtenberg and others, 1970).

In Sediments

The number of sediment samples from south Florida analyzed for insecticides and the percentage containing detectable (greater than 0.05 g/kg) concentrations are shown in figure 31. The most frequently detected compounds are chlordane, DDT, DDD, DDE, and dieldrin. Less than 5 percent of the samples analyzed contained aldrin, lindane, or toxaphene in detectable concentrations. Chlordane, dieldrin, DDT, DDD, and DDE were detected in a higher percentage of the sediment samples in south Florida than in the soil samples collected for the National Soils Monitoring Program (Wiersma and others, 1972) (Table 11). Aldrin was detected less frequently, probably indicating a difference in insecticide use in south Florida, as compared to the rest of the Nation.

Concentrations of DDD in south Florida sediments are illustrated in figure 32 for the various land-use areas. Sediment samples from the Everglades agricultural area, where DDT and DDD were directly applied to soils, showed the highest percentage of samples containing DDD and the highest concentrations. In order of decreasing levels of detected concentrations of DDD are the Everglades Agricultural area, Urban area, Everglades area, Eastern agricultural area, and the undeveloped Big Cypress watershed. The Big Cypress is remote from areas of DDT and DDD application and probably receives most of its insecticide input by atmospheric transport mechanisms. The highest concentration of DDD reported in the undeveloped Big Cypress was 6 μg/kg.

The relation between the concentration of DDE and the cumulative frequency of detection is also illustrated in figure 32. The range of DDE residues in sediments from the various land use areas is similar to that for DDD. The slopes of the semilogarithmic plots for DDE and DDD are nearly equal. This similarity indicates that the occurrence of various concentrations of these two pesticides within any one of the land-use areas is virtually the same. The similarity of concentrations and percentage of detections of DDD and DDE indicate a similarity in dispersion with distance from source areas and in persistence with time for these two insecticides.

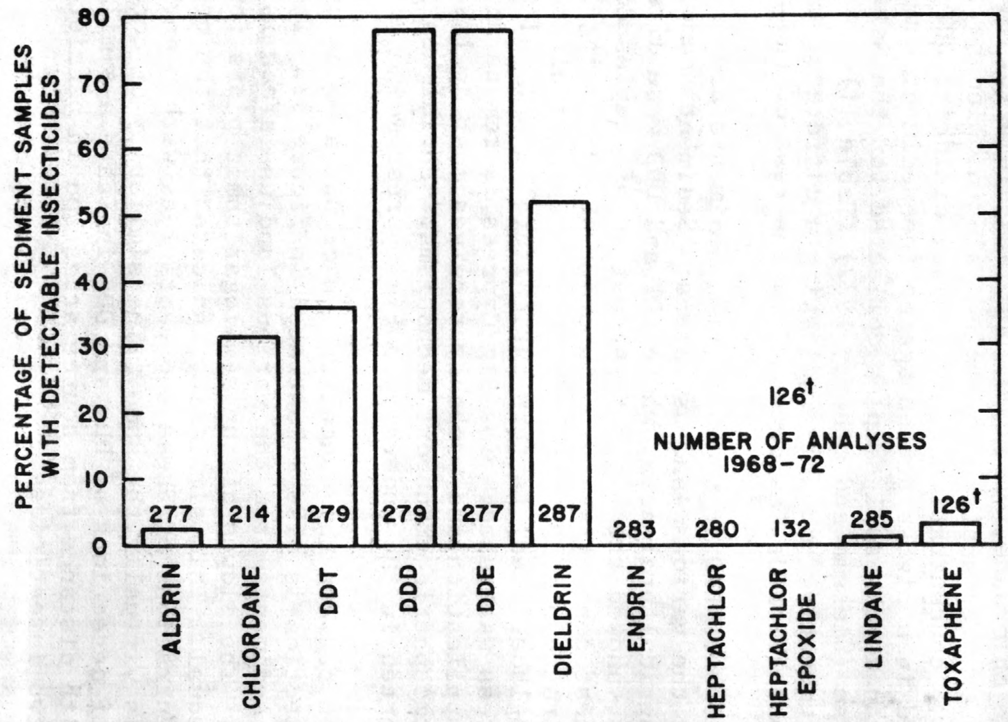


FIGURE 31.-CHLORINATED HYDROCARBONS IN SOUTH FLORIDA BOTTOM SEDIMENTS.

TABLE 11.--Comparison of insecticide residue detection frequencies in south Florida sediments and cropland soils analyzed in National Soils Monitoring Program.1/

Insecticide	Cropland soils (percent)	South Florida sediment (percent)
Dieldrin	27.8	53.3
DDE	24.8	80.5
DDT	22.2	37.3
DDD	15.3	80.3
Aldrin	10.9	2.2
Chlordane	8.7	32.7
Heptachlor epoxide	8.0	(2)
Toxaphene	4.2	3.2
Heptachlor	3.9	(2)
Endrin	2.3	(2)
Lindane	.9	.7

1 Wiersma and others (1972); samples collected for National Soils Monitoring Program.

2 Not detected.

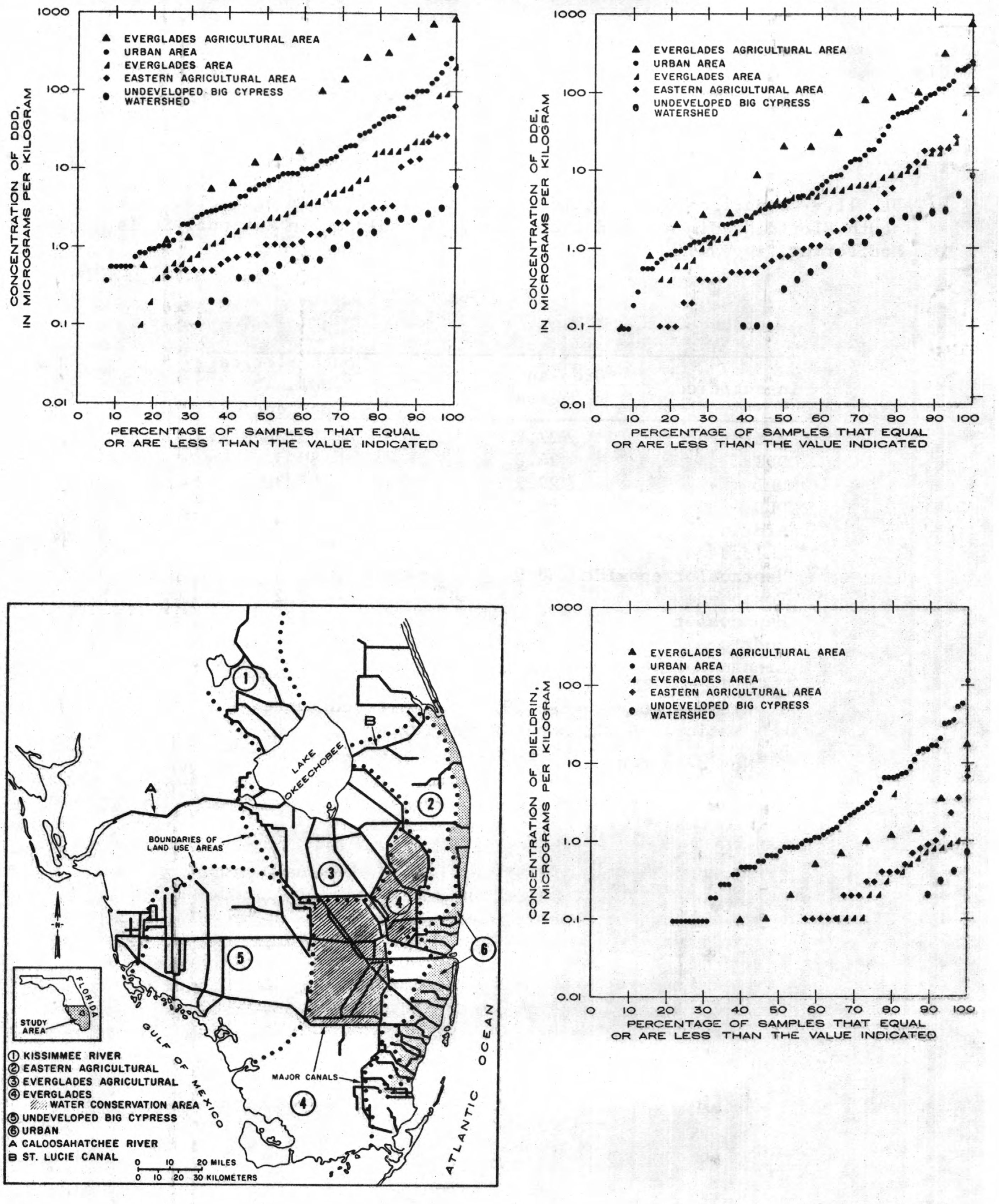


FIGURE 32.-AREAL DISTRIBUTION OF DDD, DDE AND DIELDRIN IN SOUTH FLORIDA SEDIMENTS.

Dieldrin in sediments (fig. 32) is more frequently detected and has higher concentrations in the Urban area than in any other land-use category. Use of dieldrin for eradication of domestic termites in south Florida could account for the higher occurrence frequency in urban area sediments. The overall low concentrations of dieldrin in all land-use areas indicate a lower use rate than DDT.

The undeveloped Big Cypress watershed has the lowest concentrations and the least frequent detections of dieldrin. Transfer of dieldrin from solution to the atmosphere is slow with respect to other chlorinated hydrocarbons (McKay and Wolkoff, 1973) and it should be retained more readily in the aqueous phase than the more volatile DDT, DDD, and DDE. This behavior would explain the very low detection frequency for sediments from the undeveloped Big Cypress watershed which receives most input by atmospheric transport.

As long as the bottom sediments retain high concentrations of these insecticides they pose a potential threat to aquatic life. Systematic sampling of bottom sediments for insecticides should be continued. As was suggested for trace metals this sampling could be conducted through an areal reconnaissance once every 3 to 5 years supplemented by annual sampling at selected key locations. Consideration should also be given to sampling fish in the major drainage systems as an overall indicator of insecticide levels.

Organic Carbon and Biochemical Oxygen Demand

TOC (organic carbon) and 5-day BOD (biochemical oxygen demand) measurements have been made at numerous stations in the FCD area in recent years. The 5-day BOD is a measure of the amount of oxygen utilized in the bacterial degradation of organic matter. It is strongly influenced by the type of organic matter present and the relative ease with which it can be oxidized by bacteria. For example, organic matter in domestic sewage is oxidized at a considerably faster rate than the organic matter leached from decaying vegetation in swamps and marshes. Thus, domestic sewage will have a much higher 5-day BOD even though the total organic matter in water from both sources may be the same. On the other hand, TOC measures the total amount of organic carbon in the sample regardless of the type of organic compounds present but does not give any measure of the rate at which it decomposes or how it affects the oxygen balance of the water. As a rule of thumb the concentration of total organic matter is roughly twice the organic carbon concentration. Both BOD and TOC measurements are of value in assessing the organic content of water.

Table 12 shows the mean and standard deviation BOD and TOC for more than 1,600 samples collected in various parts of the FCD area since 1969. Measurements of water color, another indicator of organic matter, are also summarized in the table. Mean BOD values were highest in the Hillsboro Canal system and in Taylor Creek and lowest in the upper St. Johns basin, the lower Kissimmee River, and Lake Okeechobee. Mean organic carbon values were highest in the Hillsboro, North New River, and Miami Canal systems and lowest in the Kissimmee River basin. Water color is highest in the Kissimmee and St. Johns River basins and lowest in the water conservation areas and Everglades National Park.

In streams having relatively low concentrations of dissolved solids such as the Kissimmee River and Fisheating Creek, a large part of the dissolved material can be organic matter. For example, the average dissolved solids (residue on evaporation) concentration in the Kissimmee River at S-65E is approximately 100 mg/l and the average organic carbon concentration is about 14 mg/l. If it is assumed that the concentration of organic matter is twice the organic carbon value, about 25 percent of the dissolved solids in the river is organic material. Similarly, about 20 percent of the dissolved solids in Fisheating Creek consists of organic material.

A correlation matrix was developed (STATPAC computer program D0101) to test for correlations between BOD and TOC for the areas listed in table 12. Several other parameters including color, organic nitrogen, nitrate-nitrogen, ammonia-nitrogen, total phosphorus, silica, dissolved oxygen, iron, turbidity, and specific conductance were also included in the correlation analysis. Results giving correlation coefficients greater than 0.7 are shown in Table 13. There was poor or no correlation between BOD and TOC. Correlation coefficients ranged from -0.10 to 0.29. The best correlations were between TOC and water color, TOC and dissolved iron, water color and dissolved iron and TOC and silica. Significant correlation between other variables are also shown in Table 13.

This analysis has shown that a fairly good base of background data on BOD is now available for virtually all the FCD area. Measurements for 5-day BOD could be discontinued except at those locations where organic pollution is apparent. Implementing a limited program to obtain some baseline information on ultimate BOD values would provide information for present and future use in water-quality models. Ultimate BOD's can be obtained by determining the BOD at 2, 5, and 10 days in addition to the standard 5-day period.

TABLE 12.--Mean and standard deviation for BOD, organic carbon, and water color for selected areas in the Central and Southern Florida Flood Control District [1/]

	BIOCHEMICAL OXYGEN DEMAND			ORGANIC CARBON			WATER COLOR		
Area	No.	Mean	Std. Dev.	No.	Mean	Std. Dev.	No.	Mean	Std. Dev.
Upper St. Johns Basin	196	1.34	0.97	173	21.8	11.6	187	137	70
Fisheating Creek and Indian Prairie Canal	21	1.93	1.09	21	20.7	6.5	20	142	86
Upper Kissimmee Basin	105	1.82	1.76	140	24.9	18.1	123	193	164
Kissimmee River S-65 to S-65E	87	1.67	0.91	254	15.5	6.4	85	79	40
Kissimmee River at S-65E	32	1.30	0.84	50	14.1	4.9	33	81	34
Entire Kissimmee Basin	192	1.75	1.43	394	18.9	12.7	208	147	140
Taylor Creek	21	2.82	1.81	17	20.9	7.6	20	127	105
Lake Okeechobee	43	1.40	0.52	36	22.8	19.1	43	47	37
St. Lucie and West Palm Beach Canals	49	2.05	1.47	83	24.7	19.0	37	60	30
Hillsboro Canal System	114	2.91	2.33	180	27.3	17.9	121	67	27
North New River Canal System	112	2.05	2.75	173	27.0	15.7	101	62	20
Miami Canal System	45	1.86	1.58	78	27.4	15.6	33	50	18
Tamiami Canal System	62	2.43	1.91	102	20.0	17.5	58	30	19
Everglades National Park	15	2.28	1.71	47	23.8	38.8	41	38	28
Lake Trafford to Caloosahatchee Canal @ S-79	73	1.73	1.33	62	18.1	14.3	65	60	34
South Florida Basin	477	2.25	2.14	749	26.1	21.1	461	56	29
Entire FCD area	952	1.92	1.78	1392	23.3	18.0	942	95	89

1 Mean and standard deviation for BOD and Organic Carbon given in milligrams per litre; water color expressed in color units on Platinum-cobalt scale.

TABLE 13.--Correlation coefficients for biochemical oxygen demand, organic carbon and other selected water-quality variables in central and southern Florida.

Area	Pair of variables	Number of pairs	Correlation coefficient (r)
Upper St. Johns River basin	Color-dissolved iron	128	0.75
	Color-total iron	45	.76
	Ammonia nitrogen-total phosphorus	103	.95
	Nitrate nitrogen-total phosphorus	104	.80
	Ammonia nitrogen-nitrate nitrogen	103	.76
Kissimmee River at S-65E	Organic carbon-dissolved iron	13	.74
	Dissolved oxygen-dissolved iron	16	- .73
	Silica-dissolved iron	22	.76
	Silica-ammonia nitrogen	47	.84
Entire Kissimmee River basin	Organic carbon-color	170	.81
	Organic carbon-dissolved iron	149	.73
	Color-dissolved iron	176	.77
Hillsboro Canal system	5-day BOD-nitrate nitrogen	87	.75
	Organic carbon-silica	138	.70
	Silica-specific conductance	106	.82
Miami Canal system	Color-specific conductance	27	.71
	Dissolved oxygen-total iron	20	- .83

The existing TOC data are sufficient to determine gross areal estimates of the concentration of organic matter in the surface waters in the FCD area. Where the frequency of sampling has been monthly or bimonthly, rough estimates of loads of organic matter flowing past a particular station can be computed. Additional data analysis could be undertaken to interpret the existing TOC data in relation to streamflow, seasonal, climatic, and cultural factors.

In somewhat the same way that specific conductance can be used to estimate concentrations of major inorganic chemical constituents, organic carbon can be used to estimate the concentration of organic material in solution. Because of the high organic content of south Florida waters, sampling for organic carbon should be continued. A more sophisticated approach to the collection and analysis of organic carbon in future studies would include sampling for both the dissolved and suspended fractions, and studying the relations between these fractions and trace metals, nutrients, productivity, and climatic and hydrologic factors.

WATER QUALITY NETWORK PLAN

Based on the foregoing analysis of the existing data base and discussions with FCD personnel, a water quality network has been designed to meet most broad long-range needs for water-quality data in the FCD area. The network is in part, a water-quality accounting network in that it should provide quantitative information on the concentrations and loads of chemical species in the complex FCD flow system. The network is made up of a modification of the existing USGS-FCD cooperative network, networks operated by the USGS in cooperation with other agencies in south Florida and the permanent network stations of the Florida Department of Environmental Regulation.

Objectives

The prime objectives of the network are as follows:

1. Water-quality accounting - This includes determining the concentrations and annual loads of major chemical constituents, nitrogen and phosphorus species, suspended sediment and organic material discharged from the major FCD drainage systems. This data would provide for an accounting of materials discharged from the major drainage systems, depict area variability, provide a means to determine long term trends and provide a base for more comprehensive basin assessments. Data collected for this objective would also provide a basis for characterization of bottom sediments and comparative estimates of primary productivity for the major drainage systems.

