United States
Environmental Protection
Agency

Region 4
345 Courtland Street, NE
Atlanta GA 30308

EPA 904/9-79-046
JULY 1979

EPA

LIMNOLOGICAL INVESTIGATION

LAKE SIDNEY LANIER WITH SPECIAL REFERENCE TO SELECTED HEAVY METALS

LIMNOLOGICAL INVESTIGATION OF LAKE SIDNEY LANIER WITH SPECIAL REFERENCE TO SELECTED HEAVY METALS

July 1979

Environmental Protection Agency
Surveillance and Analysis Division
Athens, Georgia 30605

CONTENTS

ACKNOWLEDGEMENTS

The planning and operation of this project was carried out under the supervision of Mr. L. B. Tebo, Jr., Chief of the Ecology Branch.

Dr. R. L. Raschke was the project leader and author of this report.

Personnel contributing to the field, laboratory, and data recovery aspects of the study include:

EPA, Region IV

Field

R. Raschke
P. Frey
H. Howard
D. Schultz
J. Compton
R. Tolliver
D. Smith

Laboratory

W. McDaniel
R. Lawless

STORET

W. Holsomback

EPA, Duluth Laboratory

D. Mount
E. Leonard

State of Georgia

R. Fatora
G. Engle

Others who deserve special mention and a thank you include Mrs. Trudy Stiber for typing the manuscript, and Messrs. L. B. Tebo, P. J. Frey, L. B. Carrick, and W. H. Peltier for providing editorial comments.

SUMMARY OF FINDINGS

Limnological and potamological studies were conducted in the Chattahoochee River Basin upstream of Buford, Georgia during the late summer and autumn of 1978. Sampling effort concentrated on Lake Sidney Lanier and two major rivers, the Chestatee and Chattahoochee Rivers and their tributaries. These studies were directed toward determining the extent of selected metals in the basin. In conjunction with metal determinations, effects of intermittent dam discharges on limnology were evaluated. The major findings of the study are:

- During the study copper concentrations ranged from undetectable at various depths to a high of 657 ug/L in October at the 41 meter depth, and zinc concentrations ranged from undetectable at various depths to 218 ug/L in October at the 41 meter depth of Lake Lanier.

- Copper and zinc values in sampled waters exceeded concentrations which are toxic to trout.

- On several occasions, iron concentrations exceeded 1000 ug/L, a criterion set by EPA for all aquatic life.

- Copper concentrations ranging from 144 to 200 ug/g dry weight of liver tissue were found in unstressed hatchery fish early in the study, but by November when abnormal fish mortality was occurring, accumulations ranged from 284 to 842 ug/g dry weight of liver tissue.

- The thermocline near the dam ranged in thickness from 9 meters in August to 5 meters in November. Its upper limit slowly descended during the study from within 9 meters of the surface in August to 19 meters below the surface by November.

- Thermocline descent and decrease in thickness were associated with autumn turnover, reduction in water level, and penstock releases during hydroelectric generation.

- Thermal data showed that during hydroelectric generation, opened penstocks drew water from the epilimnion, thermocline and hypolimnion.

- During periods of non-generation, water discharging from Buford Dam came from the hypolimnion.

- Dissolved oxygen concentrations of <1 mg/L existed throughout the hypolimnion by the end of October -- at about the time fish mortality began to increase at the Buford Hatchery.

- TOC concentrations ranging from undetectable to 12.0 mg/L were indicative of relatively clean waters organically.

- Hydrogen sulfide, one of the compounds suspected of killing fish at the Buford Hatchery, was not detected during the study.

INTRODUCTION

Discharges emanating from Lake Sidney Lanier have been the subject of several monitoring efforts (Kopp and Kroner, 1967; Anon, 1970, 1971a, 1971b; West, 1966; EPA Region IV STORET Files). More recently, these efforts intensified because of fish mortality every autumn since 1976 at the Georgia Game and Fish Commission Buford Fish Hatchery. Coupled with increased monitoring efforts were special studies carried out by the State of Georgia or its contractors (Noell and Oglesby, 1977; Anon., 1977; Deutsch and Oglesby, 1978; Oglesby, 1978).

EPA's involvement in the hatchery problem began in 1977 when the Georgia Department of Natural Resources asked for technical assistance. EPA responded by sending a team of biologists and chemists to the hatchery site. They systematically investigated the problem and concluded that copper was the most likely cause of trout mortality (Mount, et al., 1978). With this information in hand, Mr. John A. Little, EPA Region IV Deputy Regional Administrator, ordered a follow-up investigation. Region IV's Surveillance and Analysis Division in Athens, Georgia was assigned responsibility for conducting the study. Objectives of the study were to:

- conduct a mid-summer and early autumn limnological investigation of Lake Lanier,
- evaluate the influence of intermittent draw-off at Buford Dam on Lake Lanier limnology,
- evaluate Chestatee and Chattahoochee River inputs into Lake Lanier and track these inputs through the system.

STUDY AREA

Lake Sidney Lanier had its beginning in 1956 when the U.S. Army Corps of Engineers (COE) closed off Buford Dam for water supply, navigation, flood control and auxillary power needs. It is the uppermost reservoir of the Chattahoochee River (Figure 1) located next to the communities of Buford and Gainesville in northeast Georgia (Figure 2).

Buford Dam was designed to impound water up to a level of 330.79 meters above mean sea level (msl) forming a lake with a maximum surface area of 161.47 km^2 and a volume of 3,148.665 x 10^7 m^3 (EPA, 1975). At full pool the hydraulic retention time for the lake is approximately 1.6 years. Lake level will fluctuate seasonally, but rarely would it be expected to reach its minimum pool level at 315.55 meters above msl. Lake Lanier and downstream water levels are controlled by two penstocks located near the bottom of the dam between elevations 280.18 meters above msl and 286.89 meters above msl.

Two major tributaries provide most of the flow into Lake Lanier. They are the Chattahoochee and Chestatee Rivers (Figure 3). The Chattahoochee River receives drainage from the southern slope of the Blue Ridge Mountains in Georgia. Its average flow is 28.4 m^3/sec (EPA, 1975). The Chestatee River originates in Lumpkin County, Georgia. It flows over a relatively steep incline before entering the lake at Chattahoochee River Mile 364.5 where it forms a major arm of Lake Lanier (Figure 3). Its average flow is 15.8 m^3/sec (EPA, 1975).

