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NITROGEN, PHOSPHORUS, AND TRACE ELEMENTS IN FLORIDA SURFACE WATERS, 1970-71

By

Boyd F. Joyner

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NITROGEN, PHOSPHORUS, AND TRACE ELEMENTS IN FLORIDA SURFACE WATERS, 1970-71

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INTRODUCTION

For many years the U.S. Geological Survey has been the Nation's prime collector of water-quality data. Most of the data have been collected in cooperation with various state, county, local, and other federal agencies. Since 1941 the Geological Survey has published, in Water-Supply Papers, surface-water quality data on an annual basis. Also, since 1964 surface-water quality records for Florida have been released by the Geological Survey in annual State reports.

The purpose of this report is to summarize nitrogen, phosphorus, and trace-element data collected at selected stations on a statewide basis from Florida surface waters in 1970-71. The data were collected in cooperation with many state, county, local, and other federal agencies. Discussing the cause and effect relations and other significant features of the analyses is beyond the intent of this report. Its scope is limited to highlighting at least some of the results of the analyses of the samples collected from the selected statewide network.

STATEWIDE WATER QUALITY NETWORK

The U.S. Geological Survey maintains a network of more than 500 water-quality stations on streams, lakes, canals, and estuaries in Florida. The frequency of sampling at these stations and types of analyses made vary according to cooperator and Geological Survey needs and how the data are to be used in evaluating the water resources of the State. About 30 of the network stations are sampled daily for specific conductance and water temperature measurements. Some stations are sampled weekly for analysis for pH, specific conductance, chloride, fluoride, and phosphate. Many other stations are sampled bimonthly or quarterly for biochemical oxygen demand, dissolved oxygen, nitrogen and phosphorus species, and specific conductance. All network stations are sampled at least twice per year for field water-quality measurements and for laboratory analyses.

A statewide mass sampling of surface waters in Florida was begun in 1966 to provide a synoptic statewide view of inorganic water quality at low streamflow. This sampling was carried out at 500 to 600 stations during May, which is the normal low-flow period in the State. Samples were collected at all stations for a standard inorganic analysis plus orthophosphate and manganese. The standard inorganic analysis includes the following dissolved ion and physical determinations: alkalinity or acidity, calcium, magnesium, sodium, hardness, potassium, iron, chloride, sulfate, nitrate, fluoride, silica, specific conductance, color, pH, and dissolved solids. The statewide mass sampling at these same 500-600 locations for virtually the same type of analysis was repeated during the normal low-water periods in May 1967, 1968, and 1969. Field dissolved oxygen measurements were added to the program in 1967 and laboratory determinations for strontium and total phosphate were added in 1968.

In 1970 a major revision of the annual mass sampling of surface waters in Florida was made. The program was expanded to include an extensive analysis for about 40 chemical and physical parameters at 99 selected network stations. These stations were sampled semiannually, in May during normal low flow and in September during normal high flow.

The network stations were selected to provide water-quality information on (1) the major stream systems in Florida under differing hydrologic regimens, (2) streams either little affected or greatly affected by man's activities, (3) lakes either little affected or greatly affected by man, (4) streams with high organic color, (5) selected major springs and (6) selected estuaries. Figure 1 shows the location of the 99 network stations. Table 1 lists the stations, using the same numbers shown on the map. Table 2 gives the field and laboratory determinations made for the selected 99 network stations. Also given in table 2 are sample collection procedures, sample preservation, and laboratory analytical methods.

The sampling of the remaining 400-500 network stations not included in the selected 99-station May-September network continued for the annual low-water period but the type of analyses (or the number of parameters analyzed) was increased. Analyses for nitrate, nitrite, ammonia, organic nitrogen, orthophosphate, and total phosphate were added to the list of inorganic parameters previously determined on samples from these stations.

SUMMARY OF DATA

Table 1 gives the number of samples analyzed in May and September of 1970-71 and the ranges in concentration of the various nitrogen species, ortho and total phosphate, trace metals, dissolved solids, biochemical oxygen demand, total organic carbon, and turbidity. All data are released annually in "Water Resources Data for Florida, Part 2, Water Quality Records." A brief summary of the results for each parameter in table 1 is given below.