2. Areal assessment - This includes collection of data to make areal assessments of the gross effects of water management, land use, and development on water quality in the FCD area when used in conjunction with the accounting stations. The data would also provide information on the trophic status of selected lakes.

3. Determination of long-term trends - This includes collection of specific conductance data at all locations where streamflow, or lake records are obtained on a repetitive basis to be used in conjunction with data from objectives 1 and 2 to aid in determining gross long-term trends in water quality.

4. Reconnaissance sampling for toxic and deleterious substances - This includes making a periodic broad areal reconnaissance to determine if potential problems exist with respect to toxic and deleterious substances such as insecticides, herbicides, trace metals, bacteria, organics, etc.

5. Development of data base on lakes - This involves collection of basic morphological and limnological data on lakes in the FCD area to provide general information on the lakes and a base for more intensive limnological studies.

6. Collection of data on bulk precipitation - Determine seasonal and annual loads and composition of bulk precipitation at selected locations in the FCD area.

Operational Design of Network

Streamflow System

The implementation of a water-quality network in the FCD which will accomplish objectives (1) and (2) requires definition of the flow system to be sampled. In a natural stream system, sites can be selected which allow the tributary flow to be measured and sampled and the mainstem to be measured and sampled near the downstream end of the basin of interest. Such a site selection scheme would rather clearly define the chemical loads contributed by various parts of the basin and the total load leaving the area. Surface water in south Florida, even in a pristine state, was not amenable to such an approach. Since, during the wet season, sheet flow of water across broad areas of flat terrain took place it would have been extremely difficult to select sites where samples representative of the chemical quality of the water in the area could be collected. Measurement of flow under these conditions would not be possible. During the dry season, no flow would have been available to sample.

In its present man-modified state additional complications related to the manipulation of the water appear. However, these modifications allow for the measurement of flow and the collection of water samples in clearly defined channels (canals) and thus simplify the selection of sampling sites. The system of lakes, rivers, and marshes north of Lake Okeechobee and the sheet flow and system of sloughs south of the lake have been replaced by a man-made flow system. Instead of the natural drainage there is now a series of canals with dams, locks, spillways, salinity control structures, pumping stations, and levees. Sheet flow across flat terrain has become, in part, a series of conservation areas with many of the same control structures found in the canal system.

Lake Okeechobee is the hub of the water system in south Florida. Water enters the lake through six streams and canals on the north side of the lake and leaves the lake by way of seven canals on the east, south and west sides of the lake. Of these 13 streams and canals, six commonly flow both into or out of the lake, augmented in several instances by pumping. Thirteen stations on these waterways are shown in figure 33.

The 91 stations listed in table 14 and shown in figure 33 cover the major drainage systems, points of flow diversion and major lakes in the FCD area. Four stations (13, 18, 41, and 42) will be under the control of the St. Johns River Water Management District in the future. These 91 stations sampled for the water-quality parameters and at the sampling frequency indicated in table 14 should provide the data necessary to accomplish the network objectives.

Network Design

A description of the network design to accomplish the six network objectives follows:

1. Water-quality accounting - The first 24 stations listed in table 14 are near the mouth of major drainage systems in the FCD area and are designed as water-quality accounting stations, although they will also provide data for objectives 2 and 3. Five of the 24 stations are being sampled under the Geological Survey's National Stream Quality Accounting Network program and six are being sampled by the Florida Department of Environmental Regulation. The remaining 13 (Map numbers 1-13) are proposed to be sampled under the USGS-FCD cooperative network or by FCD. Sampling at these stations will be frequent and comprehensive, as shown in table, to provide data for water-quality accounting purposes. The bottom sediment, periphyton and phytoplankton analyses would provide comparative data on sediment composition and on productivity and trophic status in the major drainage systems.

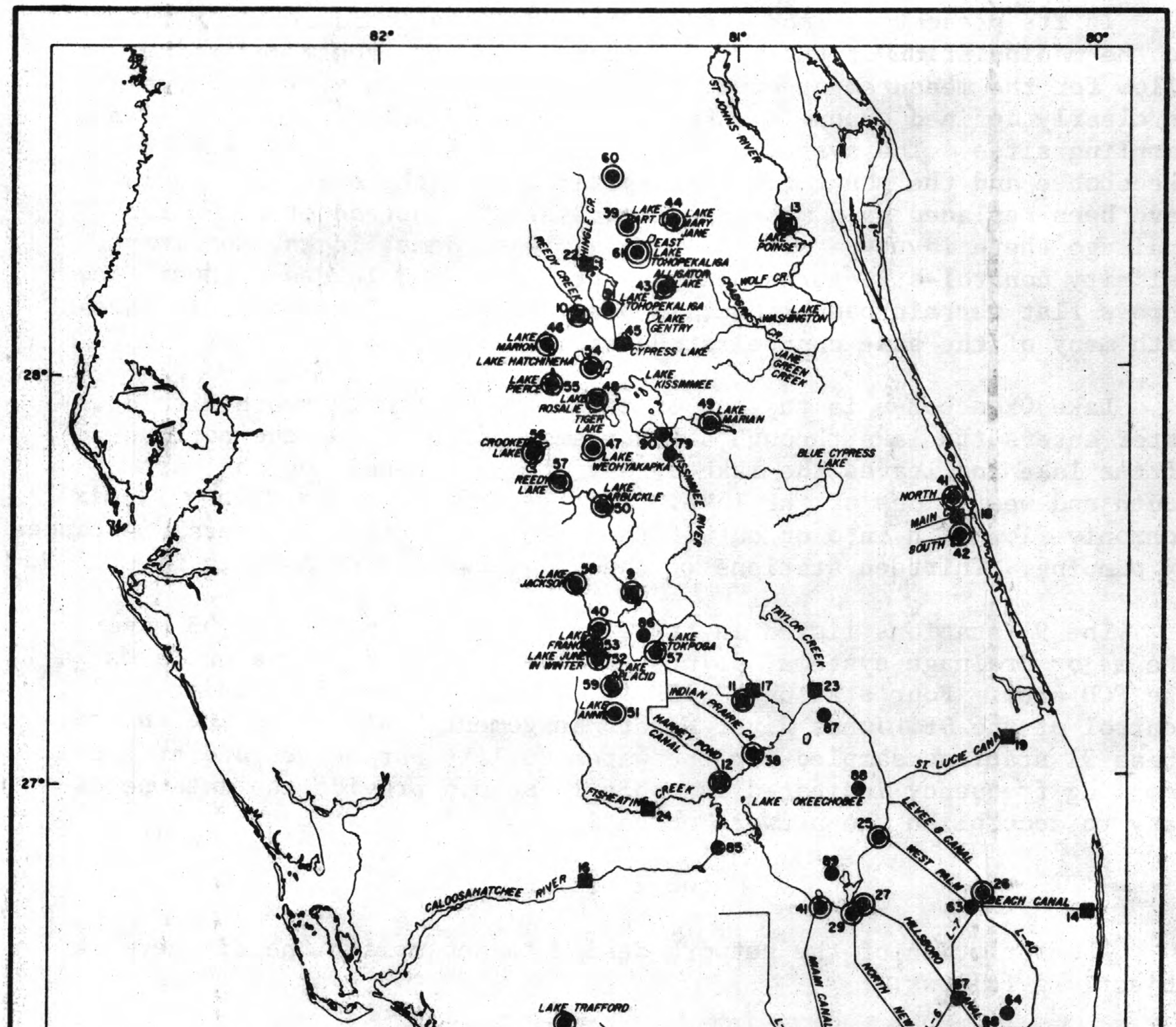


FIGURE 33.- LOCATIONS OF STATIONS FOR PROPOSED WATER-QUALITY-NETWORK PLAN.

Table 14.-- Surface-water quality network plan for the Central and Southern Florida Flood Control District.

Map number	Station number	Station name and location	Average annual discharge ft^3/s)		Water quality variable	Minimum sampling frequency
1. Water-quality accounting stations						
					Streamflow	Daily
(USGS-FCD cooperative network stations)						
1	02285000	North New River Canal at Ft. Lauderdale[1]	475[2]	(162)[3]	Nitrogen & phosphprus	Monthly
2	02288800	Tamiami Canal (Br. 84) Monroe	400	(313)	species, organic carbon,	
		to Carnestown			specific conductance, pH,	
3	02288900	Tamiami Canal (Br 105) 40 Mile Bend to Monroe	278	(197)	turbidity, water color,	
4	02290700	Snapper Creek at S-22	245	(218)	transparency, suspended	
5	02290710	Black Creek Canal at S-21	-	(136)	sediment, dissolved	
6	02290725	Mowrey Canal at S-20F near Homestead	-	(210)	oxygen & temperature	
7	02291143	Fahka Union Canal nr. Copeland	-	(244)	profiles, phytoplankton	
8	02291300	Golden Gate Canal nr. Naples[1]	336	(330)	species and number	
9	02270500	Arbuckle Creek nr. DeSoto City	357	(189)	Periphyton (biomass and	Quarterly
10	02266500	Reedy Creek nr. Loughman	81	(38)	chlorophyll content)	
11	02273300	Canal 41 at S-84 nr. Okeechobee	213	(165)	Major chemical Constituents	
12	02257800	Harney Pond Canal at S-71	199	(99)	(Ca, Mg, Na, K, Cl, SO_4,	
13	02232400	St. Johns River nr. Cocoa[4]	1,105	(576)	alkalinity, Sr, F, Hardness,	
					dissolved solids), Trace	
	(Stations Funded by USGS National Stream				Metals (As, Cd, Cu, Cr, Co,	
	Quality Accounting Network)				Fe, Pb, Mn, Ni, Hg, Zn)	
14	02279000	West Palm Beach Canal at West Palm Beach[5]	826	(501)	Bottom sediment Analysis	Annually
15	02288600	Miami Canal at N.W. 36th Street[5]	338	(239)	for: Carbon, nitrogen,	
16	02292900	Caloosahatchee Canal at S-79 nr. Olga	1,794	(385)	phosphorus, Trace Metals,	
17	02273000	Kissimmee River at S-65E[5,6]	1,418	(589)	pesticides, particle size	
18	02253000	Main Canal at Vero Beach[5]	80	(72)	volatile solids, percent	
					moisture, chemical oxygen	
					demand)	
	(Stations sampled by Florida Department of				Streamflow	Daily
	of Environemntal Regulation)					
19	02277000	St. Lucie Canal at Lock nr. Stuart	1,198	(20)	Nitrogen & phosphorus	Monthly
20	02281500	Hillsboto Canal nr. Deerfield Ceach	350	(177)	species, organic carbon,	
21	02289040	Tamiami Canal (S-12C) L-67A to 40 mi. Bend	363	(437)	specific conductance, pH,	
22	02264495	Shingle Creek nr. Campbell	94	(98)	turbidity, water color,	
23	02275500	Taylor Creek nr. Okeechobee	108	(50)	transparency, suspended	
24	02256500	Fisheating Creek at Palmdale	263	(116)	sediment, dissolved	
					oxygen & temperature	
					profiles, phytoplankton	
					species and number	
					Periphyton (biomass and	Quarterly
					chlorophyll and content)	
					Major chemical Constituents	
					(Ca, Mg, Na, K, Cl, SO_4,	
					alkalinity, Dr, F, Hardness,	
					dissolved solids), Trace	
					Metals (As, Cd, Cu, Cr, Co,	
					Fe, Pb, Mn, Ni, Hg, Zn)	

					Bottom Sediment Analysis for: Carbon, Nitrogen phophorus, Trace Metals, pesticides, particle size, volatile solids, percent moisture, chemical oxygen demand	Annually

2. Areal assessment stations; streams, canals, and lakes

(USGS - FCD cooperative network stations)

25	02278000	West Palm Beach Canal at HGS-5	170	(114)	Discharge	At time of
26	02278500	Levee 8 Canal nr. Loxahatchee	205	(-16)		sampling
27	02280500	Hillsboro Canal below HGS-4	-47	(-60)	Specific Conductance, DO	
28	02281300	Hillsboro Canal at S-39	-	-	and temperature profiles,	Bimonthly
29	02283500	North New River Canal below HGS-4	55	(-109)	water color, turbidity	
30	02284700	North New River Canal at S-34	-	-	organic carbon, nitrogen	
31	02286400	Miami Canal at HGS-3 at Lake Harbor	-26	(-58)	and phosphorus species,	
32	02286340	Biscayne Canal at S-28 near Miami	123	(90)	transparency	
33	02286350	Little River Canal at S-27 at Hialeah	-	-		
34	02290769	Canal 111 above S-18C near Florida City	143	(112)	Major Constituents	Annually
35	02289500	Tamiami Canal nr. Everglades	105	(112)		
36	02291000	Barron River Canal nr. Everglades	105	(102)		
37	02273200	Canal 41 at S-68 at Lake Istokpoga	306	(199)		
38	02259200	Indian Prairie Canal at S-72	51	(24)		
39	02262900	Boggy Creek nr. Taft	50	(29)		
40	02271500	Josephine Creek nr. DeSoto City	93	(39)		
41	02252500	North Canal nr. Vero Beach	31	(29)		
42	02253500	South Canal nr. Vero Beach	41	(43)		
			Surface Area (mi^2)			
43	02260800	Alligator Lake nr. Ashton	5.31		Stage	Each visit
44	02261900	Lake Mary Jane nr. Narcoossee	1.81			
45	02266600	Cypress Lake nr. St. Cloud	6.38		Specific cpnductance, DO	Three times
46	02266650	Lake Marion nr. Haines City	4.64		and temperature profiles,	per year
47	02268400	Lake Weokyokapka at Indian Lake Est.	11.8		water color, turbidity	
48	02268600	Lake Rosalie nr. Lake Wales	7.18		transparency, nitrogen and	
49	02268800	Lake Marion nr. Kennansville	8.95		phosphorus species, organic	
50	02269600	Lake Arbuckle nr. Avon Park	5.92		carbon, phytoplankton	
51	02270700	Lake Annie nr. Lake Placid	0.13		number and species	
52	02270900	Lake June-In-Winter nr. Lake Placid	5.72			
53	02271200	Lake Francis nr. Lake Placid	0.83		Major Constituents	Annually
54	02267400	Lake Hatchineha nr. Lake Wales	10.4			
55	02266900	Lake Pierce nr. Waverly	5.84			
56	02269200	Crooked Lake nr. Babson Park	8.65			
57	02269400	Reedy Creek nr. Frostproof	5.40			
58	02270550	Lake Jackson at Sebring	5.07			
59	02270750	Lake Placid nr. Lake Placid	5.28			
60	02262800	Lake Conway at Pine Castle	1.69			
61	02263400	East Lake Tohopekaliga	18.7			
62	02291200	Lake Trafford nr. Immokalee	2.31			

2. Areal assessment stations streams, canals, and lakes--Continued

	(Stations in USGS-Corps of Engineers network)					
63	02278450	West Palm Beach Canal above S5-A	459	(290)	Specific conductance, DO	Bimonthly
64	02281295	Everglades Sta. 1-15 in Cons. Area 1	-	-	and temperature profiles,	
65	262000080320500	North New River Ca. above S-7	-	-	turbidity, organic carbon,	
66	02284501	North New River Ca. below S-11C	-	-	nitrogen and phosphorus	
67	02281200	Hillsboro Canal at S-6	-	-	species	
68	262400080230000	Hillsboro Canal above S-10	-	-		
69	261550080251000	Everglades Sta. 2-17 Cons. Area 2	-	-	Major Constituents	Annually
70	02285400	South New River Canal at S-9	-	-		
71	02286700	Miami Canal at S-8	-	-		
72	260850080381000	Miami Canal at Alligator Alley	-	-		
73	261057080442600	Everglades Sta. 3-2 Cons. Area 3	-	-		
74	02289043	Everglades Sta. 3-28 Cons. Area 3	-	-		
75	254542080493000	Tamiami Canal above S12A	-	-		
76	02289060	Tamiami Canal L30 to L67A	266	(48)		
	(Stations in USGS-EPA Network)					
77	02286181	Snake Creek Canal below S-30	-	-		
78	02286300	Snake Creek Canal at S-29	411	(411)	Same as above	Biweekly
79	02268904	Kissimmee River below S-65	1,124	(170)		
	(Stations in USGS-Broward County Network)					
80	02286100	South New River Canal At S-13	202	(112)	Same as above	Quarterly
81	02282000	Pompano Canal at Pompano Beach	-	-		
82	02282700	Middle River Canal at S-36	25	(34)		
83	02283200	Plantation Canal at S-33	24	(27)		
	(Stations Sampled by Florida Department of Environmental Regulation)					
84	02287395	Miami Canal East of Levee 30	279	(219)	Specific conductance, DO	Monthly
85	02292000	Caloosahatchee Canal at Moore Haven	1,055	(136)	and temperature profiles,	
86	02271700	Lake Istokpoga (Southern Sector)	43[7]		turbidity, organic carbon,	
87	02276409	Lake Okeechobee below Taylor Creek	5,650[7]		nitrogen and phosphorus	
88	02276412	Lake Okeechobee W. of St. Lucie Canal	5,650[7]		species	
89	02276401	Lake Okeechobee N of Lake Harbor	5,650[7]			
90	02268900	Lake Kissimmee nr. Lake Wales	54.2		Major Constituents	Monthly
91	02264900	Lake Tohopekaliga at Outlet	29.4			

3. Monitoring for long-term trends

(USGS-FCD Cooperative Network)

This group of stations includes stations 1-91 listed in this appendix plus all additional stations in the FCD area where streamflow or stage are measured on a repetitive basis.	Specific conductance and temperature	Each visit to station

4. Reconnaissance sampling for toxic and deleterious substances				
(USGS-FCD Cooperative Network)				
--	--	Stations to be sampled will be selected on a year to year basis after discussions with FCD and after substances to be sampled for have been determined.	Determined on a year-to year basis (will include substances such as trace metals, organics, pesticides, bacteria, etc.	Once each 2-5 years
5. Collection of morphological and limnological data				
(USGS-FCD cooperative network)				
		Lakes to be sampled each year will be determined on a year-to-year basis after discussions with FCD	Surface and drainage area, volume, bottom contours, type of drainage, geologic setting, basin characteristics chemical composition and nutrient concentrations, transparency, sediment type and composition, degree of stratification, phytoplankton species and number, abundance of littoral vegetation.	One time only (Survey to be conducted late summer
6. Bulk precipitation				
(Proposed USGS-FCD Station)				
15	--	Miami area (NW 36th St.)	Total nitrogen and phosphorus, pesticides, major constituents	Continuous collection, composited monthly, analyzed quarterly
79	--	Kissimmee Basin (S-65)		
16	--	West Coast (S-79)		
(Corps of Engineers Stations)				
70	--	South New River Canal at S-9	Total nitrofen and phosphorus	Continuous collection composited and analyzed bimonthly
69	--	Corps of Engineers gage 3-2		
71	--	Tamiami Canal above S12A		
59	--	West Palm Beach Canal above S-5A		
(Dept. of Transportation Stations)				
LH	--	Lake Hope at Maitland	Total nitrogen and phosphorus major constituents, trace metals	Continuous collection, composited weekly analyzed 3 times per year

1 Partly funded by USGS programs in cooperation with other agencies.
2 Average discharge for period of record.
3 Average discharge for 1972 water year.
4 Partly funded by USGS-FCD upper St. Johns network.
5 Specific conductance and temperature measued daily or continuously.
6 Partly funded by USGS-FCD cooperative program.
7 Square miles.
8 USGS station numbers are given for stations sampled by Department of Environmental Regulation.