STATION LOCATIONS

To accomplish the major objectives of this study, EPA concentrated its effort on Lake Lanier proper and the two nearby rivers -- the Chattahoochee and Chestatee Rivers (Figure 3). As part of the overall evaluation of river inputs, personnel from the Georgia Game and Fish Commission collected fish for metal analyses in streams located in the upper reaches (upreservoir from Lake Lanier) of the Chattahoochee and Chestatee watersheds. The exact sampling sites can be obtained from the Commission's Gainesville office.

EPA sampling locations (Figure 3) are divided into river and lake stations as follows:

River Stations

Chattahoochee

Station 0 is located downstream of Buford Dam at Chattahoochee River Mile 348.5. Samples were collected from the COE's automatic water quality monitoring station.

Station CH-52 is located between Chattahoochee River Miles 387.6 and 391.2. Water samples were either collected from State Hwy 52 Bridge or Belton Bridge (County Hwy 883) located at Belton Park (Figure 3). Sample locations varied because of changing flows.

Chestatee

Station CH-60 is located downstream of Dahlonega, Georgia at Chestatee River Mile 25.9. Water samples were collected from State Hwy 60 Bridge which spans the Chestatee River.

Reservoir Stations

Water samples were collected at five reservoir stations during the study. They include stations 1, 2, 3, 4 and 5 (Figure 3).

Station 1 is located just outside of the dam safety zone in the main channel of the Chattahoochee River at River Mile 348.9.

Stations 2 and 3 are located further up-reservoir from station 1 at Chattahoochee River Mile 349.9. Station 3 is located in the main channel and station 2 to the right of the channel looking downreservoir.

Stations 4 and 5 are located near Holiday Isles at Chattahoochee River Mile 353.6. Station 5 is located in the main channel of the Chattahoochee River and Station 4 to the right as shown in Figure 3.

A special thermal study was conducted in September to determine the extent of the thermocline and to locate the plunge zone where colder incoming water descends below the surface of the lake's epilimnetic waters. Measurements were made at the following locations:

Chattahoochee River Mile - 391.2
390.0
389.0
387.6
359.97 - Browns Bridge
368.6 - Lanier Bridge
371.3 - Thompson Bridge
375.3 - Longstreet Bridge
378.3 - Clarke Bridge

Chestatee River Mile	-	21.0	
		17.8	
		16.6	
		12.6	- Wilkie Bridge
		6.9	- Bolling Bridge

METHODS

During each month of the study period, one week was allocated for river sample collections at stations CH-52 and CH-60. For five consecutive days prior to reservoir sampling, samples were collected each day for analyses of TOC, copper, zinc, manganese, iron, alkalinity, and turbidity. Temperature, pH, and conductivity were measured with each sample collection.

From June through October, it was our intent to collect water samples from stations CH-52 and CH-60 during three storm events. Unfortunately, 1978 was a relatively dry year; only one storm event occurred during the sampling schedule.

At reservoir stations 1 through 5, water temperatures were observed with a YSI Model 57 meter. Temperatures were measured every 5 meters in the epilimnion and hypolimnion and at one meter intervals through the thermocline. Other samples were collected less frequently for the measurement of conductivity, turbidity, pH, alkalinity, total organic carbon (TOC), copper, zinc, iron, and manganese.

Metals analyses of water samples were conducted according to methodology found in Methods for Chemical Analyses of Water and Wastes (EPA, 1974). Other analyses on water samples were done according to methodology found in Standard Methods (1975).

Fish tissue samples collected by the Georgia Game and Fish Commission were sent to EPA Region IV's Laboratory in Athens or to the EPA Duluth Laboratory for metals analyses. Methods used are described in Interim Methods for Sampling and Analysis of Priority Pollutants in Sediments and Fish (EPA, 1978).

During the fish-kills at the Buford Hatchery, four water samples were collected on November 3, 1978 from hatchery raceways and analyzed for copper, zinc, manganese and iron. Sample locations and times are as follows:

Raceway Number	Raceway Location	Time of Collection in Hours
15	Tail	0520
13	Middle	0520
13	Middle	0700
15	Tail	0730

RESULTS AND DISCUSSION

TEMPERATURE, DISSOLVED OXYGEN (DO) AND HYDROGEN SULFIDE

Because of fish-kill problems at the Buford Hatchery and the unknown source of poor quality water discharging from Buford Dam, we were charged with the task of evaluating the effect of intermittent drawoff at Buford Dam on the limnology of Lake Lanier. To perform this task, we concentrated our efforts at five reservoir stations located near the dam (Figure 3). Emphasis was placed on measuring dissolved oxygen and temperature over diel cycles.

The most extreme and confounding effects of drawoff should occur close to the dam. This is why station 1 was located just beyond the COE safety zone, about 0.1 River Mile (R.M.) upreservoir from the dam. Findings supported expectations; therefore, the following discussion will concentrate primarily on the Station 1 area.

The thickness of the thermocline (Figure 4 and Table 1) ranged from 9 meters in August to 5 meters thick in November. Consequently, the upper limit of the thermocline was within 10 meters of the surface in August, but by November it had descended to 19 meters. This descent is associated primarily with autumn turnover which began in early October. From the outset of turnover to the end of the study, the thickness of the thermocline continually diminished (Figure 4).

Descent and reduction in thickness of the thermocline can also be attributed to penstock releases. Penstock releases not only influenced the lowering of the thermocline, but more importantly, they influenced its character during periods of increased discharge. Extensive dips in hypolimnion and thermocline isotherms coincided with periods of water withdrawal from the dam. This influence was even evident further upreservoir at stations 2, 3, and 5 (Figures 5, 6 and 8). Station 4, located 5.1 R.M. upreservoir from the dam and to the right of the main channel, did not exhibit these effects (Figure 7). Cessation of water flow through the penstocks and its effects are even more aptly illustrated in Figure 9 which shows a temporary interruption of the

thermocline upon closure of the penstocks at 2010 to 2035 hours during the 1977 EPA investigation (Mount et al., 1978). Presumably, the momentum of bottom water rushing toward the dam shifted upward into the thermocline immediately after closure of the penstocks.

In November, during the hatchery fish-kills, discharged reservoir water temperatures were greater than expected. Higher temperatures indicated that epilimnetic waters were mixing with bottom waters. To clarify this issue, we measured temperature distribution (Figure 10) practically up to the dam wall (0.01 R.M. upreservoir from the dam wall) at a time when both penstocks were open. As shown in Figure 10, waters from the thermocline and epilimnion were drawn through the penstocks. During periods of non-generation, minimal releases of hypolimnetic water emanate from the dam and are representative of the minimal temperature values found at station 0 (Table 1) downstream from the dam.