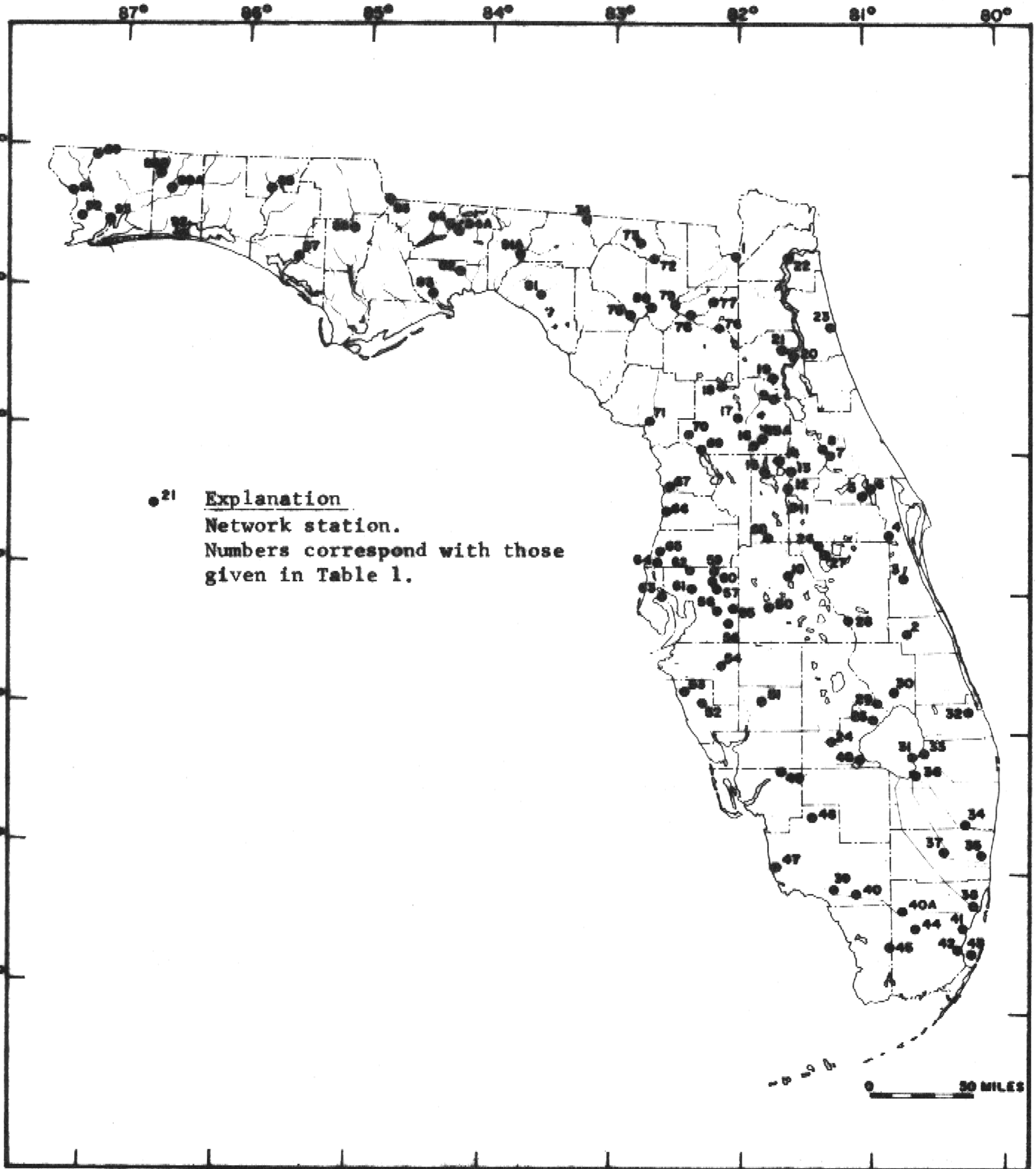

Figure 1.--Map of Florida showing selected 99-station May-September Network

TABLE 1.--SUMMARY OF ANALYSES FROM SELECTED 99-STATION MAY-SEPTEMBER NETWORK SHOWING RANGES OF DETERMINATIONS, 1970-1971

Map Site No.	Station Name	a/ No.	Nitrate (NO_3) (mg/1)	No.	Nitrite (NO_2) (mg/1)	No.	Ammonia (NH_4) (mg/1)	No.	Organic Nitrogen (N) (mg/1)	No.	Ortho Phosphate (PO_4) (mg/1)	No.	Total Phosphate (PO_4) (mg/1)
1	St. Marys River near Macclenny	7	0.0-00.3	6	0.04-0.07	4	0.01-00.14	4	0.21-00.78	4	0.13-00.27	2	0.18-00.29
2	Blue Cypress Lake near Fellsmere	12	.0- .8	11	.01- .06	11	.03- 1.1	11	.54- 3.2	12	.04- .23	11	.12-33
3	St. Johns River near Melbourne	15	.0- 1.6	15	.02- .27	13	.08- .42	14	.40- 4.5	15	.04- .24	11	.09- .34
4	St. Johns River near Cocoa	18	.0- 5.4	18	.00- .04	14	.00- .27	15	.32- 3.3	17	.02- .13	12	.05- .39
5	Econlockhatchee River near Chuluota	5	.0-10	5	.23-2.4	5	.45- 3.8	4	1.0 - 1.3	5	2.5 -14	5	3.2 -15
6	St. Johns River above Lake Harney near Geneva	11	.4- 3.4	11	.02- .26	10	.03- .55	10	.12 - 2.6	10	.37- 2.5	5	.58- 2.5
7	Blue Springs near Orange City	4	.2- 1.3	4	.01- .04	4	.08- .13	4	.10- .29	4	.17- .22	4	.21- .24
8	St. Johns River near Deland	6	.0- 4.6	6	.01- .04	4	.12- .03	4	.54- 1.9	5	.26- .91	5	.31- 1.1
9	Lake Kerr near Eureka	4	.0	4	.00- .06	4	.05- .09	3	.15- .45	4	.02- .03	4	.04- .07
10	Lake Lowery near Haines City	4	.0	4	.02- .07	4	.04- .14	4	.57- 1.7	4	.06- .09	4	.10- .21
11	Lake Apopka at Winter Garden	4	.0- 1.0	4	.01-1.7	4	.08- .58	4	2.7 -13	4	.15- 1.2	4	.42- 1.5
12	Apopka-Beauclair Canal near Astatula	6	.0- 1.0	6	.02- .17	6	.03- .58	6	.24- 7.0	6	.11- 1.9	6	.27- 2.6
13	Lake Dora at Mt. Dora	3	.0- .3	3	.04- .12	3	.03- .11	3	2.9 - 4.7	2	.19- .67	3	.45- 1.1
14	Lake Yale at Grand Island	4	.0	4	.01- .08	4	.08- .20	4	.70- 2.5	4	.08- .23	4	.17- .40
15	Lake Griffin at Leesburg	4	.0	4	.02- .07	4	.07- .13	4	.62- 4.0	4	.03- .10	4	.15- .26
15A	Oklawaha River at Moss Bluff	19	.0- 3.1	19	.01- .90	13	.02- .26	13	.34- 3.0	17	.04- .25	17	.08- .32
16	Lake Weir at Oklawaha	4	.0	4	.01- .06	4	.04- .18	4	.40- 2.3	4	.01- .04	4	.03- .07
17	Silver Springs at Silver Springs	4	2.6- 2.9	4	.00- .02	4	.03- .07	4	.05- 1.0	4	.11- .15	4	.14- .27
18	Orange Lake at Orange Lake	4	.0- .1	4	.01- .08	4	.00- .11	4	.61- 1.5	4	.05- .13	4	.11- .78
19	Oklawaha River below Rodman Dam near Orange Springs	8	.0- .2	8	.01- .02	8	.04- .09	8	.12- 1.2	8	.03- .16	8	.06- .38
20	St. Johns River at Palatka	4	.0- .4	4	.02- .05	4	.05- .08	4	.06- 4.6	4	.05- .16	4	.09- .24
21	Rice Creek near Palatka	4	.0- 3.4	4	.03- .38	4	.06- .77	4	.53- 2.2	0	--	4	.88- .15
22	St. Johns River at Jacksonville	17	.0- 1.8	17	.00- .39	13	.00- .39	9	.28- .85	16	.09- .53	16	.19- .59
23	Moultrie Creek at State Hwy 207 near St. Augustine	4	.0- 3.0	4	.02- .08	4	.06- .15	4	.62- .92	4	.16- .72	4	.25- .78
24	Fisheating Creek at Palmdale	13	.0- 1.2	13	.01- .08	8	.07- .30	8	.51- 2.2	12	.06- .90	12	.12- 1.1
25	Indian Prairie Canal above S-72 near Okeechobee	15	.0- .7	15	.01- .08	14	.05- .82	14	.23- 3.1	14	.05- 1.9	14	.12- 2.1
26	Shingle Creek at Airport near Kissimmee	5	.0- .3	5	.02- .05	5	.05- .12	5	.25- 1.3	5	2.9 -20	5	3.0 -20
27	Lake Tohopekaliga at Kissimmee	7	.0- .4	7	.01- .11	7	.03- .20	7	.67- 2.1	7	.23- 2.6	7	.37- 3.1
28	Kissimmee River at S-65 near Lake Wales	5	.0- .9	5	.02- .05	5	.05- .47	5	.63- 4.4	5	.04- .19	5	.11- .42
29	Kissimmee River above S-65E near Okeechobee	15	.0- 2.2	15	.01- .11	10	.03- .43	10	.30- 2.9	12	.04- 1.5	13	.11- 1.6

a/ Number of analyses

Table 1-Continued

Map Site No.	Station Name	No.	Arsenic (As) (µg/1)	No.	Cadmium (Cd) (µg/1)	No.	Chromium (Cr) (µg/1)	No.	Cobalt (Co) (µg/1)	No.	Iron (Fe) (µg/1)	No.	Lead (Pb) (µg/1)
1	St. Marys River near Macclenny	4	0 - 10	2	0 - 4	4	0 - 10	2	0	4	170-550	4	0 - 3
2	Blue Cypress Lake near Fellsmere	4	0 - 20	3	0 - 10	4	0	2	0	4	100-230	4	0 - 2
3	St. Johns River near Melbourne	3	0 - 30	6	0	6	0	2	0	6	70-190	4	0 - 1
4	St. Johns River near Cocoa	6	0 - 20	5	0	6	0	2	0	6	60-170	6	0 - 10
5	Econlockhatchee River near Chuluota	5	0 - 40	5	0	6	0 - 2	3	0	5	40-440	6	0 - 10
6	St. Johns River above Lake Harney near Geneva	5	10 - 20	4	0	5	0 - 10	2	0 - 1	7	40-290	5	0 - 10
7	Blue Springs near Orange City	4	0 - 20	2	0	4	0 - 10	2	0	4	30- 80	4	0 - 10
8	St. Johns River near DeLand	4	0 - 40	2	0	4	0 - 20	2	0	4	30-150	4	0 - 11
9	Lake Kerr near Eureka	3	0	2	0	4	0 - 1	2	0	4	20- 40	4	0 - 15
10	Lake Lowery near Haines City	4	0 - 10	2	0	4	0 - 10	2	0 - 1	4	30-190	4	0 - 19
11	Lake Apopka at Winter Garden	4	10 - 20	2	0	4	0 - 10	2	0 - 1	4	30-260	4	0 - 30
12	Apopka-Beauclair Canal near Astatula	5	10 - 20	2	0	5	0	2	0	5	40-260	5	0 - 10
13	Lake Dora at Mt. Dora	3	10 - 30	1	0	3	0 - 1	1	0	3	10- 70	3	2 - 30
14	Lake Yale at Grand Island	4	0 - 20	2	0	4	0 - 1	2	0	4	840-1000	4	1 - 18
15	Lake Griffin at Leesburg	4	0 - 10	2	0	4	0	2	0	4	30- 60	4	0 - 15
15A	Oklawaha River at Moss Bluff	4	0 - 20	2	0	4	0 - 10	1	0	4	0-400	4	0 - 10
16	Lake Weir at Oklawaha	4	0 - 10	2	0	4	0	2	0 - 1	4	0- 40	4	0 - 20
17	Silver Springs at Silver Springs	4	0	2	0	4	0 - 10	2	0 - 1	4	0- 20	4	0 - 20
18	Orange Lake at Orange Lake	4	0 - 40	2	0	4	0 - 10	2	0	4	20- 70	4	1 - 10
19	Oklawaha River below Rodman Dam near Orange Springs	4	0 - 10	2	0	4	0 - 10	2	0 - 1	4	30-110	4	0 - 10
20	St.Johns River at Palatka	4	0 - 20	2	0	4	0 - 10	2	0 - 1	4	40-130	4	0 - 20
21	Rice Creek near Palatka	4	0 - 20	3	0 - 1	4	0	3	0 - 1	4	210-660	4	3 - 30
22	St. Johns River at Jacksonville	4	0 - 10	3	0	4	0 - 40	3	0 - 1	4	70-250	4	0 - 10
23	Moultrie Creek at State Hwy 207 near St. Augustine	4	0 - 30	2	0 - 2	4	0 - 10	2	0 - 2	4	170-560	4	0 - 10
24	Fisheating Creek at Palmdale	4	0 - 20	2	0 - 1	4	0 - 10	2	0 - 2	4	70-510	4	0 - 13
25	Indian Prairie Canal above S-72 near Okeechobee	3	0 - 20	2	0	3	0 - 1	1	1	3	470-820	3	0 - 2
26	Shingle Creek at Airport near Kissimmee	4	0 - 30	2	0 - 1	4	0 - 20	2	0 - 1	4	90-430	4	0 - 10
27	Lake Tohopekaliga at Kissimmee	7	0 - 10	2	0	7	0 - 10	2	0 - 1	7	40-390	7	0 - 10
28	Kissimmee River at S-65 near Lake Wales	4	10 - 40	2	0	4	0 - 10	2	0 - 1	4	180-340	4	0 - 40
29	Kissimmee River above S-65E near Okeechobee	5	10 - 20	2	0 - 1	5	0 - 10	2	0 - 1	7	120-440	5	0 - 10