2. Areal assessment - Stations 25 through 91, sampled for the variables indicated and at the frequencies shown in table 14 and in conjunction with the water-quality accounting stations, should provide the data to accomplish this second objective. Of these 67 stations, 41 are on streams and canals and 26 on lakes. Of the 67 stations, it is proposed that 18 stream stations (map numbers 25-42) and 20 lake stations (Map numbers 43-62) be sampled under the USGS-FCD cooperative program or by FCD. The remaining 23 stream sites and six lake sites are sampled under the USGS cooperative programs with other agencies or by the Florida Department of Environmental Regulation.

3. Long-term-trends - In addition to the 91 stations listed in table 14, all other stations (approximately 110) in the FCD area where streamflow or stage records are being obtained by the USGS on a repetitive basis, will be sampled for specific conductance each time the stations are visited. This would be at least once every 2 months. The specific conductance data from these stations, in conjunction with the more comprehensive data collected at the water-quality accounting and areal assessment stations, should be adequate to determine gross long-term trends in major inorganic chemical quality for any gaged stream, canal or lake in the FCD area.

4. Reconnaissance sampling for toxic and deleterious substances - A broad, areal reconnaissance would be conducted annually to identify problems relating to one or more groups of potentially toxic or deleterious substances. Each year the reconnaissance would focus on a different group of substances so that sampling for a specific group would not be repeated for 3 to 5 years unless a problem was recognized. The actual sampling and type of analyses to be performed each year would be determined on a year-to-year basis and could be conducted by the FCD, the USGS, or jointly. A suggested schedule is as follows:

Fiscal Year	Group of Substances
1976	Trace metals, carbon, nitrogen and phosphorus in bottom sediment
1977	New insecticides used in the area (bottom sediment only)
1978	Insecticides in fish

Sampling stations would be selected to provide broad areal coverage of the major streams, canals and lakes and areas of different land use and development.

5. Develop base of morphological and limnological data on lakes - This is a long-range objective. A few lakes would be surveyed each year to obtain the following general information:

- Surface area
- Drainage area
- Bottom contours
- Length of shoreline
- Volume
- Geologic setting
- Hydrologic characteristics
  - Water-level fluctuation
  - Stage duration
- Drainage-basin characterictics
  - Type of drainage
    - Closed basin
    - in-stream
    - inflow tributaries only
    - outflow tributaries only
  - Land use
  - Soil type
- Chemical and physical characteristics
  - Transparency
  - Nutrient concentrations
  - Chemical composition of water
- Sediment type and composition
  - Nutrient concentration
  - Amount of organic matter
  - Pesticide concentrations
- Degree of chemical and thermal stratification
- Biological characteristics
  - Algae, species and number
  - Type and abundance of littoral vegetation

Lakes to be surveyed each year would be selected on the basis of present or planned developments and land use changes in the lake drainage basin. This objective could be best accomplished as a joint effort between the USGS and FCD.

6. Loads and chemical composition of bulk precipitation - This is a long-range objective to develop a better understanding of the chemical composition and loads of materials derived from rainfall and dry fallout. Four bulk precipitation stations are presently (1975) being sampled as part of the USGS cooperative program with the Corps of Engineers in the Everglades, and one station is being sampled in central Florida in cooperation with the Florida Department of Transportation. Three additional sampling stations are suggested to provide broad areal coverage. Station locations and variables to be measured are given in table 14.

DATA ANALYSIS AND NETWORK EVALUATION

To insure that the objectives of the network are being met, a plan for data analysis and network evaluation would have to be established and carried out. Analysis of the data would also be necessary to convert the raw data into usable water-quality information. To accomplish this, all data collected as part of the water-quality network would be stored in computerized data systems for immediate access and analysis. All data collected by the USGS are stored in WATSTORE, the Survey's national water data system; data collected by FCD could also be stored in this system as well as in that agency's data system. Data collected by the Florida Department of Environmental Regulation are routinely stored in the STORET system maintained by the Environmental Protection Agency.

Data stored in these computer systems should be reviewed on a quarterly or more frequent basis for completeness, accuracy, and general quality control. At least once each year all data should be analyzed and evaluated in terms of the network objectives. Many of the data analysis techniques used in previous sections of this report would be applicable. For the water-quality accounting stations data analysis would include as a minimum, statistical summaries of the data, graphic displays, including X-Y plots and time series plots, regression analysis and computations of annual loads for the major constituents, nitrogen, phosphorus, carbon and suspended sediment. As the data base at these stations increases, the data would also be examined for long-term trends in concentrations and loads. Areal comparisons between accounting stations would be made to look for differences in concentrations, chemical composition of water and bottom sediment, and productivity based on the phytoplankton and periphyton data. Significant differences might then be related to certain basin or drainage system characteristics.

A similar but less rigorous analysis of data from the areal assessment stations would be made. Statistical summaries would be prepared and the data analyzed in such a way as to portray areal differences. Areal portrayals might be based on mean values or data collected during a particular time of the year such as the wet season or the dry season. Maps generated from a computer terminal line printer would probably be adequate for this purpose. After 2 or 3 years of records have been accumulated, data collected from the areal assessment and accounting stations should be critically analyzed for areal patterns in water quality and, if possible, to demonstrate how water quality is affected by land use, water regulation, and general basin (or drainage system) characteristics.

Collection of data to detect gross long-term trends is an implied long-range objective. The data collected for this objective (chiefly specific conductance) would be examined at least annually to insure that the data are being stored in computer files for all streamflow and lake stations. Statistical summaries giving the maximum, minimum and mean values would be prepared each year. These data, used in conjunction with data from the accounting and areal assessment stations, would be analyzed at 3- to 5- year intervals to determine gross long-term trends in water quality.

The approach, location of sampling stations and types of data required to accomplish objective 4 and objective 5 may vary from year to year and a data analysis plan will not be presented here. However, data collected for these two purposes would be analyzed each year. Map-type reports would probably be the most useful way of depicting information obtained from the lakes (objective 5).

Data collected from the bulk precipitation stations would be summarized each year and seasonal and annual loads of nitrogen, phosphorus and major chemical constituents derived from the atmosphere would be computed.

Data collected from all segments of the network would be evaluated at least once each year to insure that the network design is adequate to accomplish the six objectives. This would permit adjustments to be made in station locations, sampling frequency, and variables measured, as necessary. Keeping the network flexible would allow modifications to be made if objectives change or if new objectives are defined.

NETWORK IMPLEMENTATION

Most of the water-quality network suggested in previous sections of this report were implemented in October 1975 by the USGS in cooperation with FCD and other agencies, by the USGS as part of the NASQAN network, or through networks operated by the FCD, Florida Department of Environmental Regulation, and the U.S. Army Corps of Engineers. Table 15 summarizes the stations that were implemented and the agency that is collecting the data. This network may be changed from year to year as a result of the annual evaluations or changes in network objectives.

TABLE 15.--Water quality network stations implemented in October 1975.

Network objective and agency collecting data	Site number (Refer to table 13.)
1. Water quality accounting stations	
USGS (cooperative network)	1-6, 13
USGS (NASQAN network)	14-18
FCD	7-12
Dept. of Environmental Regulation	19-24
2. Areal assessment stations	
FCD	25-31, 36-40
USGS (cooperative network)	32-35, 41-62, 79-83
U.S. Army Corps of Engineers	63, 65-68, 76-22, 75-76
Dept. of Environmental Regulation	84-91
3. Stations for gross long term trends	
USGS	All stations where discharge and or stage data are collected on a repetitive basis.
4. Reconnaissance sampling for toxic and deleterious substances	
USGS	Approximately 40 sites sampled for trace metals, nitrogen, phosphorus and organic carbon in 1976 fiscal year.
5. Collection of morphological and limnological data	
USGS	Cypress Lake (Site no. 45)
FCD	Assistance with biological data collection.

SELECTED REFERENCES

Blakey, J. F., Hawkinson, R. O., and Steele, T. D., 1972, An evaluation of water quality records for Texas streams: U.S. Geol. Survey open-file rept., 54 p.

Gilroy, E. J., and Steele, T. D., 1972, An analysis of sampling frequency alternatives for fitting a daily stream temperature model: Proc. Systems, Tuscon, Arizona, Dec. 1972, pp. 594-608.

Joyner, Boyd F., 1974, Chemical and biological conditions of Lake Okeechobee Florida, 1969-72: Florida Dept. of Nat. Resources, Bur. of Geology Rept. of Inv. 71, 94 p.

Klein, Howard, Armbruster, J. T., McPherson, B. F., and Freiberger, H. J., 1975, Water and the south Florida environment: U.S. Geol. Survey Water-Resources Inv. 24-75, 165 p.

Lichtenberg, J. J., Eichelberger, J. W., Dressman, R. C., and Longbottom, J. E., 1970, Pesticides in surface water of the Unites States - a 5-year summary, 1964-68: Pesticides Monitoring Jour., v. 4(2): p. 71-86.

Mc Kay, D., and Wolkoff, A. W., 1973, Rate of evaporation of low solubility contaminants from water bodies to the atmosphere: Environ. Sci. Technology, v. 7(7): p. 611-614.

Mattraw, Harold, C., Jr., 1975, Occurrence of Chlorinated hydrocarbon insecticides in southern Florida 1968-72: Pesticides Monitoring Jour., v. 9, No. 2, p. 106-114, Sept. 1975.

National Academy of Sciences, National Academy of Engineering, 1973; Water Quality Criteria 1972, A report of the committee of water quality criteria: U.S. Environmental Protection Agency rept., EPA-R3-73-033, 594 p.

Parker, G. G., Ferguson, G. E., and Love, S. K., 1955, Water resources of southeastern Florida with special reference to the geology and groundwater of the Miami area: U.S. Geol. Survey Water-Supply Paper 1255, p.

Sower, Fred B., Eicher, Ralph N., and Selner, Gary I., 1971, the STATPAC system: U.S. Geol. Survey Computer Contribution No. 11, 36 p.

Slack, L. J., and Kaufman, M. I., 1973, The specific conductance of water in Florida streams and canals: Fla. Bur. of Geol. Map Ser. 58.

Steele, Timothy Doak, 1970, Beneficial use and pitfalls of historical water quality data: Proc. National Symposium on Data and Instrumentation for Water-quality Management, Conference of State Sanitary Engrs., Madison, Wis., July 21-23, 1970, pp. 346-363.

____________________, 1972, A study of the chemical quality of streamflow in Arkansas: U.S. Geol. Survey open-file rept., 40 p.

____________________, 1972, The SYSLAB system for data analysis of historical water-quality records (Basin Programs): U.S. Geol. Survey Computer Contribution No. 19, October 1972, 155 p. Available only from U.S. Dept. Commerce, Natl. Tech. Inf. Service, Springfield, Va. 22151 as report PB-222 777.

____________________, 1974, Harmonic analysis of stream temperatures: Reston, Va.: U.S. Geol. Survey Computer Contribution, December 1974, 246 p. Available only from U.S. Dept, Commerce, Natl. Tech. Inf. Service, Springfield, Va. 22151 as report PB 239 012/AS

Steele, Timothy Doak, Gilroy, Edward, J., and Hawkinson, R. O., 1974, An assessment of areal and temporal variations in streamflow quality using selected data from the National Stream Quality Accounting Network: U.S. Geol. Survey open-file rept. 74-217, 210 p.

Waller, Bradley, G., 1975, Distribution of nitrogen and phosphorus in the conservation areas in south Florida from July 1972 to June 1973: U.S. Geol. Survey Water-Resources Inv. Report 5-75, 33 p.

Ward, J. C., 1963, Annual variation of stream water temperature: Am. Soc. Civ. Engr., Jour. San. Engr. Div. v. 89, no. SA6, pp. 1-16.

Wiersma, G. B., Tai, H., and Sand, P. F., 1972, Pesticide residue levels in soils, FY-1969 - National Soils Monitoring Program: Pesticides Monitoring Jour., c. 6(3): p. 194-228.

TABLE 1--EXISTING WATER QUALITY MONITORING NETWORKS IN THE CENTRAL AND SOUTHERN FLORIDA FLOOD CONTROL DISTRICT

(Footnotes are at end of table.)

I USGS-FCD Hydrologic Records Water Quality Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
		(Lake Okeechobee and South Florida)	
1	02277000	St. Lucie Canal at Lock	DAILY : Specific conductance temperature
2	02278000	West Palm Beach Canal at HGS-5	
3	02280500	Hillsboro Canal below HGS-4	
4	02283500	North New River Canal below HGS-4	BIMONTHLY : Nitrogen and phosphorus species
5	02285000	North New River Canal at Ft. Lauderdale	
6	02286400	Miami Canal at HGS-3	
7	02292000	Caloosahatchee Canal at Moore Haven	SEMIANNUALLY: Major constituents (calcium, magnesium, sodium, potassium, bicarbonate, chloride, sulfate, fluoride, dissolved solids, hardness, silica)
8	02256500	Fisheating Creek at Palmdale	
9	02274000	Taylor Creek nr. Bassinger	
10	02274500	Taylor Creek above Okeechobee	
		(Kissimmee Basin)	
11	02273000	Kissimmee River at S-65E	Trace metals (aluminum, arsenic, cadmium, copper, iron, lead, manganese, mercury, nickel, strontium, zinc)
12	02232400	St. Johns River nr. Cocoa	Total organic carbon BOD, DO, pH Pesticides
		(Lake Okeechobee and South Florida)	
13	02283100	Hillsboro Canal at S-39	BIMONTHLY : Nitrogen and phosphorus species, specific conductance, DO
14	02284520	Diversion from Cons. Area 2 to Cons. Area 3 at S-11A	
15	02287105	Miami Canal at S-31	QUARTERLY : Major constituents trace metals
16	02289040	Tamiami Canal Outlets at S-12 L67A to 40 mile Bend	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Cont'd.