One objective of this study was to track storm event waters through Lake Lanier. The single storm event occurred in August, but we were unable, because of timing and personnel limitations, to follow through on our plan. The location of non-storm event waters was determined indirectly through temperature measurements in September. By measuring water temperatures further upreservoir into the Chestatee and Chattahoochee arms, we located the plunge points -- areas of the lake where incoming colder water plunges below the lake surface. These points were located approximately at Chestatee R.M. 17.8 and Chattahoochee R.M. 391.5 (Figures 11 and 12). Incoming waters of both arms, between 21° and 22°C, plunged below the water surface and settled down on or into the thermocline of each arm (Figures 11 and 12).

Intermittent penstock releases had their effect on dissolved oxygen distribution in the thermocline and hypolimnion of station 1 (Figure 4). Most noticeable were the downward isopleth dips in the thermocline during September 12 and 13, and the several fluctuating isopleths in the hypolimnion throughout the study period. From mid-October

to early November, the 1 to 7 mg/L isopleths tended to converge between elevations 302 and 307 meters above msl, illustrating the effects of autumn turnover and increasing oxygen depletion in the hypolimnion.

With the progression of turnover (Figures 4 and 8), greater amounts of dissolved oxygen were found at greater depths. Turnover accompanied with loss of oxygen in the hypolimnion contributed to a narrower thermocline thickness and accompanying sharper contrasts in oxygen values from the upper to the lower thermocline in November. These oxygen changes coincided with more frequent observations of poorer water quality downstream from the dam (Communication from Buford Hatchery), but at no time during our study was H_2S detected (Table 1).

OTHER PARAMETERS, EXCLUDING METALS

Physical and chemical measurements other than oxygen, hydrogen sulfide, and temperature were made for the purpose of characterizing stream and lake waters and tracking storm event waters.

TOC, turbidity, conductivity, pH, and total alkalinity values in the reservoir were not unusually high or low. Generally higher values were located near the bottom of the lake (Table 1) except for TOC where greater concentrations were found near the surface. Values show that Lake Lanier waters are soft and neutral to slightly acid. Furthermore, TOC values were indicative of relatively clean waters organically (Raschke, 1975).

Most values for incoming and outgoing waters (Stations 0, CH-52 and CH-60) were within parameter limits found in the lake. Turbidity and TOC were the exception as higher values were observed in August during the one storm event sampling at Chestatee station 60 and Chattahoochee station 52 (Table 1).

An upward trend in turbidity minimum and maximum values was observed at station 0 (Table 1) which coincided with observations of increasing poorer water quality made by hatchery personnel (personal communication).

METALS IN WATER

Information from bioassay studies conducted in 1977 (Mount, et al., 1978) indicated that copper was the likely agent affecting fish mortality at the Buford Hatchery. Because of these findings, further studies were initiated to locate high copper concentrations upstream from the hatchery. Analyses of water samples included determinations for copper, iron, zinc and manganese. The other three metals had also been found in unusually high concentrations by other investigators (Oglesby, 1978; Deutsch and Oglesby, 1978; Noel and Oglesby, 1977; Anon., 1977; personal communication at Task Force Meetings). Consequently the State of Georgia requested that samples be analyzed for these three metals.

Copper concentrations ranged from undetectable to 657 ug/L at Lake Lanier station 1 in October (Table 2). Maximum values tended to occur near the bottom except in August. At both lake stations 1 and 5, copper maximum values showed an increasing trend early in the season, but the trend did not continue upward. This was not surprising because of the low frequency of sample collection during the study. Slugs of water containing high amounts of copper could easily be missed because of the infrequent sampling schedule.

The range in copper concentrations was much less in the rivers (Stations 0, CH-52 and CH-60) than in the lake (Table 2). Concentrations were undetectable except during the August storm event at Chattahoochee (CH-52) and Chestatee (CH-60) river sampling locations where maximum concentrations of 36 and 30 ug/L respectively were detected. Copper was undetectable in samples collected from the hatchery and the Chattahoochee River downstream of the dam (CH-0). Possibly slugs of water containing high copper concentrations were missed because of sampling frequency. Copper concentrations of up to 30 ug/L have been found in the Chattahoochee River upstream of Atlanta (Kopp and Kroner, 1967) and the State of Georgia recorded copper concentrations at the hatchery inlet ranging from undetectable to 10 ug/L (data provided by State of Georgia).

Copper levels below 20 ug/L are routinely observed in natural waters of the southeast (Kopp and Kroner, 1967). EPA (1976), in evaluating water quality criteria found that concentrations of copper below 25 ug/L are not rapidly fatal for most fish. To circumvent chronic mortality which is the general problem at the hatchery, trout should be exposed to lower concentrations than those mentioned above. In fact, Sauter et al. (1976) recommend that the maximum acceptable toxicant concentration (MATC) not exceed 9.4 ug/L of copper in soft waters (45 mg/L as $CaCO_3$). They showed that brook trout exposed for 24 months at a 9.4 ug/L copper concentration accumulated up to 239 ug copper/gram of liver tissue.

The other three metals in water samples exhibited a wide range of concentrations (Table 2). Iron ranged from undetectable in the lake to a high of 34,820 ug/L in August at Chattahoochee River station CH-52. Concentrations for manganese were quite variable ranging from undetectable at three stations to a maximum in November of 812 ug/L at the 41-meter depth of lake station 1. The greatest zinc concentration was also found in November at the Buford Hatchery. Zinc ranged from undetectable to 733 ug/L. Usually, maximum values for all three metals were found at the lower depths of the lake and during the single storm event at the two incoming river stations. Manganese and iron were the only metals that continually increased at some stations throughout the study period. Both iron and manganese maximum concentrations increased from August to November at station 0, downstream from the dam. Within the lake, manganese showed a continual increase in maximum concentration at station 1.

Maximum values of manganese found in this study (Table 2) were beyond the concentration of 20 ug/L recorded for most natural waters (Kopp and Kroner, 1967), but they are still less than the concentration of 1500 ug/L tolerated by trout (EPA, 1976).

Zinc concentrations downstream of the dam were undetectable until November when a high of 23 ug/L was found. This value is somewhat greater than the average concentration of 19 ug/L recorded for the Chattahoochee upstream of Atlanta, but substantially less than the mean of 64 ug/L in U.S. waterways (Kopp and Kroner, 1967). Levels of zinc found at all stations were high enough to affect chronic trout mortality. Rainbow trout fry populations exposed to 10 ug/L of zinc can be reduced one-half of the original population within 28 days (EPA, 1976). Higher concentrations are necessary to induce mortality in a shorter period of time. For instance, 1380 to 2500 ug/L of zinc are necessary to reduce brook trout populations by one-half within 96 hours (96 hr. TL_{50}) (EPA, 1976). Rainbow trout are more sensitive. Their 96 hr. TL_{50} concentration ranges between 285 and 820 ug/L of zinc, a range overlapping values found at the hatchery in November.