Table 1-Continued

Map Site No.	Station Name	No.	Mercury (Hg) (µg/l)	No.	Calculated Dissolved Solids (mg/l)	No.	Biochemical Oxygen Demand (BOD) (mg/l)	No.	Total Organic Carbon (TOC) (mg/l)	No.	Turbidity (JTU)	No.
1	St. Marys River near Macclenny	2	0.0	6	15- 37	3	0.0-4.1	4	18 - 30	4	5 -25	
2	Blue Cypress Lake near Fellsmere	2	.0	4	96- 147	4	.5-1.9	5	15 - 19	7	2 -12	
3	St. Johns River near Melbourne	2	.0	7	113- 429	5	.1-3.0	3	20 - 30	12	1 - 8	
4	St. Johns River near Cocoa	2	.0	8	206- 932	7	.5-3.4	6	18 - 26	13	4 -20	
5	Econlockhatchee River near Chuluota	3	.0	5	146- 292	5	.8-5.3	4	12 - 31	4	2 -18	
6	St. Johns River above Lake Harney near Geneva	2	.0	8	761- 1,980	8	.1-4.0	5	19 - 28	9	4 -15	
7	Blue Springs near Orange City	2	.0	4	478- 898	3	.2- .6	2	5.0- 6.0	4	.0- 1	
8	St. Johns River near DeLand	2	.0	4	440- 834	12	1.3-5.8	1	10	4	1 -10	
9	Lake Kerr near Eureka	2	.0	4	56- 62	3	.3-6.9	2	2.0- 3.0	3	1 - 3	
10	Lake Lowery near Haines City	2	.0	4	49- 64	3	1.7-6.9	2	17 -147	3	6 - 9	
11	Lake Apopka at Winter Garden	2	.0	4	156- 201	3	5.3-6.2	1	42	4	33 -65	
12	Apopka-Beauclair Canal near Astatula	2	.0	5	195- 231	5	2.1-7.9	3	25 - 48	5	15 -45	
13	Lake Dora at Mt. Dora	1	.0	3	191- 220	2	6.6-8.0	2	24 -233	3	20 -48	
14	Lake Yale at Grand Island	2	.0	4	91- 111	4	2.6-6.3	2	23 - 24	3	5 - 8	
15	Lake Griffin at Leesburg	4	.0	4	94- 152	4	3.4-5.6	2	19 - 41	4	5 -22	
15A	Oklawaha River at Moss Bluff	2	.0- .2	9	127- 158	9	1.6-5.9	3	17 - 28	14	5 -23	
16	Lake Weir at Oklawaha	2	.0	4	67- 69	3	1.3-2.6	1	5.0	4	2	
17	Silver Springs at Silver Springs	2	.0- .1	4	230- 248	3	.8-1.4	1	1.0	4	.1- 1.2	
18	Orange Lake at Orange Lake	2	.0	4	33- 42	2	3.3-3.6	2	16 - 18	3	6 -10	
19	Oklawaha River below Rodman Dam near Orange Springs	3	.0- .1	4	171- 250	8	.8-4.3	3	5.0- 20	8	3 -10	
20	St. Johns River at Palatka	3	.0- .1	4	367- 708	4	1.7-3.2	1	13	4	4 -12	
21	Rice Creek near Palatka	3	.0- .9	4	144- 585	3	1.3-8.2	1	49	3	2 -20	
22	St. Johns River at Jacksonville	2	.0	9	587-14,100	4	1.1-3.8	3	8.0- 18	11	1 -13	
23	Moultrie Creek at State Hwy 207 near St. Augustine	2	.0	4	100- 542	4	.8-6.4	1	16	3	1 - 5	
24	Fisheating Creek at Palmdale	2	.0	8	39- 755	4	1.3-2.1	4	14 - 34	7	2 -20	
25	Indian Prairie Canal above S-72 near Okeechobee	2	.0- .7	4	70- 146	3	1.4-3.9	4	3.0- 30	13	1 -15	
26	Shingle Creek at Airport near Kissimmee	3	.0-1.2	4	126- 660	4	1.2-13	3	13 - 30	4	2 -20	
27	Lake Tohopekaliga at Kissimmee	2	.0-1.0	7	71- 127	4	1.9-3.6	2	3.0- 11	7	5 -50	
28	Kissimmee River at S-65 near Lake Wales	2	.0- .9	4	44- 77	4	.6-4.6	1	19	5	6 -14	
29	Kissimmee River above S-65E near Okeechobee	1	.0	5	85- 144	5	.4-3.4	4	12 - 24	9	4 - 9	