I USGS-FCD Hydrologic Records Water Quality Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
		(Lake Okeechobee and South Florida)	
17	02278400	West Palm Beach Canal above S-5A	BIMONTHLY : Nitrogen and phosphorus species, specific conductance, DO SEMIANNUALLY: Major constituents
18	02278550	Levee 8 Canal at West Palm Beach Canal	
19	02286340	Biscayne Canal at S-28	
20	02290700	Snapper Creek Canal at S-22	
21	02290710	Black Creek Canal at S-21	
22	02257800	Harney Pond Canal (C-41) at S-71	
23	02259200	Indian Prairie Canal (C-40) at S-72	
		(Kissimmee River)	
24	02260800	Alligator Lake nr. Ashton	BIMONTHLY : Nitrogen and phosphorus species, specific conductance, DO SEMIANNUALLY: Major constituents
25	02261900	Lake Mary Jane nr. Narcoossee	
26	02266600	Cypress Lake nr. St. Cloud	
27	02266650	Lake Marion nr. Haines City	
28	02268400	Lake Weohyakapka at I. L. Estates	
29	02268600	Lake Rosalie nr. Lake Wales	
30	02268800	Lake Marian nr. Kenansville	
31	02269600	Lake Arbuckle nr. Avon Park	
32	02270700	Lake Annie nr. Lake Placid	
33	02270900	Lake June-in-Winter nr. Lake Placid	
34	02271200	Lake Francis nr. Lake Placid	
35	02268904	Kissimmee River at S-65	
36	02270500	Arbuckle Creek nr. Desoto City	
37	02273200	Canal 41 at S-68 at Lake Istokpoga	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

I USGS-FCD Hydrologic Records Water Quality Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
		(St. Johns and Indian River)	
38	02251800	Indian River at Wabasso	BIMONTHLY : Nitrogen and phosphorus species, specific conductance, DO
39	02252500	North Canal nr. Vero Beach	SEMIANNUALLY: Major constituents
40	02253000	Main Canal at Vero Beach	
41	02253500	South Canal nr. Vero Beach	

II USGS-FCD Upper St. Johns Monitoring Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
		(St. Johns and Indian River)	
42	02231350[1]	St. Johns Headwaters at Hwy 60	BIMONTHLY : DO and temperature profile, pH, alkalinity, specific conductance, color, nitrogen & phosphorus species, BOD, organic carbon, silica, secchi disc transparency
43	274340080453500[2]	Blue Cypress Lake Site 1	phytoplankton (sites with footnote 2/
44	02231600[1,2]	Jane Green Creek nr. Deer Park	SEMIANNUALLY: Major Trace metals (As, Cd, Cu, Fe, Pb, Mn, Hg, Sr, Zn)
45	02232000[1,2]	St. Johns River nr. Melbourne	ANNUALLY : Pesticides in bottom sediment (Sites with footnote[1]
46	02232200	Wolf Creek nr. Deer Park	
47	282020080561500[1,2]	Taylor Creek Impoundment Site I (top & bottom)	
48	282040080571000[2]	Taylor Creek Impoundment Site 3	
49	282025080560100	Taylor Creek below S-164	
12	02232400[1,2]	St. Johns River nr. Cocoa (Hwy. 520) 3/	
50	02233500[2]	Econlockhatchee River nr. Chuluota	
51	02234000[1,2]	St. Johns River nr. Geneva (Hwy. 46)	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

II USGS-FCD Upper St. Johns Monitoring Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
		(St. Johns and Indian River)	
52	274350080462000	Blue Cypress Lake Site 2	BIMONTHLY : DO and temperature profiles, specific conductance
53	282035080564500	Taylor Creek Impoundment Site 2	

III USGS-Corps of Engineers Water Quality Monitoring Program in the Everglades (1975 Fiscal Year)

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
54	261945080530000	Levee 4 Canal, 7 miles west of S-8	BIMONTHLY : Nitrogen and phosphorus species, organic carbon specific conductance, DO SEMIANNUALLY: Major constituents Trace metals; pesticides, carbon, nitrogen, phosphorus and trace metals in bottom sediment.
55	02286700	Miami Canal at S-8	
56	02284501	No. New River Canal below S-11C	
57	02285400	South New River Canal at S-9	
58	261240080494001	Levee 28 Borrow Canal below S-140	
59	260945080533000	Levee 28 Interceptor Canal 0.5 miles below SR 84	
60	260850080381000	Miami Canal at Alligator Alley	
61	261057080442600	Corps of Engr. Gage 3-2, Cons. Area 3	
62	255600080484500	Levee 28 Canal at south end 12 mi. north of US 41	
63	02289043	Everglades Station 3-28 in Cons. Area 3	
64	254542080493000	Tamiami Canal above S-12A	
16	02289040	Tamiami Canal outlets Levee 67A to 40 mile Bend[3]	
65	254620080395000	Levee 67A, 0.5 miles north of Tamiami Canal	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

III USGS-Corps of Engineers Water Quality Monitoring Program in the Everglades (1975 Fiscal Year)

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
66	02289060	Tamiami Canal Outlets L30 to L67A	BIMONTHLY : Nitrogen and phosphorus species, organic carbon specific conductance, DO SEMIANNUALLY: Major constituents Trace metals; pesticides, carbon, nitrogen, phosphorus and trace metals in bottom sediment.
17	02278450	West Palm Beach Canal above S-5A	
67	264100080210000	West Palm Beach Canal 1. mi. east of S-5AE	
68	02281200	Hillsboro Canal at S-6	
69	262000080320500	No. New River Canal above S-7	
70	262400080230000	Hillsboro Canal above S-10	
71	02281295	Everglades Station 1-15 Cons. Area 1	
72	261650080251000	Everglades Station 2-17 Cons. Area 2	
73	252500080341500	Levee 31W canal above S-175 nr. Florida City	
74		Cons. Area 3, 2 miles NW of S-12A	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

IV U. S. Geological Survey National Stream Quality Accounting Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
		(St. Johns and Indian River)	
11	02273000	Kissimmee River at S65E[3]	DAILY : Specific conductance, temperature, discharge MONTHLY : Nitrogen and phosphorus species, DO, pH, organic carbon, fecal coliform, fecal strep., suspended sediment, plytoplankton QUARTERLY: Major constituents, dissolved and suspended and total trace metals, periphyton
40	02253000	Main Canal at Vero Beach[3]	
75	02279000	West Palm Beach Ca at West Palm Beach	
76	02288600	Miami Canal at NW 36th St.	
77	02292480	Caloosahatchee Canal at Orotona Lock nr Labelle	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

V National Water Quality Surveillance System (NWQSS) Station Pairs Operated by USGS in Cooperation with the Environmental Protection Agency

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
		(Agricultural Station Pair)	
35	02268904	Kissimmee River below S-65[4]	BIWEEKLY : Specific conductance, DO, temperature, pH, secchi disk, organic carbon, nitrogen and phosphorus species, silica, suspended solids, dissolved solids, oil and grease, chlorophyll a, total iron, fecal coliform, turbidity QUARTERLY: Major constituents, total trace metals
11	02273000	Kissimmee River at S-65E[4]	
		(Urban Station Pair)	
78	02286181	Snake Creek Canal below S-30	
79	02286300	Snake Creek Canal at S-29	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

VI Florida Department of Environmental Regulation's Permanent Stations Network

Map No.	Station Number[5]	Station Name and Location	Type of Data Collected and Frequency of Measurement
45	02232400	St. Johns River nr. Melbourne	MONTHLY : Specific conductance, pH, DO, temperature, organic carbon, nitrogen and phosphorus species; chlorophyll a, b & c; total and fecal coliform, turbidity, trace metals (Cd, Cu, Fe, Pb, Zn) Major constituents (ca, Mg, Na, K, HCO_3, Cl, SO_4, F, total solids), suspended solids, Boron ANNUALLY: Analysis of bottom sediments for nitrogen and phosphorus trace metals (Cd, Cu, Fe, Pb, Zn), Pesticide scan
80	(02268900)	Lake Kissimmee at Fla Hwy #60	
81	(02264495)	Shingle Creek below Kissimmee Airport	
50	02235000	Econlockhatchee River nr. Chuluota	
7	02292000	Coloosahatchee River at Moore Haven	
82	(02292900)	Coloosahatchee River at Hwy 31 nr. Ft. Meyers	
83	---	Arbuckle Creek at Arbuckle Creek Rd.	
8	02256500	Fisheating Creek at US 27 nr. Palmdale	
84	---	Lake Istokpoga, southern section	
85	02275500	Taylor Creek at US 441 nr. Okeechobee	
1	02277000	St. Lucie Canal above Lock nr. Stuart	
86	02281500	Hillsboro Canal above lock on Deerfield Beach	
87	02287395	Miami Canal at US Hwy 27	
88	---	St. Lucie River at mouth of Mud Cove	
16	02289040	Tamiami Canal-USGS station L67A to 40 mile bend	
89	02276409	Lake Okeechobee below Taylor Creek USGS Station 9	
90	02276412	Lake Okeechobee W. of St. Lucie Canal USGS Station 12	
91	02276401	Lake Okeechobee N of Lake Harbor USGS Station 1	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

VII Water Quality Network in the Everglades National Park Operated By USGS in Cooperation with the National Park Service

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
92	02290815	Everglades Station P-33	SEMIANNUALLY: Major Constituents, nitrogen and phosphorus species, trace metals, insecticides and herbicides in water and sediment
93	02290870	Everglades Station P-35	
94	02290828	Everglades Station P-36	
95	02290820	Everglades Station P-38	
96	02290800	Taylor Slough nr. Homestead	
97	02290798	Taylor River nr. Florida City	
98	022908.70	Everglades Station P-34	SEMIANNUALLY: Major Constituents, nitrogen and phosphorus species
99	022908.10	Everglades Station P-37	
100	252405080362500	Alligator Hole nr. Taylor Slough	SEMIANNUALLY: Insecticides and herbicides in water and sediment
101	022907.96	Little Madeira Bay	
102	022908.58	Shark River at Marker 68	
103	254550080403000	Levee 67 Canal at S-12E	

VIII USGS-Broward County Cooperative Water Quality Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
86	02281500	Hillsboro Canal at Deerfield Beach	QUARTERLY : Nitrogen and phosphorus species, BOD, organic carbon, specific conductance, chlorophyll a, phytoplankton, Diel oxygen measurements
104	261349080121700	Pompano Canal at State Rd. 7	
105	02282000	Pompano Canal at S.E. 2nd Ave.	
106	02282100	Cypress Creek Canal at S-37A	
107	02282700	Middle River Canal at S-36	
108	260807080140200	Plantation Canal at N.W. 65th Ave.	
109	02283200	Plantation Canal at S-33	ANNUALLY : Major Constituents, trace metals, insecticides and herbicides in bottom sediments; carbon, nitrogen and COD in bottom sediments
110	260743080103100	North Fork New River at N.W. 6th St.	
111		North Fork New River at Broward Blvd	
112	260702080085800	New River at SW 4th and 7th Ave. Bridge	

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

VIII USGS-Broward County Cooperative Water Quality Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
5	02285000	North New River Canal at Ft. Lauderdale[3]	QUARTERLY : Nitrogen and phosphorus species, BOD, organic carbon, specific conductance, chlorophyll a, phytoplankton, Diel oxygen measurements
113	260514080110800	North New River Canal at S.W. 31st Ave.	
114	02286100	South New River Canal at S-13	
115	260333080084300	Dania Cut-off Canal W of FECRR Bridge nr. Dania	ANNUALLY : Major Constituents, trace metals, insecticides and herbicides in bottom sediments, carbon nitrogen and COD in bottom sediments
116	261034080093500	C-13 Feeder Canal at Ft. Lauderdale	
117	261030080131400	Middle River Canal (C-13) at Lauderhill	
118	02284800	North New River Canal ab. Holloway Lateral	
119	02286150	Hollywood Canal (C-10) at Dania	
120	260031080145300	Davie Road Canal at Hollywood	
121	02286200	Snake Creek Canal at N. W. 67th Ave.	

IX USGS-Collier County Cooperative Water Quality Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
122	261335081352400	Golden Gate Tributary Canal 12 miles E. of Naples	QUARTERLY : Major Constituents, trace metals, nitrogen and phosphorus species
123	261147081470400	Gorden River Canal at Naples	
124	02291280	Gorden River at State Rd. 951	SEMIANNUALLY: Insecticides in water

Table 1.--Existing water quality monitoring networks in the Central and Southern Florida Flood Control District.--Continued.

X USGS-Dade County Cooperative Water Quality Network

Map No.	Station Number	Station Name and Location	Type of Data Collected and Frequency of Measurement
125	255741080154500	Snake Creek Canal at N.W. 37th Ave.	SEMIANNUALLY: Major constituents nitrogen and phosphorus species, insecticides and herbicides in water ANNUALLY : Radiochemical analyses (Sites with footnote[6]
87	02287395	Miami Canal E. of Levee 30[6,7]	
127	02288500	Miami Canal at Hialeah Water Plant	
126	02289500	Tamiami Canal nr. Coral Gables	
76	02288600	Miami Canal at N.W. 36th St.[6]	
128	02290707	Black Creek Canal at St. Rd. 27	
21	02290710	Black Creek Canal at S-21[3]	
129	252353080342200	Levee 31 (W) Canal at St. Rd. 27	

1 Samples of bottom sediment collected annually for analysis of insecticides.
2 Phytoplankton, total cells/ml, 3 co-dominants and percentage of total; samples collected bimonthly.
3 Supplements sampling done under USGS-FCD quality-of-water network in central and southern Florida.
4 Supplements sampling done under USGS-FCD and (or) NASQAN programs
5 USGS station number for DER sampling station. Number in paranthesis is for the USGS station within 1 to 3 miles of the sampling site.
6 Sample collected annually for radiochemical analysis.
7 Sample collected daily for specific conductance and temperature.

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
02232400 St. Johns River near Cocoa (10/53 - 9/60)									
Calcium	276	0.048	4.23	25.17	13.96	0.98	2.75	10.93	6.4 - 78.0
Magnesium	276	0.017	- 0.69	6.43	4.89	0.95	1.50	23.33	0.0 - 28.0
Sodium	270	0.118	- 3.665	46.94	33.45	0.996	2.95	6.28	10.0 - 190.0
Potassium	266	0.003	- 0.094	1.35	1.105	0.86	0.56	41.48	0.0 - 6.0
Bicarbonate	276	0.036	21.79	37.43	11.20	0.91	4.57	12.21	10.0 - 81.0
Chloride	276	0.025	-12.61	96.87	71.78	0.997	5.37	5.54	18.0 - 403.0
Sulfate	266	0.065	- 5.12	22.97	19.39	0.96	5.61	24.42	0.4 - 112.0
D.S. Residue 1/	262	0.619	30.90	296.37	178.19	0.994	19.06	6.43	68.0 - 998.0
D.S. Sum 2/	13	0.500	7.14	179.39	100.03	0.998	6.25	3.48	81.0 - 381.0
Hardness	276	0.189	7.82	89.26	53.60	0.993	6.19	6.93	16.0 - 294.0
Silica	272	-0.002	5.27	4.38	2.74	-0.21	2.68	61.19	0.0 - 16.0
Discharge 3/	263	-0.410	3.78	2.57	0.24	-0.78	0.15		1.97- 3.20
02232400 St. Johns River near Cocoa (5/62 - 10/73)									
Calcium	49	0.041	11.18	53.98	34.15	0.99	5.20	9.63	15.0 - 136.0
Magnesium	49	0.018	0.21	18.71	14.84	0.98	2.70	14.43	3.4 - 56.0
Sodium	48	0.137	-13.02	131.63	113.59	0.99	13.14	9.98	21.0 - 454.0
Potassium	48	0.003	0.64	4.10	3.23	0.83	1.80	43.90	0.6 - 14.0
Bicarbonate	48	0.029	37.43	67.96	28.37	0.84	15.58	22.93	16.0 - 140.0
Chloride	49	0.272	-22.31	261.43	224.84	0.995	22.19	8.49	42.0 - 900.0
Sulfate	49	0.055	2.99	60.42	47.15	0.96	13.22	21.88	6.4 - 160.0
D.S. Residue 1/	40	0.681	0.175	629.48	482.57	0.994	53.43	8.49	168.0 -2320.0
D.S. Sum 2/	44	0.530	11.39	502.09	376.71	0.996	33.71	6.71	114.0 -1600.0
Hardness	49	0.176	30.09	213.35	146.03	0.99	21.15	9.91	52.0 - 570.0
Silica	48	-0.0013	4.97	3.62	2.91	-0.36	2.74	75.69	0.0 - 11.0
Discharge 3/	44	-0.431	4.00	2.93	0.32	-0.78	0.21		1.54- 3.51

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02234000	St. Johns River above Lake Harney near Geneva (5/54 - 5/74)						
Calcium	61	0.033	2.64	49.46	29.13	0.97	7.53	15.22	16.0 - 126.0
Magnesium	61	0.018	- 1.65	24.59	16.02	0.985	2.78	11.31	6.6 - 78.0
Sodium	33	0.148	- 14.79	215.70	144.70	0.996	12.61	5.85	61.0 - 644.0
Potassium	27	0.006	- 1.57	8.22	6.02	0.95	1.95	23.72	2.1 - 24.0
Bicarbonate	59	0.023	18.81	52.03	26.76	0.75	17.87	34.35	12.0 - 132.0
Chloride	61	0.274	- 26.82	365.72	236.86	0.997	19.20	5.25	102.0 -1180.0
Sulfate	61	0.071	- 13.01	88.98	64.80	0.95	21.04	23.65	6.8 - 270.0
D.S. Residue 1/	21	0.692	- 66.51	1058.30	704.16	0.97	167.39	15.82	324.0 -2950.0
D.S. Sum 2/	56	0.559	- 39.42	730.61	450.98	0.997	35.87	4.91	226.0 -1980.0
Hardness	61	0.157	0.48	225.64	136.70	0.99	18.76	8.31	72.0 - 636.0
Silica	59	-0.00035	4.45	3.96	4.00	-0.08	4.02	101.52	0.8 - 30.0
Discharge 3/	18	-0.447	4.37	3.06	0.23	-0.87	0.11		2.66- 3.62
		02252500	North Canal near Vero Beach (5/54 - 4/74)						
Calcium	87	0.047	30.42	60.62	12.53	0.77	8.01	13.21	21.0 - 92.0
Magnesium	87	0.024	- 3.57	12.06	5.52	0.91	2.34	19.40	3.8 - 34.0
Sodium	59	0.107	- 15.55	54.81	27.42	0.94	9.61	17.53	13.0 - 140.0
Potassium	51	0.004	0.64	3.57	2.94	0.37	2.75	77.03	0.6 - 20.0
Bicarbonate	86	0.088	105.10	161.28	30.43	0.59	24.59	15.25	49.0 - 214.0
Chloride	87	0.221	- 42.66	99.37	47.15	0.965	12.47	12.55	24.0 - 285.0
Sulfate	87	0.060	14.41	39.67	14.47	0.85	7.77	19.59	18.0 - 84.0
D.S. Residue 1/	10	0.418	184.30	622.70	116.41	0.87	61.22	9.83	476.0 - 803.0
D.S. Sum 2/	85	0.473	55.86	358.78	110.62	0.89	51.36	14.32	119.0 - 688.0
Hardness	87	0.222	58.95	201.14	48.79	0.93	17.61	8.76	68.0 - 370.0
Silica	85	0.003	8.18	9.87	9.65	0.06	9.70	98.28	5.0 - 94.0
Discharge 3/	79	-0.044	2.84	2.78	0.13	-0.16	0.13		2.33- 3.13