There is no general agreement upon the iron concentrations toxic to fish; information was lacking on this topic in EPA's Quality Criteria for Water (1976). For all aquatic life, however, a criterion of 1000 ug/L has been set by EPA (1976). Maximum iron values during the 1978 study were exceedingly high; at least once they exceeded the 1000 ug/L limit at all stations (Table 2).

COPPER IN FISH TISSUES

Originally it was our aim to analyze "natural" populations of fishes and hatchery fish for accumulations of copper, zinc, iron, and managanese; however, data gaps precluded evaluations of three of the metals. Hatchery fish were not analyzed for zinc, iron and manganese in November, and fish tissues from natural populations were not identified in November samples nor June-July samples submitted for analyses. Accordingly, the remainder of this discussion will concentrate on copper in fish tissues, especially rainbow trout livers.

Copper content ranging from 144 to 200 ug/g dry weight (D.W.) of liver tissue (Table 3) was found in unstressed hatchery trout early in the study. By November-December, the minimum copper concentration in liver tissue had exceeded the maximum level found in July. Copper concentrations in November-December hatchery trout livers ranged from 284 to 842 ug/g D.W. (Table 3). The maximum of 842 ug/g D.W. was over four times the maximum concentration found in liver tissues during July.

Trout exposed to low concentrations of copper can effectively concentrate copper within the range of values found in July's hatchery livers. For instance, McKim and Benoit (1974) showed that brook trout exposed for 24 months to copper levels ranging from 2.7 to 9.4 ug/L accumulated an average of 208 to 239 ug of copper/g D.W. of liver tissue, respectively. At these concentration levels no toxic symptoms were observed; however, toxic effects have been observed at concentration levels of 17.4 and 32.5 ug/L copper (McKim and Benoit, 1971).

November-December copper accumulations in "natural" populations ranging from 0.30 to 258 ug/g D.W. of liver tissue were less than those found in hatchery samples collected in November-December (Table 3). Highest concentrations of copper in "natural" populations were found in fish collected from McClure's Creek both in July and December (Table 3). Presumably, trout populations are exposed to greater amounts of copper in this creek than they are in other streams within the basin. McClure Creek is located in the upper reaches of the Chattahoochee River Basin where it enters the Chattahoochee River a few miles downstream of Helen, Georgia.

The high copper values in the McClure Creek trout coupled with the storm event information about copper in the Chattahoochee and Chestatee Rivers tend to support the hypothesis promulgated in the Mount et al. (1978) report that there are deposits of minerals high in copper content within the basin which are being flushed during periods of runoff.

LITERATURE CITED

Anonymous. 1970. Water Quality Data - Atlanta Area - Chattahoochee-Flint and South Rivers. Georgia Water Quality Control Board, 47 Trinity Ave., SW, Atlanta, GA 30334.

Anonymous. 1971a. Chattahoochee River Basin Study. Georgia Water Quality Control Board, 47 Trinity Ave., SW, Atlanta, GA 30334.

Anonymous. 1971b. Gainesville Area Water Quality Study. Georgia Water Quality Control Board, 47 Trinity Ave., SW, Atlanta, GA 30334.

Anonymous. 1977. A correlation analysis of chemical, biological, and mortality data collected October 29 - November 1, 1976 at the Lake Lanier Trout Hatchery. Metrics Inc., 290 Interstate North, Atlanta, GA 30339.

Deutsch, S. J. and G. B. Oglesby. 1978. Analysis of the toxic effects of physical and chemical properties of hypolimnetic waters by time series. Industrial and Systems Engineering Report Series No. J-78-1, Georgia Institute of Technology, Atlanta.

EPA. 1971. Water Quality Criteria Data Book. Volume 3. Effects of Chemicals on Aquatic Life. Water Pollution Control Research Series 18050GWV05/71.

EPA. 1974. Methods for Chemical analysis of water and wastes. EPA 625/6-74-003. MDQA Research Laboratory, Cincinnati, Ohio.

EPA. 1975. Report on Lake Sidney Lanier, Dawson Forsyth, Gwinett, Hall, and Lumpkin Counties, Georgia. EPA Region IV Working Paper No. 293. National Environmental Research Center, Las Vegas, Nevada.

EPA. 1976. Quality Criteria for Water. EPA. Washington, DC 20460.

EPA. 1978. Interim methods for sampling and analysis of priority pollutants in sediments and fish. EPA. Environmental Monitoring and Support Laboratory, Cincinnati, OH.

Kopp, J. F. and R. C. Kroner. 1967. Trace metals in waters of the U.S. U.S. Dept. of the Interior, FWPCA, Cincinnati, OH.

McKim, J. M. and D. A. Benoit. 1974. Duration of toxicity tests for establishing "no effect" concentrations for copper with Brook Trout (Salvelinus fontinalis). Journal Fisheries Research Board of Canada 31(4): 449-452.

McKim, J. M. and D. A. Benoit. 1971. Effects of long-term exposures to copper on survival, growth, and reproduction of brook trout (Salvelinus fontinalis). J. Fish. Res. Board Can. 28: 655-662.

Mount, D. J., W. Peltier, T. Bennett, R. Weldon, and T. Norberg. 1978. Investigations of fish mortality at Lake Sidney Lanier Fish Hatchery, November, 1977. EPA Environmental Research Laboratory - Duluth.

Noell, W. C. and G. B. Oglesby. 1977. Investigations regarding causes of fish kills at Lake Lanier trout hatchery. Report of Findings. State of Georgia Dept. of Natural Resources, Environmental Protection Division, Atlanta, GA.

Oglesby, G. B. 1978. A review of the proposed mechanism for trout mortality at Lake Lanier Hatchery, Georgia 1976-1977. State of Georgia, Dept. of Natural Resources, Environmental Protection Division, Atlanta, GA.

Raschke, R. L. 1975. Bankhead Reservoir, EPA, Region IV, Surveillance and Analysis Division, Athens, GA.

Sauter, S., K. S. Buxton, K. J. Macek, and S. R. Petrocelli. 1976. Effects of exposure to heavy metals on selected freshwater fish. EPA 600/3-76-105. Duluth, MN.