Table 1-Continued

Map Site No.	Station Name	No.	Nitrate (NO_3) (mg/l)	No.	Nitrite (NO_2) (mg/l)	No.	Ammonia (NH_4) (mg/l)	No.	Organic Nitrogen (N) (mg/l)	No.	Ortho Phosphate (PO_4) (mg/l)	No.	Total Phosphate (PO_4) (mg/l)
30	Taylor Creek above Okeechobee	13	0.0-14.5	12	0.02- .58	8	0.05- 2.8	8	.50- 2.6	11	1.4 - 9.7	11	1.7 -11
31	Lake Okeechobee at Pahokee	4	.2- .7	4	.03- .06	4	.07- .12	4	.59- 3.5	4	.06- .14	4	.11- .23
32	St. Lucie Canal at Lock near Stuart	10	.0- 1.0	10	.01- .15	7	.07- .14	7	.23- 1.0	10	.06- .52	10	.08- .63
33	West Palm Beach Canal at HGS-5 at Canal Point	16	.0- 4.3	16	.01- .92	12	.03- 4.0	12	.35- 7.0	16	.06- .52	16	.08- .62
34	Hillsboro Canal at S-39 near Deerfield Beach	11	.0- 1.7	11	.01- .29	11	.05- 1.5	10	.97- 5.4	11	.01- .12	11	.06- .22
35	Plantation Road Canal at S-33 near Ft. Lauderdale	6	.0-22	6	.01-2.2	6	.62-38	6	.01-20	5	7.0 -39	5	7.0 -40
36	North New River Canal at S-2 and HGS-4 near South Bay	1	1.3	1	.09	1	.28	1	1.9	1	.04	1	.12
37	North New River Canal above S-34 near Ft. Lauderdale	4	.0- .2	4	.02- .03	4	.00- .26	4	.07- 2.1	4	.01- .06	4	.03- .09
38	Miami Canal at NW 36th St. at Miami	10	.0- 2.8	10	.01- .12	9	.05- 1.2	9	.04- 1.6	9	.01- .09	9	.05- 1.4
39	Tamiami Canal Outlets (Bridge 84), Monroe to Carnestown	4	.0- .1	4	.01- .02	4	.02- .20	4	.28- 1.4	4	.00- .07	4	.04- .16
40	Tamiami Canal Outlets (Bridge 105) 40 Mile Bend to Monroe near Miami	5	.0- .2	5	.01- .06	5	.02-30	5	.30- 3.1	5	.01- .82	4	.06- 1.5
40A	Tamiami Canal at S-12B near Miami	4	.0- 1.0	4	.01- .04	4	.12- 1.2	4	1.2 - 2.5	4	.00- .15	4	.04- 2.8
41	Black Creek Canal above S-21 near Goulds	6	.3- 3.7	6	.04- .07	6	.11- .55	6	.08- 1.1	6	.44- 4.5	6	.53- 4.5
42	Military Canal near Homestead	5	.2- 8.4	5	.04- .31	5	.08- .61	5	.02- 1.5	5	.33- 6.9	5	.34- 6.9
43	Biscayne Bay near Homestead	4	.0- .3	4	.01- .03	4	.10- .21	4	.15- .85	4	.00- .06	4	.05- .08
44	Everglades P-33 near Homestead	4	.0- .4	4	.01- .02	3	.13- .15	3	.74- 3.7	4	.01- .02	4	.03- .07
45	Everglades P-35 near Homestead	4	.0- 5.9	4	.00- .04	2	.10- .18	2	.78- 3.4	3	.01- .25	2	.04- .10
46	Lake Trafford near Immokalee	3	.0	3	.02- .04	3	.06- .34	3	.80- 2.6	3	.01- .33	3	.17- .40
47	Golden Gate Canal at Naples	13	.0- .5	13	.01- .07	11	.01- .05	10	.15- .93	12	.00- .08	6	.02- .24
48	Caloosahatchee Canal at Moore Haven	13	.1- 2.8	13	.02- .23	10	.06- .80	10	.45- 2.8	14	.02- .84	14	.07- 1.0
49	Caloosahatchee River at S-79 near Olga	5	.0- 1.3	5	.01- .05	4	.06- .11	4	.11- .98	4	.03- .41	4	.11- .45
50	Peace River at Bartow	13	.0- 2.3	13	.03- .30	10	.03- 1.4	3	1.4 -13	12	5.6 -74	12	5.8 -75
51	Peace River at Arcadia	21	.2- 8.3	21	.00- .70	9	.06- .47	4	.59- 1.3	12	2.1 -10	13	6.6 -11
52	Myakka River near Sarasota	4	.0	4	.03- .05	4	.04- .09	4	.84- 2.7	4	.10- 1.2	4	.16- 1.3
53	Phillippi Creek at Sarasota	4	1.1- 4.4	4	.07- .19	4	.07- .28	4	.78- 2.5	4	1.1 - 7.5	4	1.1 - 8.0

Table 1-Continued

Map Site No.	Station Name	No.	Arsenic (As) (µg/1)	No.	Cadmium (Cd) (µg/1)	No.	Chromium (Cr) (µg/1)	No.	Cobalt (Co) (µg/1)	No.	Iron (Fe) (µg/1)	No.	Lead (Pb) (µg/1)
30	Taylor Creek above Okeechobee	4	0 - 20	2	0 - 1	4	0 - 1	2	0	5	40-490	4	2 - 20
31	Lake Okeechobee at Pahokee	4	0 - 30	2	0	4	0 - 10	2	0 - 1	4	20- 60	4	0 - 40
32	St. Lucie Canal at Lock near Stuart	4	10 - 30	2	0 - 1	4	0 - 30	2	0 - 1	4	20-260	4	0 - 10
33	West Palm Beach Canal at HGS-5 at Canal Point	5	0 - 10	2	0 - 1	5	0 - 1	2	0 - 1	4	10-350	5	2 - 30
34	Hillsboro Canal at S-39 near Deerfield Beach	9	0 - 30	3	0	9	0 - 10	1	1	7	20- 80	9	0 - 10
35	Plantation Road Canal at S-33 near Ft. Lauderdale	6	0 - 50	4	0	6	0 - 1	3	0 - 1	6	50-200	6	0 - 10
36	North New River Canal at S-2 and HGS-4 near South Bay	1	0	1	0	1	0	1	0	1	30	1	1
37	North New River Canal above S-34 near Ft. Lauderdale	4	10 - 40	2	0	4	0 - 20	2	0 - 1	3	4- 60	4	0 - 20
38	Miami Canal at NW 36th St. at Miami	5	0 - 40	2	0	5	0 - 20	2	0 - 1	7	0-250	5	1 - 10
39	Tamiami Canal Outlets (Bridge 84), Monroe to Carnestown	4	0 - 10	2	0	4	0	2	0 - 1	3	60-150	4	0 - 20
40	Tamiami Canal Outlets (Bridge 105) 40 Mile Bend to Monroe near Miami	4	0 - 30	2	0 - 1	4	0 - 10	2	0	4	40-110	4	0 - 10
40A	Tamiami Canal at S-12B near Miami	4	0 - 40	2	0	4	0	2	0 - 1	3	70-180	4	0 - 40
41	Black Creek Canal above S-21 near Goulds	4	0 - 10	2	0	4	0	2	0	4	30- 50	4	0 - 10
42	Military Canal near Homestead	4	0 - 20	2	0	4	0 - 20	2	0	4	3-150	4	0 - 20
43	Biscayne Bay near Homestead	4	0 - 20	2	0	4	0 - 40	2	0	4	100-250	4	0 - 10
44	Everglades P-33 near Homestead	3	0 - 10	-	-	3	0 - 20	-	-	3	80-700	3	0 - 10
45	Everglades P-35 near Homestead	2	0 - 10	-	-	2	0 - 20	-	-	2	90-310	2	5 - 6
46	Lake Trafford near Immokalee	3	0 - 20	2	0	3	0	2	0 - 1	3	90-230	3	2 - 30
47	Golden Gate Canal at Naples	10	0 - 30	4	0	9	0 - 10	2	0 - 2	10	20-640	10	0 - 10
48	Caloosahatchee Canal at Moore Haven	4	0 - 20	2	0 - 1	4	0	2	0 - 1	3	40-290	4	0 - 10
49	Caloosahatchee River at S-79 near Olga	4	0 - 20	3	0	4	0 - 1	3	0 - 2	4	20-330	4	0 - 2
50	Peace River at Bartow	3	0 - 80	1	0	3	0 - 10	1	0	3	40-120	3	0 - 1
51	Peace River at Arcadia	4	0 - 20	2	0	3	0	2	0 - 1	2	40-170	3	0 - 3
52	Myakka River near Sarasota	4	0 - 10	2	0	4	0 - 20	2	0	4	190-560	4	0 - 8
53	Phillippi Creek at Sarasota	4	0 - 20	3	0	4	0 - 10	3	0	4	80-350	4	0 - 10