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02253000	Main Canal at Vero Beach	(5/54 - 4/74)				
Calcium	87	0.048	36.47	82.80	18.84	0.80	11.43	13.80	22.0 - 112.0
Magnesium	88	0.026	- 4.92	20.06	8.95	0.90	3.86	19.24	3.8 - 44.0
Sodium	60	0.114	- 20.47	94.12	40.47	0.97	10.41	11.06	12.0 - 192.0
Potassium	52	0.004	2.12	6.48	8.40	0.19	8.33	128.55	0.3 - 50.0
Bicarbonate	87	0.085	114.4	196.36	47.18	0.57	39.13	19.93	22.4 - 264.0
Chloride	88	0.236	- 54.39	174.82	76.73	0.97	19.71	11.27	24.0 - 395.0
Sulfate	88	0.055	13.49	66.44	18.67	0.92	7.45	11.21	17.0 - 108.0
D.S. Residue 1/	10	0.611	12.60	785.50	183.56	0.99	29.75	3.79	486.0 -1070.0
D.S. Sum 2/	84	0.530	29.95	539.17	168.52	0.98	31.26	5.80	118.0 - 965.0
Hardness	88	0.226	69.54	289.21	74.54	0.95	22.52	7.79	71.0 - 421.0
Silica	86	0.005	6.66	11.72	8.87	0.19	8.76	74.74	1.0 - 85.0
Discharge 3/	86	-0.235	3.35	2.95	0.22	-0.46	0.20		1.60- 3.25
			02253500	South Canal near Vero Beach	(5/54 - 10/73)				
Calcium	88	0.049	31.39	65.87	15.67	0.80	9.36	14.21	18.0 - 96.0
Magnesium	88	0.027	- 6.40	12.76	7.49	0.94	2.66	20.85	2.9 - 40.0
Sodium	59	0.116	- 20.72	56.07	31.82	0.985	5.42	9.67	11.0 - 168.0
Potassium	51	0.006	- 0.23	3.68	3.32	0.49	2.92	79.35	0.3 - 20.0
Bicarbonate	87	0.090	112.43	175.07	40.40	0.57	33.37	19.06	40.0 - 234.0
Chloride	87	0.237	- 54.58	111.56	62.26	0.98	13.47	12.07	20.0 - 350.0
Sulfate	88	0.066	- 4.01	42.46	19.78	0.86	10.19	24.00	17.0 - 92.0
D.S. Residue 1/	9	0.706	- 86.27	595.89	198.65	0.994	22.91	3.84	392.0 -1020.0
D.S. Sum 2/	85	0.550	3.91	391.15	142.99	0.995	13.91	3.56	96.0 - 871.0
Hardness	88	0.237	51.61	217.39	63.35	0.96	18.49	8.51	57.0 - 404.0
Silica	86	0.007	4.69	9.30	3.34	0.51	2.89	31.08	3.8 - 21.0
Discharge 3/	85	0.019	2.79	2.82	0.15	0.07	0.15		2.28- 3.19

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02256500	Fisheating Creek near Palmdale			(10/61 - 9/73)		
Calcium	56	0.042	1.31	9.25	7.17	0.78	4.55	49.19	4.0 48.0
Magnesium	56	0.022	0.37	4.44	2.98	0.96	0.84	18.91	1.20- 14.0
Sodium	55	0.110	- 0.63	19.27	13.69	0.98	2.61	13.55	4.0 - 71.0
Potassium	55	0.009	- 0.06	1.57	1.31	0.84	0.72	46.12	0.0 - 5.10
Bicarbonate	54	0.061	7.85	18.94	16.22	0.46	14.51	76.62	8.0 -124.0
Chloride	55	0.239	- 4.83	40.13	32.49	0.97	7.41	18.47	7.0 -148.0
Sulfate	54	0.080	- 5.15	9.26	10.29	0.95	3.26	35.23	0.0 - 37.0
D.S. Residue 1/	39	0.567	33.12	142.59	77.26	0.94	25.64	17.98	41.0 -407.0
D.S. Sum 2/	48	0.533	- 1.06	93.50	66.66	1.0	6.32	6.76	27.0 -315.0
Hardness	56	0.197	4.67	41.63	27.67	0.94	9.68	23.26	16.0 -144.0
Silica	55	-0.003	3.24	2.72	1.42	-0.25	1.39	51.10	0.0 - 5.40
Discharge 3/	47	-0.152	2.41	2.17	0.26	-0.52	0.23		1.73- 2.76
			02257800, 02258000		Harney Pond Canal near Okeechobee			(11/54 - 11/73)	
Calcium	98	0.121	- 2.29	30.67	18.05	0.96	5.14	16.76	- 7.2 - 97.0
Magnesium	98	0.013	1.14	4.76	2.68	0.71	1.90	39.92	0.6 - 13.0
Sodium	73	0.070	- 1.63	16.23	8.10	0.92	3.14	19.35	3.7 - 45.0
Potassium	66	0.003	1.00	1.73	0.95	0.31	0.91	52.60	0.4 - 5.6
Bicarbonate	96	0.357	-23.09	74.51	55.18	0.94	19.12	25.66	13.0 -280.0
Chloride	98	0.124	- 4.48	29.39	18.88	0.94	6.35	21.61	8.5 -118.0
Sulfate	98	0.043	16.77	28.40	17.20	0.35	16.17	56.94	0.5 -129.0
D.S. Residue 1/	41	0.637	7.14	153.20	59.86	0.92	23.62	15.42	39.0 -316.0
D.S. Sum 2/	78	0.549	5.09	163.41	85.07	0.99	11.08	6.78	39.0 -432.0
Hardness	98	0.355	- 0.83	96.27	51.80	0.985	9.13	9.48	23.0 -276.0
Silica	96	0.004	4.19	5.29	4.25	0.14	4.23	79.96	1.1 - 40.0
Discharge 3/	0	-	-	-	-	-	-	-	

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_iK_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
02259200, 02259500 Indian Prairie Canal near Okeechobee (11/54 - 5/74)									
Calcium	96	0.139	- 5.98	36.18	19.57	0.98	4.24	11.72	7.6 - 112.0
Magnesium	96	0.020	0.54	6.73	3.25	0.86	1.65	24.52	1.7 - 18.0
Sodium	67	0.058	- 2.28	16.18	10.03	0.86	5.12	31.64	2.1 - 52.0
Potassium	61	0.0013	1.58	2.00	1.18	0.17	1.17	58.50	0.3 - 6.5
Bicarbonate	91	0.263	-22.64	58.29	49.01	0.74	32.91	56.46	2.0 - 244.0
Chloride	95	0.080	- 0.59	22.69	13.23	0.80	7.97	35.13	3.0 - 71.0
Sulfate	96	0.192	4.55	62.81	38.51	0.69	28.18	44.87	17.0 - 248.0
D.S. Residue 1/	23	0.764	- 2.89	190.65	79.49	0.96	22.13	11.61	66.0 - 382.0
D.S. Sum 2/	90	0.615	- 6.86	185.17	86.02	0.99	11.56	6.24	63.0 - 519.0
Hardness	96	0.429	-12.23	118.34	59.88	0.99	9.20	7.77	37.0 - 346.0
Silica	92	0.0004	5.89	6.02	4.20	0.01	4.22	70.10	0.4 - 35.0
Discharge 3/	3								
02268903 Kissimmee River at S-65 near Lake Wales (12/52 - 7/74)									
Calcium	28	0.085	- 1.39	8.44	2.95	0.75	1.98	23.46	4.6 - 17.0
Magnesium	28	0.019	0.33	2.57	0.71	0.71	0.51	19.84	1.2 - 3.8
Sodium	29	0.079	0.47	9.48	2.38	0.86	1.23	12.97	4.8 - 14.0
Potassium	29	0.011	- 0.27	0.98	0.39	0.73	0.27	27.55	0.3 - 1.7
Bicarbonate	29	0.252	- 5.28	23.48	8.28	0.79	5.16	21.98	14.0 - 48.0
Chloride	28	0.108	3.175	15.60	3.35	0.835	1.88	12.05	9.8 - 22.0
Sulfate	28	0.061	1.96	9.02	2.37	0.67	1.79	19.84	5.3 - 14.0
D.S. Residue 1/	26	0.549	29.95	99.69	17.86	0.88	8.62	8.65	70.0 - 131.0
D.S. Sum 2/	24	0.542	- 1.95	63.58	12.59	0.96	3.68	5.79	44.0 - 98.0
Hardness	29	0.288	- 1.33	31.55	8.24	0.91	3.52	11.16	18.0 - 56.0
Silica	34	0.022	- 0.14	2.54	1.31	0.47	1.18	46.46	0.6 - 5.0
Discharge 3/	17	-0.074	2.22	2.01	0.10	-0.28	0.10		1.80- 2.25

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02272990	Kissimmee River near Okeechobee (9/52 - 9/62)						
Calcium	336	0.080	- 0.31	6.91	4.15	0.84	2.28	33.00	2.4 - 64.0
Magnesium	336	0.021	0.17	2.09	1.35	0.68	0.99	47.37	0.1 - 17.0
Sodium	331	0.067	1.80	7.72	5.99	0.44	5.38	69.69	3.4 - 82.0
Potassium	331	0.011	- 0.24	0.73	0.77	0.57	0.64	87.67	0.0 - 4.6
Bicarbonate	337	0.316	- 8.33	20.22	15.07	0.91	6.30	31.16	0.26-182.0
Chloride	333	0.082	4.85	12.20	4.31	0.80	2.59	21.23	0.2 - 40.0
Sulfate	330	0.115	- 3.21	6.98	5.30	0.86	2.67	38.25	0.2 - 79.0
D.S. Residue 1/	306	0.578	25.11	74.59	17.62	0.86	9.00	12.07	39.0 -136.0
D.S. Sum 2/	323	0.581	- 1.00	50.86	28.58	0.79	17.59	34.60	23.0 -347.0
Hardness	337	0.289	- 0.26	25.85	14.91	0.84	8.11	31.37	12.0 -230.0
Silica	330	0.028	1.24	3.70	2.52	0.44	2.27	61.35	0.30- 22.0
Discharge 3/	72	-0.220	2.62	2.01	0.22	-0.61	0.17		0.76- 2.73
		02272990	Kissimmee River near Okeechobee (10/59 - 9/62)						
Calcium	114	0.078	- 0.27	7.31	6.24	0.81	3.65	49.93	2.4 - 64.0
Magnesium	114	0.024	- 0.29	2.03	2.09	0.74	1.41	69.46	0.5 - 17.0
Sodium	110	0.060	1.86	7.28	3.51	0.97	0.90	12.36	4.2 - 31.0
Potassium	110	0.011	0.04	1.06	1.00	0.64	0.77	72.64	0.0 - 4.6
Bicarbonate	115	0.365	-11.60	23.88	24.61	0.96	6.92	28.97	11.0 -182.0
Chloride	110	0.071	5.02	11.65	5.08	0.86	2.57	22.06	5.5 - 40.0
Sulfate	107	0.142	- 5.43	7.44	8.38	0.975	1.87	25.13	0.4 - 79.0
D.S. Residue 1/	107	0.550	22.71	72.25	33.90	0.93	12.41	17.18	39.0 -347.0
D.S. Sum 2/	0	-	-	-	-	-	-	-	-
Hardness	115	0.293	- 1.75	26.66	23.34	0.81	13.72	51.46	14.0 -230.0
Silica	108	0.031	0.24	3.04	2.50	0.71	1.77	58.22	0.3 - 22.0
Discharge 3/	115	-0.239	2.69	1.93	0.19	-0.76	0.13		1.71- 2.73

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02272500	Kissimmee River near Bassinger (8/62 - 9/67)						
Calcium	78	0.116	- 4.08	9.07	2.65	0.85	1.41	15.55	6.4 - 28.0
Magnesium	77	0.015	0.92	2.62	0.54	0.54	0.46	17.56	1.5 - 4.4
Sodium	79	0.040	4.46	8.99	1.32	0.59	1.07	11.90	5.0 - 12.0
Potassium	79	0.016	- 0.50	1.33	0.96	0.33	0.92	69.17	0.0 - 5.1
Bicarbonate	79	0.300	-11.77	22.10	13.62	0.43	12.39	56.06	8.0 -119.0
Chloride	78	0.066	7.88	15.40	2.04	0.63	1.59	10.32	9.5 - 20.0
Sulfate	78	0.108	- 0.21	12.03	3.09	0.68	2.29	19.04	5.4 - 21.0
D.S. Residue 1/	55	0.680	10.58	89.67	19.52	0.54	16.62	18.54	44.0 -120.0
D.S. Sum 2/	75	0.472	10.60	63.77	15.80	0.58	12.97	20.34	44.0 -161.0
Hardness	79	0.360	- 7.53	33.15	7.91	0.89	3.70	11.16	12.0 - 85.0
Silica	78	0.0016	2.38	2.57	1.97	0.02	1.99	77.43	0.0 - 16.0
Discharge 3/	76	-0.122	2.40	2.05	0.07	-0.53	0.06		1.87- 2.32
		02272990	Kissimmee River near Okeechobee (2/40 - 2/41)						
Calcium	40	0.034	2.82	5.57	0.53	0.69	0.39	7.00	4.4 - 6.4
Magnesium	39	0.013	0.72	1.76	0.32	0.43	0.29	16.48	1.2 - 2.5
Sodium	40	0.112	- 1.31	7.72	1.31	0.91	0.55	7.12	4.6 - 10.0
Potassium	40	0.017	- 0.57	0.79	0.33	0.54	0.28	35.44	0.3 - 2.0
Bicarbonate	40	0.117	4.48	13.92	1.64	0.76	1.08	7.76	10.0 - 16.0
Chloride	40	0.189	- 2.80	12.49	2.22	0.91	0.93	7.45	9.0 - 17.0
Sulfate	40	0.072	0.16	5.98	1.12	0.69	0.83	13.88	3.8 - 8.6
D.S. Residue 1/	40	0.437	36.56	71.82	6.24	0.75	4.21	5.86	60.0 - 82.0
D.S. Sum 2/	40	0.467	5.96	43.70	5.27	0.95	1.72	3.94	34.0 - 54.0
Hardness	40	0.137	10.21	21.27	2.23	0.66	1.71	8.04	17.0 - 26.0
Silica	40	-0.029	4.55	2.18	0.79	-0.40	0.73	33.49	1.2 - 4.7
Discharge 3/	36	-0.332	2.96	1.90	0.06	-0.76	0.04		1.79- 2.00

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District. Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02273000	Kissimmee River at S-65E near Okeechobee	(5/67 - 7/74)					
Calcium	29	0.155	- 8.61	19.95	9.50	0.90	4.19	21.00	9.7 - 45.0
Magnesium	29	0.012	1.06	3.37	0.94	0.74	0.64	18.99	2.2 - 5.9
Sodium	29	0.030	5.78	11.39	2.79	0.60	2.27	19.93	7.2 - 17.0
Potassium	29	0.005	0.35	1.33	0.41	0.72	0.29	21.80	0.5 - 2.4
Bicarbonate	25	0.420	-23.91	56.88	27.43	0.85	14.70	25.84	21.0 -128.0
Chloride	27	0.050	9.11	18.63	4.71	0.59	3.86	20.72	11.0 - 28.0
Sulfate	27	0.089	- 0.79	16.04	5.89	0.84	3.24	20.20	7.2 - 29.0
D.S. Residue 1/	36	0.638	15.10	133.33	34.87	0.95	11.38	8.54	84.0 -220.0
D.S. Sum 2/	26	0.546	0.53	104.89	30.42	0.987	4.95	4.72	55.0 -179.0
Hardness	29	0.431	-15.09	64.55	25.47	0.94	9.01	13.96	30.0 -132.0
Silica	36	0.006	1.98	3.14	1.57	0.21	1.56	49.68	1.1 - 7.3
Discharge 3/	15	-0.118	2.56	2.23	0.13	-0.55	0.12		1.97 - 2.50
		02274000	Taylor Creek near Bassinger	(5/66 - 5/74)					
Calcium	11	0.082	3.05	21.96	10.57	0.77	7.06	32.15	6.6 - 41.0
Magnesium	11	0.027	- 1.87	4.49	3.36	0.82	2.02	44.99	1.6 - 11.0
Sodium	10	0.076	- 0.77	17.67	8.18	0.93	3.24	18.34	6.5 - 31.0
Potassium	10	0.007	1.37	3.06	1.24	0.56	1.09	35.62	1.8 - 6.0
Bicarbonate	9	0.320	- 2.03	79.89	32.97	0.92	13.87	17.36	17.0 -123.0
Chloride	10	0.103	4.55	29.70	10.69	0.95	3.69	12.42	13.0 - 44.0
Sulfate	10	0.093	-10.34	12.31	11.69	0.78	7.79	63.28	0.6 - 37.0
D.S. Residue 1/	10	0.511	36.81	160.60	53.29	0.955	16.73	10.42	86.0 -247.0
D.S. Sum 2/	8	0.571	- 7.35	136.63	59.88	0.99	8.11	5.94	45.0 -214.0
Hardness	11	0.327	- 1.59	74.27	34.06	0.96	9.62	12.95	23.0 -122.0
Silica	10	0.002	2.79	3.23	3.69	0.05	3.91	121.05	0.0 - 12.0
Discharge 3/	4								

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_iK_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District .--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02274500	Taylor Creek above Okeechobee		(1/58 - 9/73)			
Calcium	75	0.041	14.39	60.99	48.08	0.96	12.86	21.09	7.2 - 166.0
Magnesium	75	0.021	- 1.65	22.82	24.53	0.992	3.06	13.41	0.5 - 99.0
Sodium	72	0.143	- 20.52	146.95	165.36	0.994	18.70	12.73	6.0 - 700.0
Potassium	72	0.004	2.17	7.11	8.17	0.59	6.62	93.11	0.1 - 55.0
Bicarbonate	73	0.031	59.91	96.48	58.55	0.62	46.44	48.13	20.0 - 254.0
Chloride	74	0.273	- 41.70	273.64	315.01	0.993	38.44	14.05	10.0 -1350.0
Sulfate	74	0.082	- 4.11	90.37	94.29	0.994	10.72	11.86	1.2 - 328.0
D.S. Residue 1/	25	0.551	50.88	466.08	334.83	0.998	21.28	4.57	102.0 -1250.0
D.S. Sum 2/	72	0.582	- 17.20	651.10	669.61	0.998	41.46	6.37	42.0 -2730.0
Hardness	75	0.190	28.80	246.35	218.27	0.992	28.61	11.61	20.0 - 815.0
Silica	74	0.0001	5.18	5.31	2.95	0.43	2.97	55.93	0.0 - 14.0
Discharge 3/	61	-0.52	3.57	2.85	0.53	-0.85	0.28		-0.15- 3.01
			02277000	St. Lucie Canal at Lock near Stuart			(11/54 - 10/73)		
Calcium	111	0.036	37.11	61.06	18.38	0.76	12.03	19.70	6.6 - 103.0
Magnesium	111	0.018	- 0.44	11.26	7.65	0.89	3.50	31.08	1.2 - 53.0
Sodium	85	0.150	- 37.06	51.69	45.21	0.98	9.44	18.26	10.0 - 280.0
Potassium	77	0.005	- 0.12	3.10	1.85	0.86	0.96	30.97	0.2 - 12.0
Bicarbonate	110	0.101	120.1	185.41	51.87	0.72	36.14	19.49	73.0 - 278.0
Chloride	111	0.255	- 68.69	98.72	98.85	0.985	16.88	17.10	18.0 - 640.0
Sulfate	110	0.039	9.23	34.67	16.25	0.895	7.27	20.97	8.8 - 116.0
D.S. Residue 1/	37	0.574	23.57	430.11	178.77	0.984	32.07	7.46	211.0 - 789.0
D.S. Sum 2/	99	0.549	8.18	347.56	201.60	0.997	14.86	4.28	112.0 -1420.0
Hardness	110	0.168	88.87	197.56	68.18	0.91	28.14	14.24	23.2 - 475.0
Silica	110	0.0035	4.73	6.98	3.34	0.39	3.10	44.41	0.3 - 15.0
Discharge 3/	47	-0.124	2.98	2.71	0.22	-0.71	0.16		2.30- 3.42