Standard Methods for the Examination of Water and Waste Water. 1975 14th Edition. American Public Health Association. 1015 Eighteenth Street, NW, Washington, DC.

West, A. W. 1966. Report on pollution of the Chattahoochee River, Alabama-Georgia. U.S. Dept. of Health, Education and Welfare. Robert A. Taft Sanitary Engineering Center. Cincinnati, OH.

TABLES

TABLE 1

LAKE LANIER STUDY, 1978
RANGE OF PARAMETER VALUES

Station	Month	Depth of Thermocline in Meters Upper	Lower	Water Temp. °C	DO mg/L	Turbidity NTU	Conductivity in micromhos at 25°C	pH	Total Alk. as $CaCO_3$ mg/L	TOC mg/L	H_2S ug/L
0	Aug	—	—	8.9 - 8.9	5.3	4	30	6.6	7	—	—
	Sept	—	—	8.9 - 12.3	2.8-3.4	5-8	30-31	--	—	1.3-2.5	—
	Oct	—	—	8.4 - 12.3	4.7-6.3	6-10	25-31	6.2-6.4	9	1.6-3.2	—
	Nov	—	—	9.5 - 16.1	1.4-4.4	8-17	30-34	6.4-6.6	9	<1.0-1.6	—
1	Aug	10(23.3)[a]	19(10.3)	6.2 - 26.3	0.6-8.6	2-9(45)	26-32(43)	5.7-7.1	7-9	1.7-2.6(5)	<0.2
	Sept	9(27.4)	21(11.3)	6.5 - 29.5	2.1-8.2	2-8(30-40)	17-34(5)	5.6-6.4	7-9	1.0-3.0(5)	<0.2
	Oct	17(19.2)	23(12.1)	7.3 - 19.7	0.1-9.0	1-27(43)	25-39(20)	5.7-6.5	8-11	1.0-4.2(40)	<0.2
	Nov	19(16.9)	24(11.3)	8.0 - 18.9	0.0-8.4	2-13(37-44)	29-36(43)	5.7	7-10	<1.0-1.5(35)	<0.2
5	Aug	9(24.3)	19(10.8)	6.3 - 26.8	1.0-8.6	1-4(40)	29-30	5.8-7.1	7-8	1.7-2.7(5)	<0.2
	Sept	10(27.1)	22(14.3)	6.5 - 27.6	1.4-7.8	1-9(30)	24-35(30-35)	6.0-6.4	6-9	1.0-2.7(30)	<0.2
	Oct	17(19.3)	20(14.3)	7.4 - 20.1	0.1-8.6	2-12(35)	27-29(35-40)	5.5-5.7	9-11	1.0-4.2(40)	<0.2
	Nov	19(17.5)	22(12.9)	8.5 - 18.0	0.1-8.4	1-22(40)	29-32(40)	5.6-5.7	7-14	<1.0-2.2(10)	<0.2
CH 60	July	—	—	25.0 - 25.0		7	26	6.5-6.6	8	—	—
(Chestatee	Aug	—	—	19.3 - 21.9		30-175	20-28	6.2-6.6	3-8	2.5-12.0	—
River)	Sept	—	—	20.2 - 21.5		6-8	24-27	6.1-6.9	7-10	<1.0-1.6	—
	Oct	—	—	12.2 - 15.2		4-11	20-30	5.7-6.2	8-9	<1.0-3.4	—
CH 52	July	—	—	25.4 - 25.4		11-14	—	—	—	—	—
(Chatta-	Aug	—	—	19.9 - 22.6		35-475	21-25	6.1-6.6	5-6	3.4-12.0	—
hoochee	Sept	—	—	20.3 - 22.0		4-9	27-32	6.2-6.5	7-9	1.0-2.0	—
River)	Oct	—	—	12.2 - 15.2		6-10	20-27	5.6-6.2	8-9	—	—

Station 0 is located downstream from Buford Dam at the COE monitor.
Station 1 is located 0.1 R.M. upreservoir from dam.
Station 5 is located 4.7 R.M. upreservoir from dam.

a. Temperature values in °C in parantheses.

b. For turbidity, conductivity, and TOC, number in parantheses is depth in meters of maximum value.

TABLE 2

LAKE LANIER STUDY, 1978
RANGE OF METALS VALUES IN ug/L

Station	Month	Depth of Thermo-Cline in meters Min	Max	Copper	Iron	Mangenese	Zinc
Buford Hatchery	Nov	—	—	<10	869-1095	581-654	430-733
0	Aug	—	—	—	—	—	—
	Sept	—	—	<10	172-338	104-193	<10
	Oct	—	—	<10	290-692	187-435	<10
	Nov	—	—	<10-14	89-1075	26-658	<10-23
1	Aug	10	19	<10-20 (5)	53-442 (43)	<10-152 (45)	<10-118 (30&43)
	Sept	9	21	<10-113 (42)	<50-672 (42)	<10-298 (43)	<10-56 (30)
	Oct	17	23	<10-657 (41)	109-2896 (41)	26-620 (41)	<10-218 (41)
	Nov	19	24	<10-10 (44)	77-1825 (44)	28-812 (41)	<10-104 (22)
5	Aug	9	19	<10-26 (5)	<50-261 (45)	<10-139 (30)	<10
	Sept	10	22	<10-19 (43)	<50-734 (43)	<10-506 (30)	<10-74 (12)
	Oct	17	20	<10	187	26	10
	Nov	19	22	<10	168-1212 (30)	26-728 (30)	<10
CH 60 (Chestatee River)	Aug	—	—	<10-30	2874-15390	76-328	<10-64
	Sept	—	—	<10	396-743	<10-24	<10
	Oct	—	—	<10	475-876	13-141	<10
CH 52 (Chatta-hoochee River)	Aug	—	—	10-36	2722-34820	55-559	<10-46
	Sept	—	—	<10	462-581	18-31	<10
	Oct	—	—	<10	608-1000	32-46	<10

Station 0 is located downstream from Buford dam at the COE monitor.
Station 1 is located 0.1 R.M. upreservoir from dam.
Station 5 is located 4.7 R.M. upreservoir from dam.

( ) Depth in meters of maximum value

TABLE 3

COPPER CONCENTRATION IN ug/g D.W. OF
RAINBOW TROUT LIVER TISSUE

Month	Location	
	Buford Hatchery	Lake Lanier & Tributaries
Nov-Dec	284-842[a]	0.30-258[b]
July & Oct	144-200	c

a. Range of values.

b. High value in trout from McClure's Creek.

c. Fish tissue collected from McClure's Creek in July contained the greatest concentration of copper (358.1 ug per gram dry weight of tissue). This concentration was found either in liver or muscle tissue, but since the tissues were not identified, it is impossible to attribute this high concentration to liver tissue.