Table 1-Continued

Map Site No.	Station Name	No.	Mercury (Hg) (µg/1)	No.	Calculated Dissolved Solids (mg/1)	No.	Biochemical Oxygen Demand (BOD) (mg/1)	No.	Total Organic Carbon (TOC) (mg/1)	No.	Turbidity (JTU)	No.	
30	Taylor Creek above Okeechobee	2	0.0	6	48- 1,790	4	2.1-5.3	3	14 -35	8	4 -15		
31	Lake Okeechobee at Pahokee	2	.0-1.0	4	173- 325	4	1.0-2.0	2	15 -27	4	11 -46		
32	St. Lucie Canal at Lock near Stuart	2	.0	4	203- 364	4	.5-1.7	3	13 -24	7	10 -28		
33	West Palm Beach Canal at HGS-5 at Canal Point	2	.0- .5	6	181- 671	4	1.6-2.4	3	19 -35	12	9 -48		
34	Hillsboro Canal at S-39 near Deerfield Beach	2	.0	10	153- 802	3	2.3-2.8	3	24 -35	12	3 -22		
35	Plantation Road Canal at S-33 near Ft. Lauderdale	2	.0	6	254- 401	3	2.8-6.9	3	17 -28	5	4 -30		
36	North New River Canal at S-2 and HGS-4 near South Bay	1	.2	1	317	1	1.5	1	24	1	15		
37	North New River Canal above S-34 near Ft. Lauderdale	2	.2- .6	4	310- 622	3	.8-3.2	2	21 -41	4	10 -20		
38	Miami Canal at NW 36th St. at Miami	2	.0	8	293- 412	5	1.0-2.3	1	15	9	3 -28		
39	Tamiami Canal Outlets (Bridge 84), Monroe to Carnestown	1	.0	4	139-43,700	3	1.0-1.7	1	10	3	4 - 7		
40	Tamiami Canal Outlets (Bridge 105) 40 Mile Bend to Monroe near Miami	2	.0-1.2	4	127- 259	3	1.8-4.7	2	12 -24	5	5 -55		
40A	Tamiami Canal at S-12B near Miami	1	.0	4	129- 376	3	1.7-2.0	1	25	4	4 -15		
41	Black Creek Canal above S-21 near Goulds	2	.0	6	279-33,700	4	1.4-4.3	2	2.0 -10	6	0 -15		
42	Military Canal near Homestead	2	.0	5	360-34,800	3	2.5-4.0	1	13	5	1 -17		
43	Biscayne Bay near Homestead	2	.0	4	22,100-45,000	4	1.0-3.5	2	10 -11	4	3 - 6		
44	Everglades P-33 near Homestead	-	-	3	243- 307	-	-	-	-	-	-		
45	Everglades P-35 near Homestead	1	.6	4	262-12,600	-	-	-	-	2	5 -10		
46	Lake Trafford near Immokalee	2	.0	3	87- 130	3	.9-6.1	2	14 -24	3	2 - 5		
47	Golden Gate Canal at Naples	3	.0-1.8	12	294- 653	5	1.0-2.8	3	17 -22	11	2 -62		
48	Caloosahatchee Canal at Moore Haven	2	.0- .3	4	194- 305	3	2.0-2.8	2	20 -25	9	1 -22		
49	Caloosahatchee River at S-79 near Olga	3	.0-2.3	3	301- 799	5	1.1-1.7	3	13 -22	4	10 -15		
50	Peace River at Bartow	1	.0	3	153- 273	2	5.6-7.9	1	47	12	1 -65		
51	Peace River at Arcadia	1	.0	9	63- 291	3	.7-1.6	1	10	13	3 -25		
52	Myakka River near Sarasota	2	.0- .5	4	46- 115	3	1.0-2.4	2	26 -72	4	2 -10		
53	Philippi Creek at Sarasota	2	.0-1.7	4	337- 700	3	2.0-3.3	2	16 -21	4	1 -44		

Table 1-Continued

Map Site No.	Station Name	No.	Arsenic (As) (µg/l)	No.	Cadmium (Cd) (µg/l)	No.	Chromium (Cr) (µg/l)	No.	Cobalt (Co) (µg/l)	No.	Iron (Fe) (µg/l)	No.	Lead (Pb) (µg/l)
54	Manatee River near Myakka Head	4	10 - 30	2	0	4	0	2	0 - 1	4	70-470	4	0 - 1
55	North Prong Alafia River at Keysville	4	0 - 20	2	0	4	0 - 10	2	0 - 1	4	30-110	4	0 - 1
56	South Prong Alafia River near Lithia	3	0 - 20	2	0	3	0	2	0 - 1	3	50-110	3	0 - 6
57	Baker Creek near Thonotasassa	4	0 - 40	2	0 - 1	4	0	2	0 - 1	4	100-170	4	0 - 4
58	Alafia River at Lithia	4	0 - 10	1	0	4	0 - 2	3	0 - 1	4	0- 70	4	0 - 3
59	Hillsborough River near Zephyrhills	3	0 - 30	2	0	3	0 - 10	2	0	3	30-170	3	0 - 1
60	Flint Creek near Thonotosassa	3	10 - 20	2	0	3	0	2	0	3	20- 70	3	0 - 15
61	Hillsborough River at Fowler Ave near Tampa	4	0 - 20	2	0	4	0 - 30	2	0	4	40-280	4	0 - 25
62	Lake Magdalene near Lutz	4	0 - 10	2	0	4	0 - 10	2	0 - 1	4	20- 50	4	0 - 8
63	Old Tampa Bay at Safety Harbor	4	0 - 20	2	0	4	0 - 40	2	0	4	50-140	4	0 - 6
64	Anclote River near Elfers	4	10 - 20	2	0	4	0	2	0	5	40-460	4	0 - 10
65	Pithlachascotee River near New Port Richey	1	0	1	0	-	-	-	-	3	100-170	1	0
66	Weekiwachee Springs near Brooksville	4	0 - 10	3	0 - 1	4	0 - 1	3	0	4	0- 60	4	0 - 2
67	Chassahowitzka River near Homosassa	4	0 - 30	2	0	4	0	2	0	4	20- 60	4	0 - 5
68	Withlacoochee River near Eva	4	10 - 60	2	1 - 2	4	0	2	0	4	230-770	4	0 - 20
69	Withlacoochee River near Holder	4	0 - 10	2	0	4	0 - 10	2	0	4	20-430	4	0 - 10
70	Rainbow Springs near Dunnellon	4	0 - 10	2	0	4	0 - 20	2	0	3	5- 30	4	0 - 20
71	Waccasassa River near Gulf Hammock	4	0 - 10	2	0	4	0	2	0	4	30-520	4	2 - 20
72	Suwannee River at White Springs	4	0 - 30	2	0	4	0 - 10	2	0	4	300-580	3	1 - 10
73	Swift Creek at Facil	4	0 - 10	3	0 - 2	4	0 - 1	3	0 - 2	4	90-228	4	0 - 20
74	Withlacoochee River near Pinetta	4	0 - 10	2	0 - 1	4	0	2	0 - 1	4	230-440	3	1 - 10
75	Suwannee River at Branford	4	0 - 20	2	0 - 1	4	0 - 20	2	0	4	100-180	4	0 - 1
76	Santa Fe River near Graham	4	0 - 30	2	0 - 1	4	0 - 1	2	0 - 1	4	290-550	4	0 - 20
77	New River near Lake Butler	4	0 - 20	2	0 - 2	4	0 - 10	2	0 - 1	4	170-550	4	0 - 10
78	Santa Fe River at Worthington Springs	4	0 - 10	2	0 - 1	4	0 - 10	2	0	4	260-360	4	0 - 20

Table 1-Continued

Map Site No.	Station Name	No.	Mercury (Hg) (µg/1)	No.	Calculated Dissolved Solids (mg/1)	No.	Biochemical Oxygen Demand (BOD) (mg/1)	No.	Total Organic Carbon (TOC) (mg/1)	No.	Turbidity (JTU)	No.	
54	Manatee River near Myakka Head	2	0.0	4	16- 78	1	0.1	1	4.0	4	1 - 5		
55	North Prong Alafia River at Keysville	2	.0- .3	4	331- 627	3	.6-1.3	2	63 - 92	13	3 -30		
56	South Prong Alafia River near Lithia	2	.0	4	186- 259	2	.7-1.3	4	11 - 17	13	3 -13		
57	Baker Creek near Thonotasassa	3	.0-2.2	5	77- 291	3	.1-4.1	3	11 - 48	13	4 -88		
58	Alafia River at Lithia	3	.0-1.0	5	239- 542	4	.1-2.4	2	8.0- 10	15	1 -30		
59	Hillsborough River near Zephyrhills	2	5.1-5.2	4	148- 181	2	.4- .9	2	1.0- 5.0	7	1 -17		
60	Flint Creek near Thonotosassa	2	.0	5	103- 162	-	-	3	27 -105	8	4 -25		
61	Hillsborough River at Fowler Ave near Tampa	3	.0-4.6	5	121- 189	3	.4-3.6	2	7.0- 17	10	1 -13		
62	Lake Magdalene near Lutz	2	.0	4	54- 67	4	1.7-2.5	3	5.0- 19	4	1 - 5		
63	Old Tampa Bay at Safety Harbor	2	.0	4	17,600-28,500	3	2.0-2.7	1	15	4	1 -15		
64	Anclote River near Elfers	2	.0-1.4	14	42- 230	5	.3-1.0	2	15 - 24	11	2 -22		
65	Pithlachascotee River near New Port Richey	-	-	1	160	1	.2	-	-	4	3 - 4		
66	Weekiwachee Springs near Brooksville	2	.0	4	147- 155	2	1.0-1.1	2	1.0- 2.0	10	0 - 2		
67	Chassahowitzka River near Homosassa	2	.0	4	272- 401	3	.2-2.5	3	.0- 8.0	12	0 - 5		
68	Withlacoochee River near Eva	2	.0	7	22- 91	3	1.0-3.2	2	30 -124	8	1 - 8		
69	Withlacoochee River near Holder	2	.0	8	121- 186	8	.1-1.5	1	22	11	1 - 8		
70	Rainbow Springs near Dunnellon	3	.0	4	67- 76	4	.2-1.2	1	0	8	0 - 2		
71	Waccasassa River near Gulf Hammock	2	.0	4	127- 549	4	.6-2.3	2	3.0- 10	3	3 - 5		
72	Suwannee River at White Springs	2	.0	3	16- 17	6	.5-5.2	3	31 - 70	8	1 -18		
73	Swift Creek at Facil	3	.0	4	98- 437	6	1.1-6.1	4	11 - 22	8	6 -28		
74	Withlacoochee River near Pinetta	2	.0	11	19- 188	6	.9-3.8	4	12 - 18	15	2 -30		
75	Suwannee River at Branford	2	.0	10	24- 173	6	.0-2.1	3	7.0- 32	15	2 -20		
76	Santa Fe River near Graham	2	.0	4	23- 34	6	.2-2.0	4	30 - 70	8	1 - 8		
77	New River near Lake Butler	2	.0	4	66- 150	4	.7-2.9	3	11 - 18	3	4 -20		
78	Santa Fe River at Worthington Springs	2	.0	12	33- 81	4	.5-1.4	2	15 - 23	12	2 -15		