1/ Residue on evaporation at 180° Celsius

2/ Sum of dissolved chemical constituents

3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} . Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02278000	West Palm Beach Canal at HGS-5 at Canal Point (7/40 - 9/72)						
Calcium	166	0.054	21.26	51.56	21.91	0.90	9.52	18.46	28.0 - 180.0
Magnesium	166	0.023	1.17	13.97	9.85	0.85	5.26	37.65	3.4 - 57.0
Sodium	115	0.137	-29.73	44.27	45.10	0.97	10.59	23.92	16.0 - 269.0
Potassium	114	0.005	- 0.38	2.44	1.85	0.90	0.80	32.79	0.1 - 10.0
Bicarbonate	167	0.242	45.64	180.43	89.86	0.98	19.09	10.58	94.0 - 606.0
Chloride	167	0.171	-31.21	63.69	63.20	0.98	13.07	20.52	22.0 - 390.0
Sulfate	167	0.085	- 3.01	44.52	33.45	0.93	12.07	28.46	16.0 - 202.0
D.S. Residue 1/	47	0.688	-26.31	447.87	276.71	0.99	37.13	8.29	192.0 -1320.0
D.S. Sum 2/	163	0.553	8.54	316.42	217.22	0.93	78.88	24.93	110.0 -1430.0
Hardness	167	0.230	58.07	186.01	88.98	0.94	31.21	16.78	94.0 - 559.0
Silica	151	0.021	- 1.18	10.20	9.06	0.80	5.43	53.24	0.6 - 56.0
Discharge 3/	50	-0.031	2.72	2.64	0.13	-0.075	0.135		1.65- 3.09
		02278450	West Palm Beach Canal above S-5A near Loxahatchee (10/59 - 10/73)						
Calcium	66	0.049	23.28	67.94	24.38	0.93	9.19	13.53	27.0 - 120.0
Magnesium	66	0.025	- 2.28	20.52	12.18	0.95	3.93	19.15	0.6 - 51.0
Sodium	66	0.144	-28.87	101.58	67.13	0.98	12.68	12.48	15.0 - 256.0
Potassium	66	0.005	- 0.26	4.51	2.71	0.89	1.24	27.49	0.3 - 14.0
Bicarbonate	67	0.234	40.42	253.46	116.18	0.92	46.25	18.25	35.6 - 532.0
Chloride	67	0.191	-34.80	139.22	88.66	0.985	15.54	11.16	23.0 - 355.0
Sulfate	67	0.051	14.01	60.15	40.68	0.57	33.70	56.03	5.2 - 270.0
D.S. Residue 1/	34	0.665	-32.98	610.18	312.85	0.99	37.69	6.18	219.0 -1200.0
D.S. Sum 2/	52	0.623	-29.84	530.56	296.21	0.997	21.79	4.11	114.0 -1220.0
Hardness	67	0.227	44.93	252.14	110.01	0.945	36.32	14.40	68.0 - 510.0
Silica	66	0.019	- 2.41	14.42	9.34	0.91	3.88	26.91	3.2 - 40.0
Discharge 3/	41	0.041	2.77	2.89	0.24	0.09	0.24		0.70- 3.41

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02278550	Levee 8 Canal at West Palm Beach Canal near Loxahatchee (10/60 - 5/70)						
Calcium	38	0.060	21.25	58.28	19.83	0.88	9.40	16.13	8.8 - 104.0
Magnesium	38	0.023	- 2.33	11.64	7.42	0.89	3.42	29.38	0.7 - 35.0
Sodium	37	0.120	- 18.29	54.74	36.07	0.95	10.90	19.91	4.4 - 154.0
Potassium	37	0.004	0.03	2.59	1.34	0.905	0.58	22.39	0.5 - 6.4
Bicarbonate	37	0.238	45.81	190.11	71.58	0.95	22.56	11.87	30.0 - 350.0
Chloride	38	0.187	- 28.77	86.89	56.31	0.97	13.37	15.39	9.0 - 218.0
Sulfate	37	0.049	1.69	32.41	20.02	0.73	13.78	42.52	1.6 - 105.0
D.S. Residue 1/	12	0.525	36.89	444.58	178.36	0.88	90.06	20.26	276.0 - 893.0
D.S. Sum 2/	27	0.574	2.90	330.30	181.46	0.99	29.47	8.92	43.0 - 820.0
Hardness	37	0.238	46.82	194.60	74.05	0.955	22.35	11.49	25.0 - 384.0
Silica	36	0.013	0.18	8.29	4.80	0.81	2.88	34.74	2.4 - 25.0
Discharge 3/	27	-0.573	3.95	2.68	0.25	-0.72	0.18		1.58- 3.18
		02280500	Hillsboro Canal below HGS-4 near South Bay (9/50 - 9/71)						
Calcium	125	.091	3.03	0.45	45.57	.93	16.68	18.65	31.0 - 216.0
Magnesium	125	.028	0.33	26.79	16.00	.81	9.38	35.00	6.4 - 69.0
Sodium	104	.107	17.04	84.92	51.74	.95	15.43	18.16	18.0 - 218.0
Potassium	104	.005	0.27	4.16	0.38	.90	1.04	25.04	0.3 - 12.0
Bicarbonate	126	.317	11.69	313.65	151.56	.97	34.39	10.97	109.0 - 610.0
Chloride	125	.136	15.91	112.95	66.63	.95	20.97	18.57	26.0 - 290.0
Sulfate	125	.113	19.09	88.44	62.48	.85	33.54	37.93	20.0 - 292.0
D.S. Residue 1/	31	0.748	62.45	594.87	322.00	0.995	33.57	5.64	202.0 -1230.0
D.S. Sum 2/	125	.660	47.75	597.10	310.00	.993	37.04	6.93	165.0 -1220.0
Hardness	126	.343	7.05	334.13	165.73	.97	43.58	13.04	108.0 - 691.0
Silica	115	.024	4.34	18.72	12.07	.90	5.38	28.78	0.0 - 63.0
Discharge 3/	15	0.175	3.18	2.75	0.14	-0.29	0.14	-	2.01- 2.97

1/ Residue on evaporation at 180° Celsius

2/ Sum of dissolved chemical constituents

3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} . Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02281200	Hillsboro Canal at S-6 near Shawno			(9/45 - 10/73)		
Calcium	67	0.057	27.04	72.76	17.10	0.87	8.38	11.52	46.0 -108.0
Magnesium	67	0.034	- 4.24	23.60	10.28	0.88	4.82	20.45	9.10 - 44.0
Sodium	66	0.136	-37.63	71.20	36.81	0.96	9.74	13.69	26.0 200.0
Potassium	66	0.005	- 0.65	3.01	1.25	0.96	0.36	11.89	1.20 - 6.70
Bicarbonate	68	0.353	21.76	308.93	102.57	0.91	41.70	13.50	162.0 -520.0
Chloride	68	0.160	-36.77	93.38	44.61	0.95	13.52	14.48	36.0 -250.0
Sulfate	68	0.043	14.28	49.60	21.05	0.55	17.73	35.74	17.0 -122.0
D.S. Residue 1/	63	0.706	-15.24	588.08	193.23	0.96	52.60	9.43	286.0 -863.0
D.S. Sum 2/	63	0.620	-14.96	488.05	167.79	0.99	21.78	4.46	262.0 -841.0
Hardness	67	0.287	47.53	281.60	84.83	0.91	36.29	12.89	162.0 -446.0
Silica	66	0.012	10.26	19.68	5.97	0.52	5.15	26.20	4.0 - 31.0
Discharge 3/	0	-	-	-	-	-	-	-	- -
			02281294	Everglades Station 1-9 near Delray Beach			(6/55 - 7/64)		
Calcium	60	0.078	- 0.23	7.51	4.23	0.83	2.40	31.96	2.8 - 34.0
Magnesium	58	0.009	0.47	1.38	0.86	0.475	0.77	55.80	0.1 - 4.4
Sodium	40	0.123	- 0.32	11.13	5.71	0.75	3.84	34.50	4.4 - 28.0
Potassium	40	0.006	0.085	0.68	0.43	0.52	0.37	54.41	0.0 - 2.4
Bicarbonate	60	0.157	1.37	16.93	10.82	0.65	8.29	48.97	9.0 - 88.0
Chloride	59	0.173	2.18	19.17	9.00	0.86	4.65	24.26	8.0 - 40.0
Sulfate	58	0.009	0.59	1.51	1.56	0.27	1.51	100.00	0.0 - 7.0
D.S. Residue 1/	0	-	-	-	-	-	-	-	- -
D.S. Sum 2/	48	0.466	6.35	54.37	24.03	0.90	10.49	19.29	23.0 -149.0
Hardness	51	0.236	1.17	25.90	12.46	0.87	6.21	23.98	10.0 - 94.0
Silica	59	0.017	0.01	1.66	1.89	0.40	1.75	105.42	0.0 - 10.0
Discharge 3/	0	-	-	-	-	-	-	-	- -

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_iK_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
02281300 Hillsboro Canal at S-39 near Deerfield Beach (12/57 - 10/73)									
Calcium	78	0.048	22.92	63.79	19.59	0.79	12.04	18.87	23.0 - 110.0
Magnesium	78	0.024	- 2.53	17.48	9.44	0.805	5.64	32.27	1.8 - 40.0
Sodium	72	0.137	- 22.19	94.14	46.09	0.96	12.81	13.61	13.0 - 237.0
Potassium	72	0.004	0.41	4.17	2.29	0.63	1.80	43.06	0.0 - 12.0
Bicarbonate	77	0.237	46.27	247.43	83.07	0.93	31.48	12.72	69.0 - 428.0
Chloride	78	0.188	- 26.48	133.05	62.07	0.98	13.59	10.21	16.0 - 340.0
Sulfate	78	0.047	- 3.07	36.70	21.36	0.71	15.21	41.44	2.3 - 106.0
D.S. Residue 1/	33	0.638	5.88	579.00	182.56	0.98	32.56	5.62	163.0 - 896.0
D.S. Sum 2/	75	0.583	- 8.58	484.72	192.94	0.99	26.74	55.17	106.0 - 953.0
Hardness	78	0.215	48.89	231.08	75.87	0.91	31.33	13.56	65.0 - 437.0
Silica	78	0.010	2.43	10.54	5.85	0.53	5.01	47.53	0.8 - 26.0
Discharge 3/	23	-0.109	3.14	2.93	0.188	-0.38	0.18		0.48- 3.01
02281500 Hillsboro Canal near Deerfield Beach (10/43 - 7/73)									
Calcium	40	0.032	60.18	85.15	17.53	0.39	16.38	19.24	25.0 - 121.0
Magnesium	40	0.016	- 2.15	10.65	5.52	0.63	4.35	40.84	2.20- 29.0
Sodium	27	0.136	- 43.80	57.0	14.61	0.90	6.38	11.19	31.0 - 92.0
Potassium	27	0.003	2.25	4.28	1.08	0.25	1.06	24.87	2.10- 7.40
Bicarbonate	38	0.176	133.94	272.74	65.04	0.59	53.44	19.59	72.0 - 430.0
Chloride	40	0.176	- 40.99	96.90	44.40	0.84	24.33	25.11	38.0 - 280.0
Sulfate	40	0.022	10.53	27.69	9.12	0.51	7.95	28.71	5.60- 57.0
D.S. Residue 1/	38	0.427	117.55	455.79	126.52	0.72	88.41	19.40	124.0 - 868.0
D.S. Sum 2/	20	0.536	20.56	421.90	54.19	0.97	12.54	2.97	287.0 - 504.0
Hardness	40	0.146	142.67	256.93	51.27	0.60	41.41	16.12	93.0 - 388.0
Silica	28	0.002	6.57	7.94	1.44	0.12	1.45	18.33	4.70- 11.0
Discharge 3/	11	-0.059	2.99	2.86	0.06	-0.52	0.05		2.78- 2.94

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02283500	North New River Canal below HGS-4 near South Bay (2/57 - 4/74)						
Calcium	114	0.083	13.07	87.33	37.91	0.90	16.76	19.19	40.0 - 186.0
Magnesium	114	0.035	- 3.82	27.31	28.26	0.50	24.51	89.75	6.3 - 290.0
Sodium	98	0.102	-13.88	75.25	47.24	0.91	19.34	25.70	17.0 - 184.0
Potassium	98	0.004	0.56	3.79	1.87	0.84	1.03	27.18	0.4 - 8.4
Bicarbonate	114	0.293	37.90	301.41	128.90	0.94	45.21	14.97	124.0 - 537.0
Chloride	114	0.132	-12.85	105.89	60.48	0.90	26.50	25.03	26.0 - 250.0
Sulfate	114	0.103	-13.46	78.79	53.09	0.80	32.25	40.93	13.0 - 232.0
D.S. Residue 1/	23	0.723	-29.96	640.18	276.28	0.97	69.38	10.84	327.0 -1120.0
D.S. Sum 2/	112	0.630	-18.91	550.02	266.50	0.97	61.57	11.19	190.0 -1080.0
Hardness	114	0.317	36.41	320.90	139.04	0.94	48.45	15.10	126.0 - 642.0
Silica	114	0.021	- 2.91	15.65	9.54	0.89	4.34	27.73	2.1 - 36.0
Discharge 3/	48	-0.344	3.71	2.86	0.21	-0.43	0.19		1.34- 3.15
		02285000	North New River Canal near Ft. Lauderdale (2/51 - 6/73)						
Calcium	54	0.047	37.49	67.27	17.32	0.52	14.95	22.22	9.6 - 93.0
Magnesium	54	0.022	- 3.10	10.87	5.02	0.84	2.77	25.48	2.1 - 25.0
Sodium	46	0.136	-41.18	51.56	20.90	0.88	10.09	19.57	4.7 - 134.0
Potassium	46	0.005	- 1.71	2.01	0.89	0.83	0.50	24.88	1.1 - 4.6
Bicarbonate	53	0.254	78.37	238.25	65.74	0.74	44.79	18.80	31.0 - 300.0
Chloride	54	0.151	-22.27	73.02	32.13	0.89	14.56	19.94	17.0 - 208.0
Sulfate	54	0.015	6.06	15.56	16.46	0.17	16.36	105.14	0.0 - 62.0
D.S. Residue 1/	33	0.593	14.58	409.52	69.57	0.97	17.37	4.24	321.0 - 688.0
D.S. Sum 2/	53	0.459	56.57	345.91	93.23	0.94	31.63	9.14	80.0 - 623.0
Hardness	54	0.211	80.32	213.24	51.34	0.78	32.42	15.20	44.0 - 276.0
Silica	53	0.002	7.38	8.60	2.58	0.14	2.58	30.00	3.3 - 17.0
Discharge 3/	14	-0.029	2.87	2.82	0.08	-0.29	0.08		- 0.30- 2.87

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02286400 Miami Canal at HGS-3 at Lake Harbor (12/50 - 4/74)						
Calcium	99	0.086	9.45	63.09	28.62	0.86	14.76	23.40	27.0 - 144.0
Magnesium	99	0.028	0.16	17.72	9.49	0.85	5.06	28.56	6.0 - 59.0
Sodium	87	0.093	- 9.75	50.21	32.59	0.86	16.87	33.60	7.5 - 235.0
Potassium	87	0.003	0.49	2.74	1.53	0.68	1.13	41.24	0.3 - 9.9
Bicarbonate	99	0.296	25.77	212.70	95.15	0.91	40.30	18.95	53.0 - 484.0
Chloride	99	0.120	- 3.45	71.85	53.15	0.65	40.66	56.59	9.0 - 400.0
Sulfate	99	0.103	- 9.74	55.07	33.78	0.88	16.23	29.47	5.1 - 210.0
D.S. Residue 1/	39	0.636	44.17	543.00	205.48	0 93	77.59	14.29	166.0 -1150.0
D.S. Sum 2/	97	0.609	- 11.71	370.62	182.17	0.97	45.39	12.25	117.0 -1100.0
Hardness	100	0.339	16.40	230.69	107.23	0.92	42.95	18.62	56.0 - 602.0
Silica	90	0.018	- 1.48	9.81	6.89	0.76	4.46	45.46	1.4 - 35.0
Discharge 3/	28	0.031	2.63	2.69	0.13	0.245	0.13		-1.0 - 3.38
			02287395 Miami Canal East of Levee 30 near Miami (11/58 - 4/74)						
Calcium	337	0.020	62.29	73.19	7.31	0.20	7.18	9.81	49.0 - 91.0
Magnesium	335	0.023	- 4.26	8.00	2.71	0.60	2.18	27.25	0.9 - 20.0
Sodium	335	0.122	- 32.19	33.32	9.90	0.87	4.89	14.68	18.0 - 71.0
Potassium	334	0.002	0.24	1.19	0.77	0.16	0.76	63.87	0.1 - 8.0
Bicarbonate	337	0.181	157.0	253.85	24.47	0.52	20.89	8.23	174.0 - 312.0
Chloride	337	0.199	- 58.15	48.70	16.10	0.87	7.86	16.14	23.0 - 100.0
Sulfate	334	0.005	1.99	4.56	4.28	0.08	4.27	93.64	0.0 - 40.0
D.S. Residue 1/	251	0.532	58.72	338.07	44.92	0.86	23.29	6.89	250.0 - 556.0
D.S. Sum 2/	333	0.468	51.38	302.64	34.51	0.96	10.08	3.33	204.0 - 459.0
Hardness	338	0.148	136.3	215.41	20.81	0.50	18.04	8.37	154.0 - 280.0
Silica	334	0.014	- 1.14	6.15	2.15	0.44	1.93	31.38	2.0 - 16.0
Discharge 3/	73	0.0015	2.715	2.72	0.04	0.008	0.04		1.79- 2.94