FIGURES

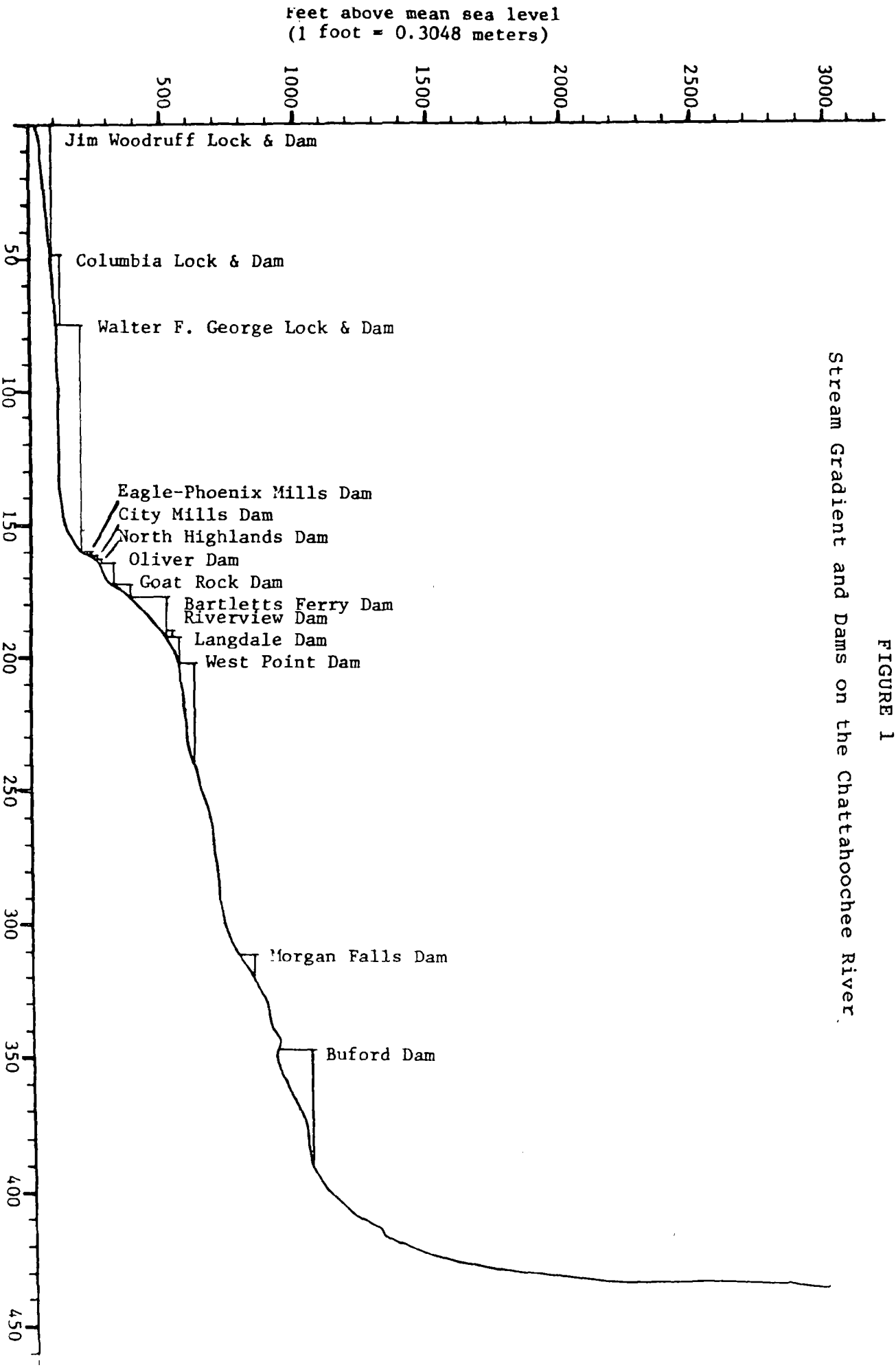


FIGURE 1

Stream Gradient and Dams on the Chattahoochee River

Chattahoochee River Basin

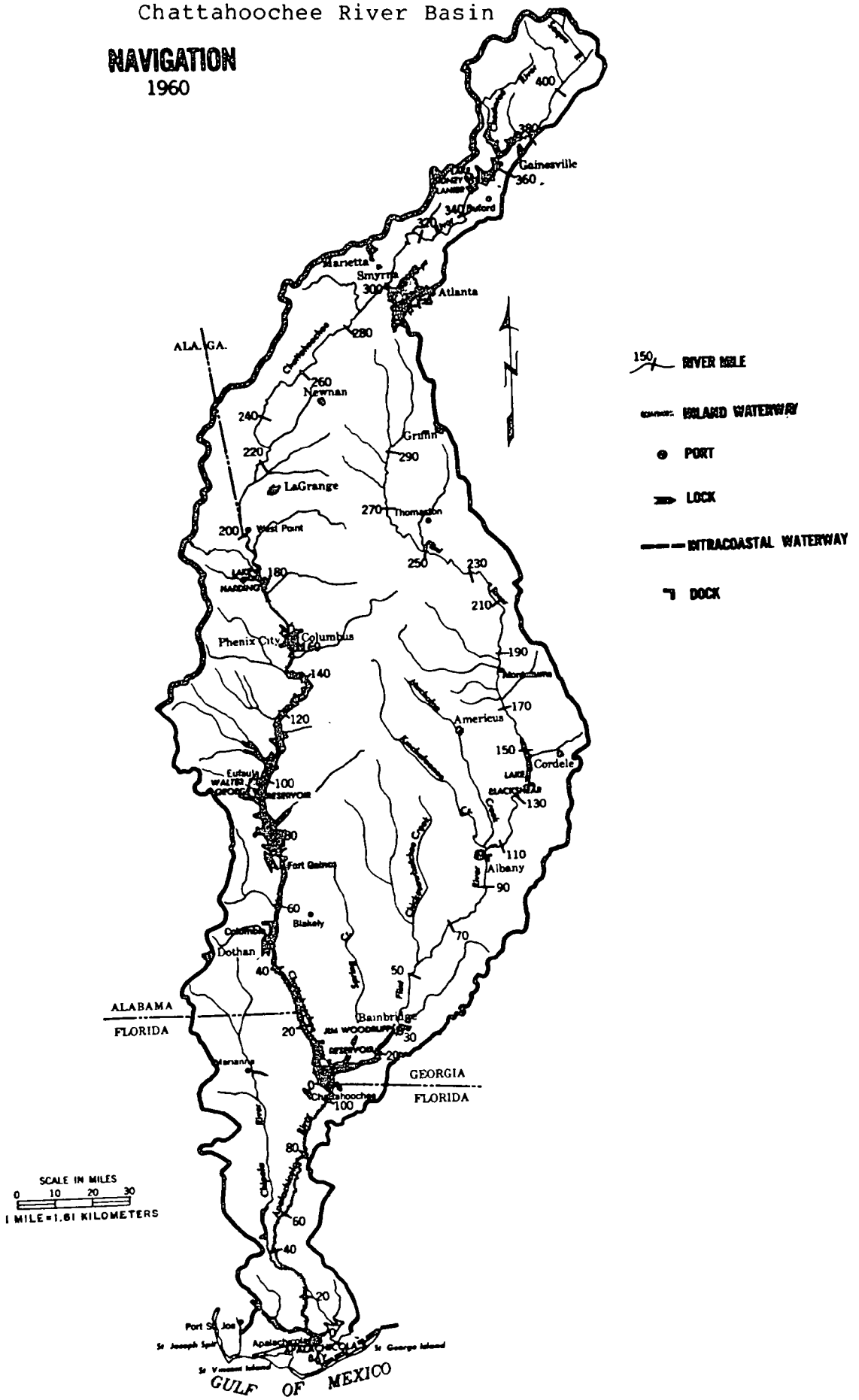