Table 1-Continued

Map Site No.	Station Name	No.	Nitrate (NO_3) (mg/1)	No.	Nitrite (NO_2) (mg/1)	No.	Ammonia (NH_4) (mg/1)	No.	Organic Nitrogen (N) (mg/1)	No.	Ortho Phosphate (PO_4) (mg/1)	No.	Total Phosphate (PO_4) (mg/1)
54	Manatee River near Myakka Head	3	0.0-00.2	3	0.01-0.03	4	0.02-00.13	4	0.20-01.1	4	0.56-02.9	4	0.64-02.9
55	North Prong Alafia River at Keysville	17	.0- 7.1	17	.01- .08	11	.01- 6.1	5	.42- .69	17	15 -125	15	22 -130
56	South Prong Alafia River near Lithia	16	.0- .3	16	.01- .07	10	.01- .17	5	.31- 1.1	16	11 -41	13	11 -50
57	Baker Creek near Thonotasassa	13	.0- 4.5	15	.00- .28	11	.06- 2.2	7	.54- 5.4	12	1.1 - 3.4	12	1.2 - 3.8
58	Alafia River at Lithia	18	.0- 8.6	18	.00- .09	12	.05- .66	7	.04- 7.8	18	12 -81	16	12 -81
59	Hillsborough River near Zephyrhills	7	.0- 5.7	7	.00- .17	5	.05- .18	4	.31- 1.2	8	.93- 3.5	6	.99- 3.6
60	Flint Creek near Thonotosassa	10	.0-14	10	.01- .10	8	.07- .52	4	1.0 - 2.9	8	1.1 - 2.2	8	1.2 - 2.5
61	Hillsborough River at Fowler Ave near Tampa	11	.0- 2.2	10	.01- .05	8	.04- .18	4	.08- 1.1	10	.66- 3.2	10	.71- 3.4
62	Lake Magdalene near Lutz	4	.0	4	.00- .02	4	.02- .12	4	.36- .65	4	.01- .05	4	.05- .07
63	Old Tampa Bay at Safety Harbor	4	.0- .2	4	.00- .02	4	.01- .23	4	.04- 1.1	4	2.1 - 4.4	4	2.3 - 4.7
64	Anclote River near Elfers	19	.0- 1.3	19	.00- .15	9	.03- .17	5	.15- .50	14	.04- .13	15	.10- 1.2
65	Pithlachascotee River near New Port Richey	1	2.4	1	.04	1	.05	4	.16- .62	4	.03- .12	2	.04- .13
66	Weekiwachee Springs near Brooksville	11	.1- .5	11	.00- .05	10	.01- .10	5	.12- 1.3	11	.02- .16	10	.03- .16
67	Chassahowitzka River near Homosassa	15	.5- .9	15	.00- .06	9	.03- .14	9	.07- .51	15	.02- .07	7	.06- .09
68	Withlacoochee River near Eva	14	.0- .1	14	.02- .11	9	.05- .83	9	.13- 1.6	13	.07- .23	12	.08- .32
69	Withlacoochee River near Holder	17	.0- .6	17	.00- .03	11	.03- .10	11	.08- 3.3	14	.01- .12	14	.05- .17
70	Rainbow Springs near Dunnellon	6	.2- 2.5	6	.00- .11	4	.04- .08	3	.00- .35	5	.06- .19	6	.09- .29
71	Waccasassa River near Gulf Hammock	4	.0- .2	4	.03- .07	4	.06- .09	4	.20- .50	4	.09- .16	4	.11- .21
72	Suwannee River at White Springs	8	.0- .4	8	.03- .08	8	.00- .18	8	.16- 1.1	8	.23- .68	8	.23- .81
73	Swift Creek at Facil	8	.1-26	8	.01-1.0	8	.05-30	8	.00- 1.2	8	25 -95	8	26 -97
74	Withlacoochee River near Pinetta	20	.0- 3.5	20	.02- .09	14	.00- .12	15	.17- 1.6	10	.20- 1.3	18	.30- 1.4
75	Suwannee River at Branford	19	.0- 5.0	19	.01- .07	15	.00- .10	15	.09- 1.0	18	.28- .82	10	.31- .85
76	Santa Fe River near Graham	8	.0	8	.02- .08	8	.00- .14	8	.15- 3.8	8	.09- .56	8	.12- .61
77	New River near Lake Butler	4	1.6- 3.2	4	.06- .20	4	.03- .27	4	.48- .68	4	1.3 - 3.5	4	1.4 - 3.8
78	Santa Fe River at Worthington Springs	16	.0- .9	16	.01- .08	12	.00- .13	12	.27- 2.1	16	.44- .99	16	.48- 1.2

Table 1-Continued

Map Site No.	Station Name	No.	Mercury (Hg) (µg/1)	No.	Calculated Dissolved Solids (mg/1)	No.	Biochemical Oxygen Demand (BOD) (mg/1)	No.	Total Organic Carbon (TOC) (mg/1)	No.	Turbidity (JTU)	No.
79	Olustee Creek near Providence	2	0.0	4	25- 32	4	0.9-21	2	27 - 44	3	2 - 3	
80	Ichatucknee Springs near Hildreth	2	.0	4	170- 173	4	.2- 2.6	3	.0- 9.0	3	0 - 2	
81	Fenholloway River at Foley	3	.0	4	230- 1,560	2	2.5-152	3	132 -452	4	1 - 30	
81A	Aucilla River at Lamont	2	.0 - .5	4	23- 58	4	.6- 2.2	3	29 - 53	4	0 - 5	
82	Wakulla Springs near Crawfordville	2	.0	4	143- 156		.0- 1.2	3	1.0- 33	2	2 - 3	
83	Sopchoppy River near Sopchoppy	-2	.0 -2.0	2	11- 142	11	.4- 4.2	3	18 - 39	14	2 - 7	
84	Ochlockonee River near Havana	3	.0	11	29- 108	4	.4- 2.3	2	8.0- 20	11	1 -50	
84A	Lake Jackson near Tallahassee	2	.0 - .5	4	9- 15	4	1.0- 2.9	3	4.0- 7.0	4	1 - 5	
85	Apalachicola River at Chattahoochee	2	.0 - .7	11	38- 73	4	.8- 2.3	1	2.0	11	5 -50	
86	Chipola River near Altha	1	.0	6	57- 116	3	.1- .6	2	2.0	9	1 -90	
87	Deer Point Lake near Panama City	2	.0	4	41- 109	4	.0- 1.2	3	3.0- 69	4	1 - 4	
88	Choctawhatchee River at Caryville	2	.0	8	26- 52	4	.7- 1.5	4	2.0- 7.0	7	2 -40	
88A	Yellow River at Milligan	2	.0	8	20- 41	3	.5- .9	2	3.0- 5.0	8	5 -30	
88B	Blackwater River near Baker	2	.0	4	13- 17	4	.3- .8	3	3.0- 5.0	4	1 - 4	
89	Escambia River near Century	3	.0 -1.0	8	22- 74	4	.4- 2.2	2	5.0- 6.0	3	10 -20	
90	Elevenmile Creek near Ensley	3	.0	5	558- 678	4	10 -82	3	100 -214	4	1 -60	
91	Perdido River at Barineau Park	2	.0	4	17- 20	4	.2- 2.3	3	2.0-171	4	2 - 3	
92	Choctawhatchee Bay near Villa Tasso	2	.0	4	9,470- 18,000	4	.1- 1.0	2	6.0- 7.0	4	3 - 6	
93	Escambia Bay at I-10 at Pensacola	2	.0	4	9,480- 14,500	4	1.6- 2.7	2	4.0- 7.0	4	1 -13	