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_iK_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02288600 Miami Canal at NW 36th Street at Miami (5/66 - 10/73)						
Calcium	19	-0.038	96.84	74.37	5.43	-0.45	4.985	6.70	58.0 - 85.0
Magnesium	19	0.046	- 17.21	9.95	3.88	0.76	2.58	25.93	5.8 - 19.0
Sodium	18	0.181	- 68.87	39.00	17.23	0.70	12.69	32.54	24.0 - 86.0
Potassium	18	0.002	0.47	1.64	0.99	0.13	1.01	61.59	0.5 - 5.2
Bicarbonate	17	0.035	244.7	265.88	19.85	0.12	20.35	7.65	224.0 -308.0
Chloride	19	0.244	- 86.52	58.95	26.03	0.61	21.24	36.03	36.0 -140.0
Sulfate	19	0.073	- 36.94	6.84	10.94	0.44	10.13	148.10	0.0 - 43.0
D.S. Residue 1/	18	0.650	- 23.02	364.61	58.29	0.74	40.18	11.02	260.0 -493.0
D.S. Sum 2/	16	0.572	- 12.18	332.69	58.15	0.67	44.74	13.45	234.0 -475.0
Hardness	19	0.095	171.00	227.79	10.97	0.56	9.32	4.09	169.0 -244.0
Silica	18	0.015	- 2.87	6.11	1.66	0.605	1.36	22.26	3.4 - 10.0
Discharge 3/	4								
			02289060 Tamiami Canal at Bridge 45 near Miami (9/50 - 4/74)						
Calcium	123	0.184	- 4.06	60.25	24.84	0.97	6.18	10.26	16.0 -124.0
Magnesium	123	0.009	0.51	3.63	2.39	0.49	2.10	57.85	0.2 - 16.0
Sodium	82	0.031	0.59	11.28	5.13	0.80	3.07	27.22	3.5 - 30.0
Potassium	82	0.0007	0.25	0.48	0.275	0.33	0.26	54.17	0.0 - 1.3
Bicarbonate	120	0.582	- 12.43	189.59	78.08	0.98	17.02	8.98	74.0 -388.0
Chloride	123	0.053	0.24	18.70	8.995	0.77	5.78	30.91	6.0 - 60.0
Sulfate	123	0.009	1.18	4.41	3.58	0.34	3.39	76.87	0.0 - 22.0
D.S. Residue 1/	77	0.609	18.91	224.48	83.84	0.96	22.68	10.10	96.0 -400.0
D.S. Sum 2/	120	0.582	- 3.66	198.56	77.33	0.99	12.71	64.01	77.0 -373.0
Hardness	123	0.498	- 8.795	165.77	67.19	0.97	15.715	9.48	64.0 -332.0
Silica	112	0.0045	4.92	6.44	5.975	0.10	5.97	92.70	0.4 - 35.0
Discharge 3/	12	-0.101	2.67	2.49	0.17	-0.73	0.125		0.0 - 3.50

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_iK_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District. Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
Tamiami Canal -- 5 Stations (02288900, 02289018, 02289040, 02289060, 02289500)									
Calcium	70	0.079	31.55	67.26	20.17	0.58	16.56	24.62	32.0 - 110.0
Magnesium	70	0.020	- 3.87	5.14	3.71	0.79	2.28	44.36	1.1 - 18.0
Sodium	65	0.083	- 15.69	21.84	15.76	0.80	9.46	43.32	3.5 - 76.0
Potassium	65	0.007	- 1.62	1.46	2.74	0.38	2.55	174.66	0.1 - 18.0
Bicarbonate	65	0.303	81.09	217.88	62.82	0.73	42.96	19.72	101.0 - 344.0
Chloride	70	0.134	- 25.49	34.80	24.82	0.80	15.16	43.56	6.5 - 130.0
Sulfate	70	0.023	- 5.00	5.20	8.75	0.38	8.15	156.73	0.0 - 58.0
D.S. Residue 1/	62	0.543	36.50	281.45	88.77	0.94	31.14	11.06	124.0 - 477.0
D.S. Sum 2/	64	0.516	16.51	249.36	81.72	0.97	20.53	8.23	105.0 - 441.0
Hardness	70	0.284	61.22	189.37	53.99	0.78	34.23	18.08	87.0 - 300.0
Silica	65	0.004	3.07	4.99	3.65	0.18	3.62	72.55	1.0 - 22.0
Discharge 3/	13								
02291300 Golden Gate Canal at Naples (11/65 - 5/74)									
Calcium	42	0.086	56.79	124.12	16.36	0.70	11.89	9.58	81.0 - 151.0
Magnesium	42	0.016	- 5.52	6.90	2.55	0.83	1.45	21.01	3.5 - 170.0
Sodium	42	0.098	- 41.54	34.76	15.22	0.85	8.15	23.45	11.0 - 83.0
Potassium	42	0.0008	0.67	1.27	0.70	0.15	0.71	55.91	0.2 - 3.9
Bicarbonate	42	0.187	159.7	305.62	41.29	0.60	33.50	10.96	214.0 - 364.0
Chloride	42	0.195	- 87.95	64.12	30.82	0.83	17.18	26.79	19.0 - 160.0
Sulfate	42	0.057	26.08	70.52	12.05	0.62	9.53	13.51	31.0 - 95.0
D.S. Residue 1/	40	0.594	49.02	510.23	85.75	0.93	32.05	6.28	327.0 - 728.0
D.S. Sum 2/	39	0.552	30.16	458.87	77.79	0.97	20.47	4.46	285.0 - 653.0
Hardness	42	0.287	114.8	338.95	45.70	0.83	25.79	7.61	220.0 - 420.0
Silica	42	0.004	4.17	7.64	2.23	0.26	2.18	28.53	0.03- 160.0
Discharge 3/	13	-0.049	2.99	2.88	0.05	-0.31	0.053		2.68- 3.05

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents
3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} . Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
		02292000	Caloosahatchee Canal at Moore Haven			(3/41 - 10/73)			
Calcium	126	0.090	7.22	45.52	13.22	0.85	6.93	15.22	11.0 - 90.0
Magnesium	126	0.028	- 1.59	10.27	3.95	0.89	1.85	18.01	1.1 - 27.0
Sodium	82	0.084	- 6.09	30.34	12.00	0.95	3.83	12.62	7.1 - 62.0
Potassium	82	0.006	- 0.41	2.17	1.06	0.76	0.70	32.26	0.3 - 5.9
Bicarbonate	126	0.293	20.11	145.00	41.40	0.89	18.78	12.95	33.0 - 271.0
Chloride	126	0.117	- 6.11	43.58	15.93	0.92	6.19	14.20	11.0 - 92.0
Sulfate	126	0.100	- 8.28	34.21	13.83	0.91	5.80	16.95	4.0 - 94.0
D.S. Residue 1/	40	0.577	40.50	309.23	81.46	0.97	18.47	5.97	204.0 - 580.0
D.S. Sum 2/	112	0.531	20.35	251.17	89.85	0.76	58.50	23.29	54.0 - 775.0
Hardness	126	0.339	11.90	156.80	45.30	0.94	15.70	10.01	32.0 - 326.0
Silica	122	-0.0015	6.86	6.23	4.35	-0.04	4.37	70.14	0.7 - 27.0
Discharge 3/	25	-0.023	2.63	2.58	0.17	-0.27	0.105		1.0 - 3.74
		02292900	Caloosahatchee River near Olga			(5/66 - 5/74)			
Calcium	42	0.014	54.31	67.38	18.37	0.71	13.03	19.34	34.0 - 124.0
Magnesium	42	0.020	- 0.18	19.59	19.91	0.996	1.84	9.39	4.8 - 122.0
Sodium	42	0.167	- 56.71	104.52	162.47	0.995	15.77	15.09	13.0 - 930.0
Potassium	42	0.006	- 0.85	4.79	5.78	0.98	1.22	25.47	0.7 - 34.0
Bicarbonate	40	0.018	181.8	199.80	33.83	0.53	29.10	14.56	124.0 - 254.0
Chloride	42	0.297	-103.8	182.98	288.48	0.997	22.40	12.24	20.0 -1640.0
Sulfate	42	0.047	13.27	58.48	45.70	0.992	5.81	9.94	16.0 - 284.0
D.S. Residue 1/	39	0.595	23.49	469.67	254.30	0.984	45.67	9.72	180.0 -1300.0
D.S. Sum 2/	33	0.558	3.75	618.06	591.40	0.999	27.25	4.41	202.0 -3260.0
Hardness	42	0.118	135.30	249.45	118.39	0.967	30.67	12.30	110.0 - 812.0
Silica	42	-0.001	6.44	5.55	2.68	-0.34	2.55	45.95	0.2 - 9.9
Discharge 3/	12	-0.065	2.90	2.70	0.10	-0.72	0.07		-0.22- 3.87

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

3/ Log-Log regression; equation of line is $K_{sc} = 10^{a_i} \cdot Q^{b_i}$

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02260800	Alligator Lake near Ashton	(10/54 - 11/73)				
Calcium	27	0.029	0.54	2.69	0.80	0.79	0.50	18.79	1.6 - 4.8
Magnesium	27	0.027	- 0.31	1.65	0.60	0.97	0.14	8.35	0.8 - 3.0
Sodium	18	0.074	2.03	8.03	1.77	0.92	0.71	8.90	4.9 -11.0
Potassium	18	0.012	0.00	1.00	0.38	0.72	0.27	26.91	0.2 - 1.6
Bicarbonate	27	-0.031	7.47	5.22	1.67	-0.40	1.56	29.94	2.0 -10.0
Chloride	27	0.134	2.87	12.65	3.11	0.93	1.15	9.13	8.5 -20.0
Sulfate	27	0.185	- 6.57	6.96	4.39	0.91	1.83	26.25	0.5 -19.0
D.S. Residue 1/	10	0.397	27.91	65.40	9.66	0.79	6.25	9.56	51.0 -83.0
D.S. Sum 2/	27	0.459	2.62	36.19	10.37	0.96	3.03	8.38	19.0 -58.0
Hardness	27	0.187	- 0.10	13.59	4.29	0.94	1.43	10.55	8.0 -24.0
Silica	27	-0.006	1.77	1.31	1.03	-0.13	1.04	79.07	0.0 5.6
			02261900	Lake Mary Jane near Narcoossee	(10/60 - 5/74)				
Calcium	12	0.045	0.20	4.23	1.88	0.60	1.57	37.28	1.6 - 9.0
Magnesium	12	0.020	0.26	2.08	0.57	0.89	0.27	13.05	1.0 - 3.0
Sodium	12	0.090	0.96	9.00	2.38	0.95	0.81	8.95	3.5 -13.0
Potassium	12	0.007	0.16	0.78	0.25	0.68	0.19	24.98	0.4 - 1.1
Bicarbonate	12	-0.039	7.16	3.67	1.87	-0.52	1.68	45.69	0.0 - 7.0
Chloride	12	0.190	- 0.38	16.67	5.00	0.96	1.51	9.07	6.0 -24.0
Sulfate	12	0.116	- 1.43	8.95	4.17	0.70	3.13	35.01	0.4 -16.0
D.S. Residue 1/	11	0.409	46.97	84.36	16.10	0.65	12.86	15.25	44.0 -98.0
D.S. Sum 2/	12	0.428	7.97	46.42	11.74	0.92	4.83	10.41	18.0 -61.0
Hardness	12	0.198	1.37	19.17	6.95	0.72	5.07	26.46	8.0 -35.0
Silica	12	-0.022	3.99	2.03	2.28	-0.24	2.32	114.76	0.0 - 9.0

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02262200	Lake Hart near Narcoossee		(10/54 - 4/69)			
Calcium	21	0.048	- 0.02	4.05	2.33	0.96	0.66	16.32	1.7 - 10.0
Magnesium	21	0.026	- 0.25	1.90	1.25	0.94	0.43	22.70	0.5 - 5.5
Sodium	12	0.034	4.43	7.90	2.29	0.84	1.31	16.64	3.8 - 12.0
Potassium	12	0.043	- 2.16	2.16	2.48	0.96	0.70	32.58	0.2 - 7.2
Bicarbonate	20	-0.030	7.81	5.30	2.60	-0.55	2.24	42.21	1.0 - 12.0
Chloride	21	0.071	6.55	12.57	3.74	0.88	1.80	14.35	6.0 - 21.0
Sulfate	21	0.290	-13.91	10.51	13.71	0.98	2.93	27.89	0.2 - 50.0
D.S. Residue [1/]	3								
D.S. Sum [2/]	20	0.517	- 1.96	41.40	24.91	0.98	4.61	11.15	20.0 -109.0
Hardness	21	0.228	- 1.19	18.00	10.63	0.99	1.41	7.83	9.0 - 48.0
Silica	21	0.007	1.12	1.71	0.98	0.33	0.95	55.45	0.4 - 4.1
			02263400	East Lake Tohopekaliga at St. Cloud		(10/54 - 5/68)			
Calcium	23	0.067	- 1.23	4.80	1.90	0.91	0.79	16.49	2.4 - 10.0
Magnesium	23	0.013	0.74	1.93	0.52	0.66	0.40	20.66	1.0 - 3.2
Sodium	14	0.061	2.46	8.29	1.98	0.85	1.10	13.27	4.3 - 11.0
Potassium	14	0.007	0.53	1.23	0.37	0.54	0.33	26.60	0.5 - 1.7
Bicarbonate	23	0.003	7.06	7.30	1.87	0.04	1.91	26.17	1.0 - 10.0
Chloride	23	0.073	6.95	13.54	2.86	0.66	2.18	16.13	8.0 - 21.0
Sulfate	23	0.225	- 9.78	10.56	6.49	0.90	2.86	27.09	1.8 - 29.0
D.S. Residue [1/]	4								
D.S. Sum [2/]	23	0.502	0.88	46.22	13.50	0.97	3.49	7.55	26.0 - 79.0
Hardness	23	0.218	0.14	19.83	5.99	0.95	1.97	9.95	12.0 - 36.0
Silica	23	0.039	- 1.10	2.45	2.07	0.49	1.85	75.51	0.3 - 7.0

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02264900	Lake Tohopekaliga at Kissimmee			(10/54 - 9/73)		
Calcium	29	0.131	- 5.00	12.49	7.16	0.90	3.25	26.01	4.0 - 28.0
Magnesium	29	0.022	0.15	3.09	1.43	0.75	0.96	31.11	0.2 - 6.0
Sodium	21	0.017	6.88	9.49	2.83	0.29	2.78	29.31	4.7 - 18.0
Potassium	21	0.004	0.83	1.47	0.60	0.33	0.58	39.52	0.6 - 3.0
Bicarbonate	28	0.536	-29.20	41.93	29.11	0.91	12.06	28.77	12.0 -108.0
Chloride	28	0.016	11.01	13.13	3.87	0.20	3.86	29.40	6.0 - 25.0
Sulfate	28	0.031	4.25	8.33	3.47	0.44	3.18	38.13	2.0 - 18.0
D.S. Residue 1/	13	0.361	47.88	105.77	20.34	0.87	10.40	9.83	68.0 -133.0
D.S. Sum 2/	28	0.539	0.96	72.50	27.56	0.97	6.79	9.36	34.0 -122.0
Hardness	29	0.419	-11.90	44.00	22.05	0.93	8.32	18.90	17.0 - 92.0
Silica	29	0.021	1.20	4.01	1.89	0.55	1.61	40.21	1.4 - 8.9
			02266600	Cypress Lake near St. Cloud			(11/54 - 4/74)		
Calcium	34	0.039	1.53	5.31	1.51	0.85	0.82	15.38	3.0 - 8.6
Magnesium	34	0.031	- 0.79	2.19	1.08	0.93	0.40	18.22	0.4 - 4.3
Sodium	24	0.114	- 1.50	10.15	4.12	0.97	0.96	9.49	3.2 - 17.0
Potassium	24	0.017	- 0.41	1.33	0.67	0.89	0.31	23.17	0.0 - 2.5
Bicarbonate	33	0.106	1.57	11.76	4.98	0.70	3.59	30.50	1.0 - 27.0
Chloride	34	0.166	- 0.23	15.78	5.62	0.96	1.51	9.59	6.0 - 27.0
Sulfate	34	0.109	- 1.10	9.36	4.01	0.88	1.92	20.48	0.0 - 17.0
D.S. Residue 1/	10	0.459	42.04	101.40	14.14	0.67	11.18	11.02	88.0 -124.0
D.S. Sum 2/	33	0.528	0.95	51.58	17.83	0.98	3.84	7.44	20.0 - 86.0
Hardness	34	0.226	0.58	22.32	7.78	0.95	2.56	11.47	10.0 - 39.0
Silica	33	-0.005	2.84	2.36	2.37	-0.07	2.41	101.91	0.0 - 13.0