FIGURE 3

Lake Lanier Sample Locations, 1978

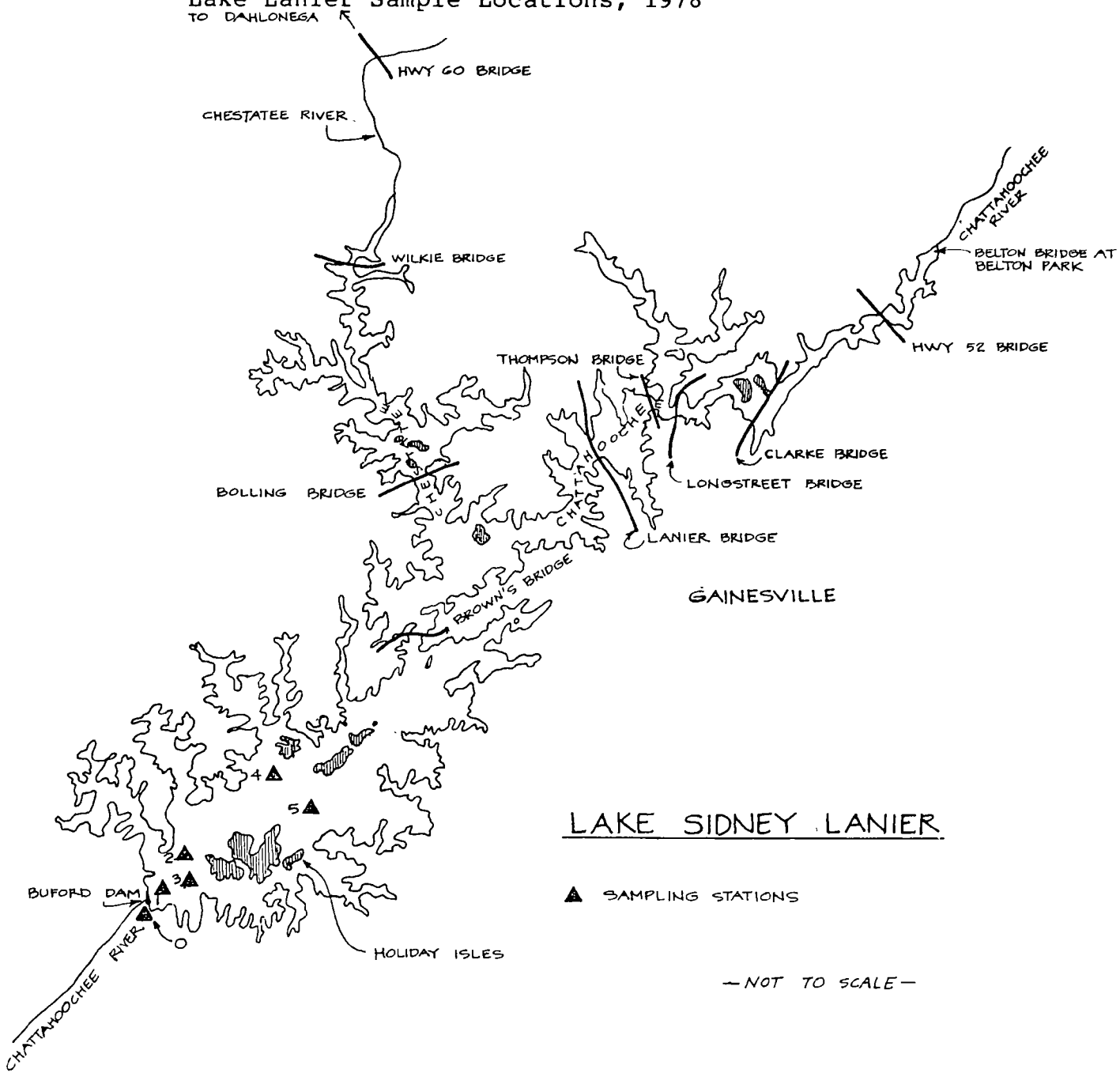


FIGURE 4

Lake Lanier Station, Temperature and Dissolved Oxygen Isopleths, 1978

STATION 1