TABLE 2.--FIELD AND LABORATORY DETERMINATIONS, SAMPLING PROCEDURES AND ANALYTICAL METHODS

	LABORATORY DETERMINATIONS					
Field Determinations	Anions bottle (filtered - 0.45 micron filter)	Cations bottle (filtered - 0.45 micron filter 1 ampoule HNO_3)	Nutrient bottle (unfiltered - 20 drops $HgCl_2$)	BOD bottle (unfiltered - shipped to lab. on ice)	Cations bottle (unfiltered - 1 ampoule HNO_3 /6)	Total Organic Carbon (glass vial, 1 drop $HgCl_2$)
Temperature, °C Dissolved Oxygen pH Gage Height Discharge	Sulfate Chloride Fluoride Dissolved Solids	Calcium /1 Magnesium /1 Strontium /1 Iron /1 Manganese /1 Copper /1 Chromium /1 Zinc /1 Cadmium /2 Cobalt /2 Lead /2 Sodium /2 Potassium /2	Nitrate /3 Nitrite /3 Ammonia /3 Total Organic Nitrogen /3 Orthophosphate /3 Total Phosphorus/3 Silica /3 Turbidity	BOD Alkalinity Color Arsenic Specific Conductance	Total Recoverable Mercury /4	Total Organic Carbon /5 Total Inorganic Carbon /5 Total Carbon/5

Analytical method:

1/ Atomic Assorption direct on aqueous solution.
2/ Atomic Assorption after solvent extraction.
3/ Auto Analyzer.
4/ Cold-Vapor Atomic Assorption.
5/ Carbon Analyzer.
6/ 3 milliliters of double distilled nitric acid diluted 1:1 with distilled water.

Nitrate (NO_3).--Nitrate is usually the most prevalent form of nitrogen in water because it is the end product of the aerobic decomposition of organic nitrogen.

Eight hundred and forty four samples from the 99 network stations were analyzed for nitrate. The nitrate concentration did not exceed 45 mg/l (milligrams per liter), the limit for drinking water recommended by the U.S. Public Health Service, 1962, in any of the samples analyzed. At 11 percent of the stations concentrations were greater than 5 mg/l, and at 3 percent greater than 10 mg/l. The concentration was highest, 26 mg/l at station 73, Swift Creek at Facil, which receives industrial waste. The concentrations were lowest in the 15 lakes because of utilization of nitrate by algae and aquatic plants. The nitrate concentration was zero for all samples collected from nine of the fifteen lakes.

Nitrite (NO_2).--Nitrite is an intermediate product in the oxidation of ammonia to nitrate. It is unstable in the presence of oxygen and is generally present only in low concentrations in natural waters under aerobic conditions. The presence of nitrite in water is sometimes an indication of organic pollution.

Eight hundred and thirty two samples from the 99 stations were analyzed for nitrite. At two-thirds (67) of the stations the nitrite concentrations were less than 0.1 mg/l; only 6 percent had maximum concentrations greater than 1.0 mg/l. At only two stations was the nitrite concentration greater than 2.0 mg/l, the limit generally accepted for domestic water supplies (McKee and Wolf, 1963). These were station 5, Econlockhatchee River (2.4 mg/l) and station 35, Plantation Road Canal (2.2 mg/l), both of which receive domestic sewage effluent.

Ammonia (NH_4).--Ammonia is normally present in water as the ammonium ion (NH^{+4}). Ammonia is produced by bacterial breakdown of organic nitrogen material and by excretion of urea and amino acids by zooplankton and other aquatic organisms. More than 0.1 mg/l of ammonia in water usually indicates organic pollution (Rudolph, 1931).

A total of 671 samples was analyzed for ammonia. At 22 percent of the stations ammonia did not exceed 0.10 mg/l. Eight percent had minimum concentrations in excess of 0.10 mg/l and 10 percent had maximum concentrations in excess of 1.0 mg/l. Ammonia was highest, 38 mg/l, at station 35, Plantation Road Canal at S-33 near Fort Lauderdale.

Organic nitrogen (N).--Organic nitrogen includes all nitrogenous organic compounds, such as amino acid, polypeptides, and proteins. It is present in all surface waters as the result of inflow of nitrogenous products and normal biological activity in the water body. Sewage and industrial effluents often contain high organic nitrogen concentrations. Organic nitrogen is important in aquatic biological activity because it is a potential source of nitrogen for both plant and animal life.

A total of 624 samples was analyzed for organic nitrogen from the 99 stations. The organic nitrogen content did not exceed 1.0 mg/l at 31 percent of the stations and was always greater than 1.0 mg/l at 8 percent. Three percent had concentrations greater than 10 mg/l. It was highest, 20 mg/l, at station 35, Plantation Road Canal.

Orthophosphate (PO_4).--Phosphate has been named as the primary nutrient contributing to the over-enrichment or eutrophication of lakes and other water bodies. Orthophosphate is the major inorganic form of phosphorus and is the most readily available form for aquatic plant growth.

In 1970-71, 766 samples from 97 of the network stations were analyzed for orthophosphate. In water samples from 12 percent of the stations the orthophosphate content did not exceed 0.1 mg/l; from 38 percent of the stations the range was from 0.1 to 1.0 mg/; from 19 percent the range was from 0.51 to 1.0 mg/l; from 19 percent the range was 1.1 to 5.0 mg/l; and 12 percent of the stations had concentrations in excess of 5.0 mg/l. The maximum concentration of 125 mg/l occurred at station 55, North Prong Alafia River at Keysville. Concentrations were highest in streams draining the phosphate mining areas.

Total phosphate (PO_4).--Total phosphate includes all forms of inorganic and organic phosphorus.

A total of 715 samples was analyzed for total phosphate from the 99 stations. Total phosphate was generally only slightly higher than orthophosphate. The high ortho and total phosphate from the mining areas were frequently the same, indicating that all was in the inorganic form.

Arsenic (As).--Arsenic compounds are present naturally in some waters, but the occurrence of quantities detrimental to health is rare. Weed killers, insecticides, and many industrial wastes contain arsenic and are potential sources of water pollution.

A total of 402 samples was analyzed for arsenic from the 99 stations. Arsenic was detected at 92 percent of the stations, however, the concentrations were always less than 10 μg/l (micrograms per liter) for 41 percent of the stations and less than 20 μg/l for 74 percent of the stations. Only two stations exceeded 50 μg/l, the maximum concentration considered safe for drinking water (U.S. Public Health Service, 1962). The highest concentration of 80 μg/l occurred at station 50, Peace River at Bartow.

Cadmium (Cd).--Cadmium is one of the most toxic trace metals in the environment, however, in natural forms it is not very soluble in water. The maximum concentration of cadmium considered safe for drinking water by the U.S. Public Health Service is 10 µg/1. Toxic concentrations sometimes occur in effluent from such industries as metallurgy, electroplating, ceramics, and photography.

A total of 215 samples was analyzed for cadmium from 97 of the network stations. Cadmium was detected in low concentrations (generally less than 2 µg/1) at 32 percent of the stations. The highest concentration of 10 µg/1 occurred at station 2, Blue Cypress Lake at Fellsmere in April 1970. However, 10 µg/1 was the lower limit of detection for the analytical procedure used in April 1970. Later procedures involving solvent extraction lowered the detection limit for cadmium to 1 µg/1.

Chromium (Cr).--Chromium is a trace toxic metal occurring in the hexavalent (Cr^{+6}) and tervalent (Cr^{+3}) forms. Few waters contain chromium from natural sources. Potential sources are effluents from such industries as manufacturers of paints, dyes, explosives, ceramics, paper, metal plating, anodizing aluminum, and textile dyeing. The U.S. Public Health Service recommends that hexavalent chromium in drinking water not exceed 50 µg/1. No limits have been established for the tervalent form.

A total of 405 samples was analyzed for chromium from 98 stations. The values given in table 1 are for total chromium (hexavalent + tervalent) in 1970 and hexavalent chromium in 1971. Chromium was detected at 74 percent of the stations, ranging up to 40 µg/1. The chromium at 79 percent of the stations did not exceed 10 µg/1. Total chromium was 40 µg/1 at four stations. Hexavalent chromium was detected only in trace quantities (maximum 2 µg/1) at a few stations.