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_iK_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02266650	Lake Marion near Haynes City		(1/66 - 6/74)			
Calcium	13	0.138	- 5.28	12.58	2.40	0.85	1.32	10.47	6.5 - 16.0
Magnesium	13	0.044	- 1.75	3.90	0.69	0.94	0.25	6.34	2.2 - 4.9
Sodium	13	0.018	3.72	6.07	1.45	0.19	1.48	24.45	4.5 - 9.2
Potassium	13	0.015	- 0.70	1.22	0.50	0.44	0.47	38.60	0.9 - 2.8
Bicarbonate	13	0.768	-53.04	46.15	13.62	0.83	7.91	17.13	20.0 - 72.0
Chloride	13	0.013	8.58	10.23	1.69	0.11	1.76	17.16	7.5 - 14.0
Sulfate	13	0.091	- 2.67	9.04	1.87	0.71	1.37	15.14	4.8 - 12.0
D.S. Residue 1/	12	0.843	-19.71	90.67	17.80	0.66	14.07	15.52	57.0 -123.0
D.S. Sum 2/	13	0.666	-16.87	69.15	10.49	0.94	3.85	5.57	48.0 - 87.0
Hardness	13	0.531	-20.92	47.69	8.76	0.89	4.10	8.60	25.0 - 58.0
Silica	13	0.053	- 4.50	2.38	2.01	0.39	1.93	80.88	0.0 - 5.8
			02267400	Lake Hatcheneha near Lake Wales		(11/54 - 4/68)			
Calcium	22	0.084	- 0.33	7.18	2.57	0.85	1.37	19.12	4.4 - 12.0
Magnesium	22	0.042	- 1.28	2.52	1.38	0.80	0.85	33.55	0.1 - 6.0
Sodium	16	0.063	0.89	6.54	2.13	0.87	1.09	16.61	3.6 - 9.6
Potassium	16	0.011	- 0.13	0.81	0.48	0.64	0.39	47.50	0.0 - 1.6
Bicarbonate	22	0.185	1.60	18.23	6.60	0.74	4.58	25.13	10.0 - 33.0
Chloride	22	0.103	2.74	11.97	3.14	0.86	1.66	13.85	6.0 - 16.0
Sulfate	22	0.146	- 4.78	8.30	4.19	0.91	1.76	21.20	1.2 - 14.0
D.S. Residue 1/	2								
D.S. Sum 2/	22	0.548	0.87	50.00	14.83	0.97	3.90	7.79	25.0 - 74.0
Hardness	22	0.384	- 6.19	28.27	11.07	0.91	4.74	16.77	12.0 - 52.0
Silica	22	-0.013	4.41	3.25	1.80	-0.19	1.81	55.58	0.7 - 8.2

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02268400 Lake Weohyakpka at Indian Lake Estates (5/66 - 6/74)						
Calcium	13	0.068	- 1.33	4.60	1.38	0.59	1.16	25.19	2.2 - 6.7
Magnesium	13	0.028	0.41	2.84	0.56	0.59	0.47	16.70	1.9 - 3.7
Sodium	13	0.050	2.98	7.38	1.13	0.54	0.99	13.48	5.6 - 8.6
Potassium	13	-0.004	1.32	0.96	0.33	-0.15	0.34	35.22	0.5 - 1.7
Bicarbonate	13	0.317	-11.92	15.69	6.24	0.61	5.17	32.94	5.0 - 24.0
Chloride	13	0.065	7.03	12.68	2.91	0.27	2.93	23.10	9.0 - 18.0
Sulfate	13	0.075	2.53	9.08	1.89	0.48	1.73	19.03	5.6 - 11.0
D.S. Residue 1/	12	0.386	25.93	60.00	7.86	0.57	6.75	11.25	44.0 - 72.0
D.S. Sum 2/	13	0.418	13.19	49.62	5.44	0.92	2.22	4.47	41.0 - 59.0
Hardness	13	0.248	1.11	22.69	4.27	0.69	3.21	14.13	18.0 - 30.0
Silica	13	-0.035	6.53	3.48	1.56	-0.27	1.57	45.17	0.7 - 5.5
			02268600 Lake Rosalie near Lake Wales (4/66 - 6/74)						
Calcium	14	0.034	2.08	5.38	1.60	0.34	1.57	29.16	3.2 - 9.3
Magnesium	14	0.032	- 0.29	2.81	0.57	0.89	0.27	9.46	2.0 - 4.0
Sodium	14	0.081	0.28	8.07	1.69	0.75	1.17	14.48	5.8 - 11.0
Potassium	14	0.003	0.51	0.84	0.31	0.17	0.32	37.76	0.1 - 1.3
Bicarbonate	14	0.019	11.45	13.29	6.66	0.04	6.93	52.13	4.0 - 25.0
Chloride	14	0.131	0.40	12.99	2.68	0.76	1.80	13.87	9.8 - 18.0
Sulfate	14	0.219	- 9.51	11.55	5.08	0.67	3.92	33.91	4.7 - 22.0
D.S. Residue 1/	13	0.573	15.55	71.23	14.74	0.60	12.29	17.25	52.0 -102.0
D.S. Sum 2/	14	0.453	7.80	51.29	7.52	0.94	2.69	5.25	41.0 - 72.0
Hardness	14	0.214	4.66	25.14	5.04	0.66	3.94	15.66	20.0 - 40.0
Silica	14	-0.029	4.77	1.99	0.97	-0.47	0.89	45.05	0.6 - 3.9

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02268800	Lake Marion near Kenansville					
Calcium	12	0.084	- 2.02	7.18	1.29	0.87	0.66	9.17	5.4 - 9.6
Magnesium	12	-0.016	5.60	3.83	5.43	-0.04	5.69	148.64	1.3 - 21.0
Sodium	11	0.090	0.02	10.04	1.54	0.79	1.01	10.03	7.7 - 13.0
Potassium	11	0.026	- 1.55	1.35	0.51	0.69	0.39	28.97	0.4 - 2.2
Bicarbonate	11	0.335	- 16.19	21.00	5.40	0.83	3.14	14.95	12.0 - 30.0
Chloride	11	0.153	- 0.45	16.27	2.37	0.89	1.12	6.87	12.0 - 20.0
Sulfate	12	0.033	2.20	5.80	0.84	0.52	0.76	13.03	4.0 - 6.8
D.S. Residue 1/	10	0.953	- 25.87	81.10	15.40	0.83	9.06	11.18	44.0 -100.0
D.S. Sum 2/	11	0.464	6.13	57.55	8.49	0.73	6.08	10.56	40.0 - 69.0
Hardness	12	0.329	- 8.91	27.25	4.96	0.89	2.34	8.59	19.0 - 36.0
Silica	11	-0.009	1.76	0.80	0.50	-0.24	0.51	63.51	0.1 - 1.9
			02268900	Lake Kissimmee near Lake Wales		(11/54 - 6/69)			
Calcium	25	0.083	- 0.31	7.31	2.39	0.85	1.29	17.65	4.4 - 15.0
Magnesium	25	0.037	- 1.10	2.34	1.09	0.84	0.60	25.70	0.1 - 4.9
Sodium	19	0.070	0.27	6.65	2.06	0.91	0.88	13.29	3.6 - 9.9
Potassium	19	0.007	0.26	0.86	0.46	0.38	0.44	51.31	0.0 - 1.8
Bicarbonate	25	0.175	2.88	18.96	5.00	0.86	2.64	13.94	12.0 - 32.0
Chloride	25	0.120	1.02	12.00	3.14	0.93	1.19	9.88	5.5 - 17.0
Sulfate	25	0.146	- 4.85	8.57	3.98	0.90	1.80	21.03	3.2 - 17.0
D.S. Residue 1/	3								
D.S. Sum 2/	25	0.568	- 2.11	50.04	14.29	0.97	3.55	7.09	26.0 - 81.0
Hardness	25	0.360	- 5.15	27.92	9.45	0.93	3.55	12.73	12.0 - 52.0
Silica	25	-0.000	2.78	2.78	1.67	-0.00	1.70	61.21	0.6 - 7.1

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
02269600 Lake Arbuckle near Avon Park (11/54 - 6/74)									
Calcium	23	0.083	- 1.06	8.95	2.98	0.93	1.11	12.37	4.8 - 17.0
Magnesium	23	0.035	- 0.50	3.74	1.48	0.80	0.91	24.38	1.5 - 6.8
Sodium	15	0.064	- 0.26	7.89	2.45	0.96	0.68	8.64	4.4 - 13.0
Potassium	15	0.017	- 0.44	1.75	0.80	0.79	0.51	29.36	1.0 - 4.0
Bicarbonate	22	0.300	-15.17	20.82	10.83	0.95	3.62	17.41	9.0 - 45.0
Chloride	23	0.082	2.50	12.39	3.15	0.87	1.60	12.87	9.0 - 22.0
Sulfate	23	0.143	2.22	19.43	5.38	0.89	2.54	13.09	12.0 - 29.0
D.S. Residue 1/	8	0.436	39.63	105.25	17.82	0.88	9.05	8.60	77.0 -132.0
D.S. Sum 2/	22	0.568	- 2.17	66.09	19.91	0.98	4.53	6.85	42.0 -112.0
Hardness	23	0.361	- 5.50	37.96	12.57	0.96	3.64	9.59	20.0 - 67.0
Silica	22	-0.013	3.70	2.15	1.21	-0.36	1.16	53.86	0.5 - 4.9
02270700 Lake Annie near Lake Placid (4/66 - 6/74)									
Calcium	9	0.090	- 0.98	1.86	0.35	0.52	0.32	17.40	1.4 - 2.5
Magnesium	9	-0.015	1.04	0.57	0.07	-0.44	0.07	12.00	0.5 - 0.7
Sodium	9	0.049	1.66	3.21	0.41	0.25	0.42	13.15	2.7 - 4.0
Potassium	9	-0.016	0.91	0.41	0.13	-0.26	0.13	31.91	0.3 - 0.6
Bicarbonate	9	0.060	2.12	4.00	1.00	0.12	1.06	26.53	2.0 - 5.0
Chloride	9	0.159	0.64	5.64	0.79	0.41	0.77	13.71	4.2 - 6.6
Sulfate	9	0.164	- 3.33	1.84	1.21	0.28	1.24	67.21	0.0 - 4.0
D.S. Residue 1/	8	0.719	1.34	24.13	2.90	0.52	2.67	11.08	21.0 - 29.0
D.S. Sum 2/	9	0.548	- 0.50	16.78	2.11	0.53	1.91	11.37	13.0 - 19.0
Hardness	9	0.221	- 0.19	6.78	1.09	0.41	1.06	15.69	6.0 - 9.0
Silica	9	-0.006	1.18	0.98	0.49	-0.03	0.52	53.48	0.1 - 1.9

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District.--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
02270950 Lake June in Winter near Lake Placid (7/65 - 6/74)									
Calcium	11	0.018	3.15	5.06	0.71	0.17	0.74	14.62	3.8 - 6.4
Magnesium	11	0.035	- 0.37	3.35	0.69	0.34	0.69	20.50	1.9 - 4.6
Sodium	10	0.086	- 1.29	7.85	0.99	0.62	0.83	10.57	6.3 - 9.2
Potassium	10	0.007	1.52	2.31	0.46	0.12	0.48	20.78	1.8 - 3.2
Bicarbonate	10	0.065	2.09	9.00	1.05	0.44	1.00	11.15	7.0 -10.0
Chloride	11	0.173	- 5.45	13.09	1.51	0.79	0.98	7.52	11.0 -16.0
Sulfate	11	0.211	- 2.64	20.00	2.05	0.71	1.52	7.61	17.0 -23.0
D.S. Residue 1/	10	0.844	-24.52	65.60	8.83	0.69	6.82	10.40	46.0 -76.0
D.S. Sum 2/	10	0.592	- 5.96	57.30	5.29	0.80	3.34	5.83	49.0 -64.0
Hardness	11	0.215	3.57	26.55	2.46	0.60	2.08	7.84	22.0 -30.0
Silica	10	0.032	- 2.78	0.66	0.32	0.71	0.24	36.49	0.1 - 1.2
02271200 Lake Francis near Lake Placid (4/66 - 6/74)									
Calcium	11	-0.025	6.90	4.47	0.65	-0.28	0.66	14.74	3.1 - 5.4
Magnesium	11	0.049	- 1.50	3.25	0.45	0.80	0.28	8.71	2.7 - 4.1
Sodium	10	0.102	- 2.63	7.34	0.83	0.95	0.28	3.79	6.1 - 8.5
Potassium	10	0.023	- 0.29	1.92	0.38	0.46	0.36	18.80	1.5 - 2.7
Bicarbonate	10	0.004	8.63	9.00	1.63	0.02	1.73	19.24	7.0 -12.0
Chloride	11	0.253	-12.05	12.68	2.03	0.91	0.87	6.88	9.5 -16.0
Sulfate	11	0.113	3.66	14.73	1.01	0.82	0.61	4.12	13.0 -16.0
D.S. Residue 1/	9	1.076	-44.20	62.33	8.32	0.89	4.03	6.47	48.0 -71.0
D.S. Sum 2/	10	0.506	0.97	50.40	4.25	0.92	1.81	3.59	44.0 -55.0
Hardness	11	0.128	11.97	24.45	2.16	0.43	2.05	8.40	21.0 -29.0
Silica	10	0.019	- 0.79	1.07	0.53	0.28	0.53	49.99	0.2 - 1.9

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_iK_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
02273200 Lake Istokpoga at Outlet near Lake Placid (2/63 - 6/74)									
Calcium	23	0.041	2.97	7.51	1.36	0.47	1.23	16.36	5.1 - 11.0
Magnesium	23	0.027	0.36	3.37	1.75	0.24	1.74	51.75	2.2 - 11.0
Sodium	23	0.062	0.98	7.82	1.20	0.81	0.73	9.30	5.5 - 9.8
Potassium	23	0.008	1.11	1.99	2.85	0.04	2.92	146.78	1.0 - 15.0
Bicarbonate	23	0.050	7.17	12.70	3.64	0.22	3.63	28.63	7.0 - 22.0
Chloride	23	0.101	2.51	13.57	2.59	0.61	2.11	15.55	11.0 - 22.0
Sulfate	23	0.185	- 3.16	17.14	3.64	0.79	2.28	13.28	9.2 - 22.0
D.S. Residue [1]	16	0.640	2.33	72.06	19.71	0.57	16.70	23.18	45.0 -102.0
D.S. Sum [2]	15	0.454	10.46	61.33	9.88	0.78	6.45	10.52	44.0 - 82.0
Hardness	23	0.213	7.39	30.83	4.30	0.77	2.79	9.06	22.0 - 40.0
Silica	23	0.016	0.23	1.96	3.11	0.08	3.17	161.63	0.5 - 16.0
02276401 - 02276418 Lake Okeechobee (18 Stations) (12/63 - 12/74)									
Calcium	267	0.060	16.85	48.07	6.40	0.73	4.37	9.09	28.0 - 86.0
Magnesium	267	0.029	- 1.77	13.33	2.54	0.89	1.13	8.50	3.3 - 24.0
Sodium	267	0.100	-10.48	41.29	8.35	0.93	3.04	7.36	11.0 - 82.0
Potassium	267	0.005	0.54	2.88	0.46	0.77	0.29	10.12	1.6 - 5.3
Bicarbonate	267	0.240	30.86	155.30	21.33	0.88	10.30	6.63	65.0 -241.0
Chloride	267	0.139	-10.98	60.98	11.25	0.96	3.13	5.13	19.0 -115.0
Sulfate	263	0.103	- 8.24	45.04	9.03	0.89	4.17	9.27	14.0 -101.0
D.S. Residue [1]	212	0.574	32.20	332.01	50.46	0.97	12.90	3.88	152.0 -596.0
D.S. Sum [2]	263	0.564	2.19	294.16	44.92	0.98	9.62	3.27	110.0 -532.0
Hardness	267	0.283	27.80	174.46	25.98	0.85	13.80	7.91	76.0 -271.0
Silica	267	0.005	2.43	5.20	2.83	0.15	2.80	53.84	0.6 - 17.0

1/ Residue on evaporation at 180° Celsius
2/ Sum of dissolved chemical constituents

Table 2.--Results of Regression Analyses, $C_i = a_i + b_i K_{sc}$, for Selected Chemical Constituents for stations in the Central and Southern Florida Flood Control District--Continued.

Variable (i)	No. of paired values	Regression coefficient (b_i)	Intercept (a_i)	Mean C_i	Standard deviation C_i	Correlation coefficient (r)	Std. error of estimate (SE_e)	SE_e as percent of mean	Range in C_i
			02291200	Lake Trafford near Immokalee			(7/65 - 5/73)		
Calcium	12	0.116	0.48	30.25	8.18	0.96	2.43	8.05	20.0 - 43.0
Magnesium	12	0.011	1.13	4.02	0.92	0.83	0.54	13.55	2.3 - 5.2
Sodium	12	0.060	0.24	15.70	4.66	0.87	2.37	15.10	8.4 - 24.0
Potassium	12	0.009	- 0.13	2.08	0.81	0.71	0.60	28.93	1.0 - 3.8
Bicarbonate	12	0.336	5.07	91.25	27.11	0.84	15.53	17.02	43.0 -136.0
Chloride	12	0.126	- 3.73	28.67	9.52	0.90	4.42	15.41	16.0 - 47.0
Sulfate	12	0.037	- 6.01	3.53	4.04	0.62	3.31	93.78	0.0 - 14.0
D.S. Residue 1/	12	0.453	52.30	168.58	34.27	0.89	16.10	9.55	123.0 -233.0
D.S. Sum 2/	12	0.743	-45.40	145.08	55.35	0.91	24.46	16.86	87.0 -266.0
Hardness	12	0.336	6.15	92.33	23.54	0.96	6.51	7.05	62.0 -129.0
Silica	12	0.010	0.83	3.38	2.60	0.26	2.63	77.99	0.0 - 9.7

Calcium
Magnesium
Sodium
Potassium
Bicarbonate
Chloride
Sulfate
D.S. Residue 1/
D.S. Sum 2/
Hardness
Silica

1/ Residue on evaporation at 180° Celsius

2/ Sum of dissolved chemical constituents