Cobalt (Co).--Cobalt reportedly has a relatively low toxicity to man and trace quantities are essential to plant growth and animal nutrition. Some uses of cobalt are in nuclear technology, for making alloys, in high-speed tool steel, as binders in the tugsten-carbide tool industry, and as a pigment in the china and glass industry.

A total of 197 samples was analyzed for cobalt from 96 of the network stations. Trace quantities of cobalt were detected at 57 percent of the stations. Concentrations were as high as 2 µg/l at only 7 percent of the stations.

Iron (Fe).--Iron is one of the most abundant metals in the earth's crust; however, because it is readily precipitated in alkaline water, it is seldom one of the major dissolved constituents. Iron in concentrations greater than 200 µg/l is objectionable in waters for public supply because of deposition of red stains on plumbing fixtures and laundry. The U.S. Public Health Service (1962) recommends that iron in public water supplies not exceed 300 µg/l.

A total of 411 samples was analyzed for iron from the 99 stations. Concentrations of iron were highest at stations where water was the most highly colored which, generally, was at high flow rates. Iron concentrations were always in excess of 300 µg/l at 6 percent of the stations and at 39 percent of the stations it sometimes exceeded 300 µg/l. The highest concentration of 1,300 µg/l occurred at station 81A, Aucilla River at Lamont.

Lead (Pb).--Lead is only a minor element in most natural waters, but some industrial effluents may contain appreciable quantities. Many of the lead salts are water soluble and are used for such purposes as printing, dyeing, photography, and engraving. Lead used as gasoline additives is probably the major source of lead in the environment. Leaded gasoline contains 2-4 grams of tetraethyl lead (1.3-2.6 grams lead) per gallon (Hall, 1972). Lead is a cumulative poison to humans and animals but the individual sensitivity differs. The U.S. Public Health Service recommends that the lead in drinking water not exceed 50 µg/l.

A total of 405 samples was analyzed for lead from the network stations. Lead was detected at all stations but one and was in all samples from 23 percent of the stations. Lead concentrations did not exceed 10 µg/l at 61 percent of the stations and 20 µg/l at 79 percent of the stations. The highest concentration of 48 µg/l occurred at station 81, Fenholloway River at Foley, just downstream from heavy industrial pollution.

Mercury (Hg).--Mercury has received much attention in the past few years as a major pollutant in the environment. Very few natural waters contain detectable concentrations of mercury, however, the element may be introduced into water through effluent from metallurgical or other industrial waste. All soluble mercury salts are exceedingly poisonous to human and animal life. The unofficial suggested upper limit for drinking water is 5.0 µg/l.

Analyses for total recoverable mercury on unfiltered samples which includes mercury in solution and on suspended material was made on 203 samples from 97 of the stations, mostly in May and September 1971. Mercury, mostly in small concentrations, was detected at 32 percent of the stations. The highest concentration, 5.1 and 5.2 µg/l, occurred at station 59, Hillsborough River at Zephyrhills.

Dissolved solids (calculated).--Calculated dissolved solids is a summation of all major dissolved constituents. Water with several thousand milligrams per liter of dissolved solids is generally not palatable. The U.S. Public Health Service (1962) recommends that the maximum concentration of dissolved solids not exceed 500 mg/l in drinking water.

Dissolved solids was determined on 518 samples from the 99 network stations. Nine of the stations are in tide water (or subject to salt-water intrusion); consequently, the dissolved solids were very high, as much as 45,000 mg/l at station 43, Biscayne Bay near Homestead. The average dissolved solids for sea water is 35,000 mg/l. Excluding the nine stations subject to salt-water intrusion, dissolved solids at 21 percent of the remaining stations exceeded 500 mg/l for some of the samples analyzed. The highest concentration of 1,980 mg/l occurred at station 6, St. Johns River above Lake Harney near Geneva. The high dissolved solids in the upper St. Johns River during drought periods are caused by the inflow of highly mineralized artesian water from flowing wells and by upward seepage from the artesian aquifer through the faulted confining beds.

Biochemical oxygen demand (BOD).--The 5-day biochemical oxygen demand is a measure of the oxygen consumed by biochemical processes in 5 days and gives an indication of the degree of organic pollution from such sources as domestic wastes. Raw sewage will contain a high BOD of several hundred milligrams per liter, whereas, unpolluted water often has a BOD less than 1.0 mg/l. Heavy BOD loading causes a depletion of dissolved oxygen in a stream.

BOD was determined on 381 samples from 96 of the network stations. BOD was always less than 5.0 mg/l for 77 percent of the stations. Only four stations had BOD's greater than 10 mg/l. The highest BOD, 152 mg/l occurred in the heavily polluted Fenholloway River at Foley.

Total organic carbon (TOC).--TOC includes all natural organic carbon and also that caused by pollution. In the highly colored streams of Florida concentrations of organic carbon are high although the stream may contain little or no organic pollution.

TOC was determined on 232 samples from 96 stations. The organic carbon did not exceed 10 mg/l for 25 percent of the stations,25 mg/l for 59 percent of the stations, and 50 mg/l for 85 percent of the stations. It exceeded 100 mg/l for 7 percent of the stations. The highest concentration of 452 mg/l occurred in the polluted Fenholloway River at Foley.

Turbidity.--Turbidity, reported in Jackson Turbidity Units (JTU), is a measure of the degree of opaqueness of water. It is caused by the presence of suspended particulate matter such as clay or silt, finely divided organic matter, plankton, and other microscopic organisms. Turbidity is measured rapidly with a turbidity meter by the nephelometric method. The U.S. Public Health Service recommends that turbidity in finished drinking water not exceed 5.0 JTU.

A total of 666 turbidity measurements was made on samples from 98 of the network stations. Twenty percent of the stations did not exceed 5.0 JTU, the limit for drinking water. Seventy-two percent of the stations did not exceed 25 JTU and 90 percent did not exceed 50 JTU. The highest measurement of 90 JTU occurred in a sample from the Chipola River near Altha.

CONCLUSIONS

Nitrogen and phosphorus were adequate in samples from most stations sampled to support normal biological activity. The nitrate concentrations did not exceed 45 mg/l, the upper limit for drinking water. Excessive concentrations of nitrite were detected in the Econlockhattchee River (2.4 mg/l) and Plantation Road Canal (2.2 mg/l). Samples from Plantation Road Canal contained excessive concentrations of ammonia (38 mg/l) and organic nitrogen (20 mg/l). Streams draining the phosphate mining area contained the highest concentrations of phosphate. A maximum of 125 mg/l orthophosphate was detected in a sample from North Prong Alafia River.

Of the toxic trace elements only arsenic exceeded the U.S. Public Health Service limit of 50 µg/l for drinking water, in one sample from Peace River (map site 50), and one sample from the Withlacoochee River (map site 68). The arsenic content in these samples were 80 µg/l and 60 µg/l. In two samples mercury exceeded the suggested limit of 5.0 µg/l for drinking water in the Hillsborough River (5.1 and 5.2 µg/l at map site 59). Iron, a non-toxic metal, exceeded the U.S. Public Health Service standard of 300 µg/l at 39 percent of the stations.

Excluding nine stations subject to salt-water intrusion, 21 percent of the remaining stations yielded water samples that contained more than 500 mg/l of dissolved solids, the U.S. Public Health Service's limit for drinking water. BOD was generally low except at a few stations. The highest BOD of 152 mg/l was for a sample collected from the Fenholloway River. TOC was highest in colored water samples and polluted water. A concentration of 452 mg/l was measured in a sample from the Fenholloway River in Taylor County where the river contains pulp-mill waste. Turbidity was generally less than 50 JTU.

REFERENCES

Brown, Eugene, Skougstad, M. W., and Fishman, M. J., 1970, Methods for collection and analysis of water samples for dissolved minerals and gases: U.S. Geol. Survey Techniques of Water Resources Investigations, book 5, chap. A1, 160 p.

Hall, Stephen K., 1972, Lead pollution and poisioning: Environmental Science and Technology, v. 6, no. 1, p. 30-35.

McKee, J. E., and Wolf, H. W., 1963, Water quality criteria: State Water Quality Control Board, pub. 3A, Sacramento, Calif., p. 226.

Rudolph, Z., 1931, Principles of the determination of the physical and chemical standards of water for drinking, industrial, and domestic purposes: Water Pollution Abs. 4 (March).

U.S. Geol. Survey, released annually, Water resources data for Florida, Part 2, Water quality records.

U.S. Public Health Service, 1962, Drinking water standards: U.S. Public Health Service pub. 956, 61 p.