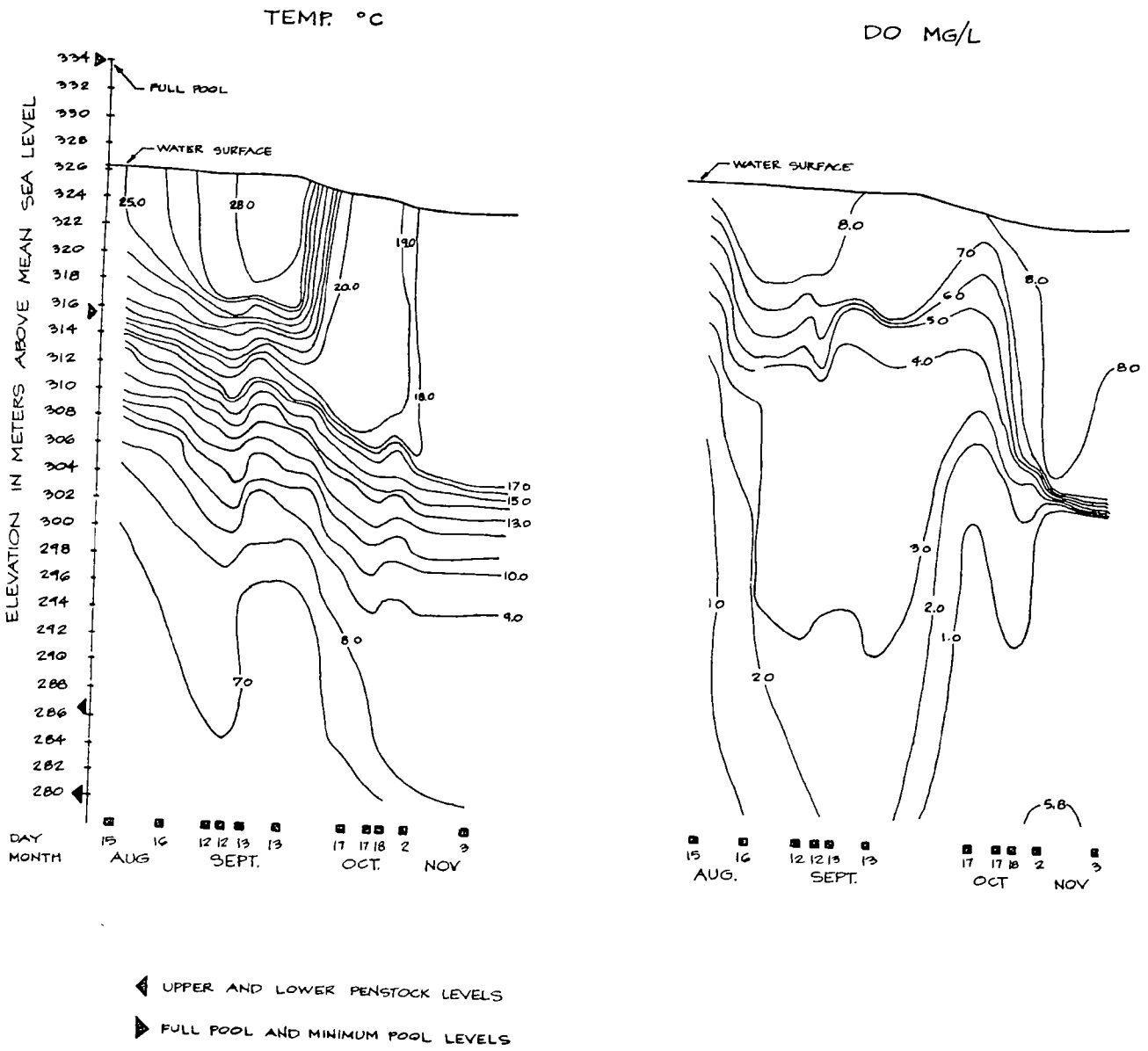


FIGURE 5

Lake Lanier Station 2 Isotherms, 1978

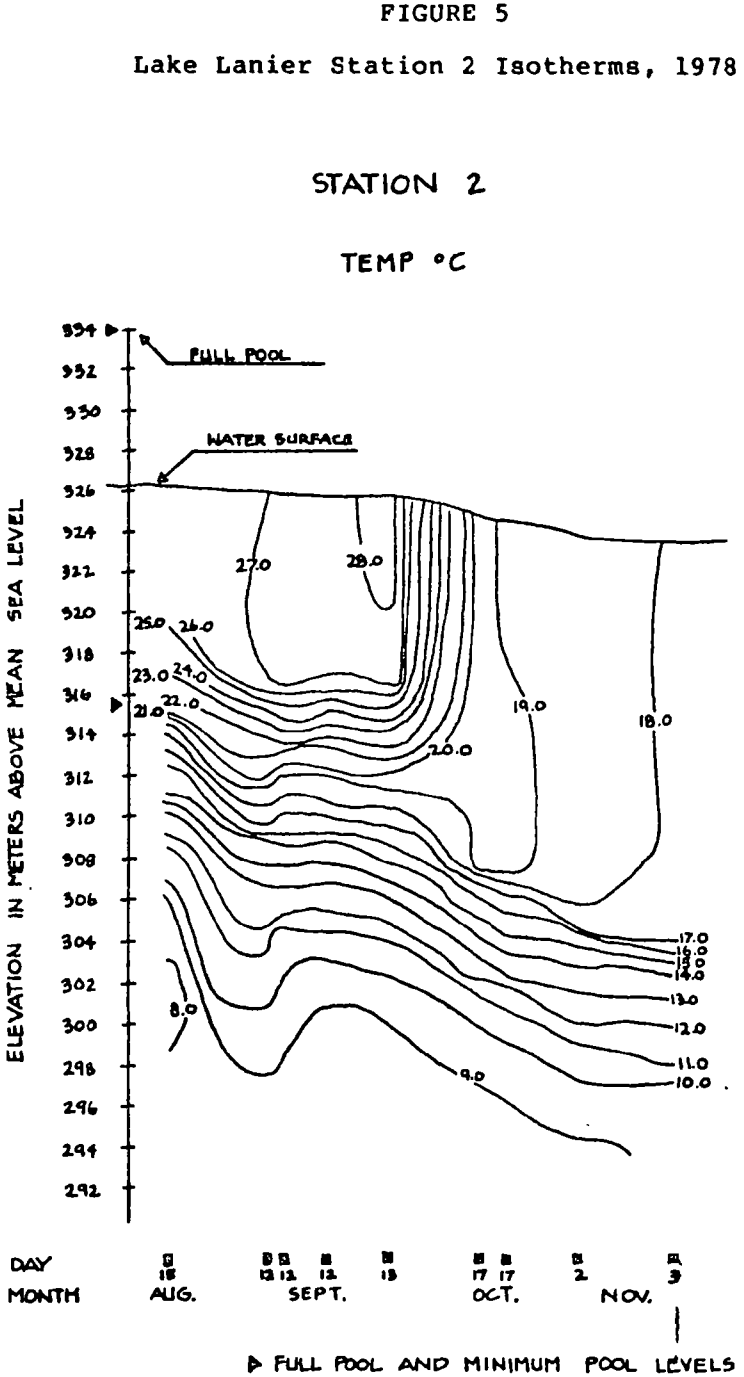


FIGURE 6

Lake Lanier Station 3 Isotherms, 1978

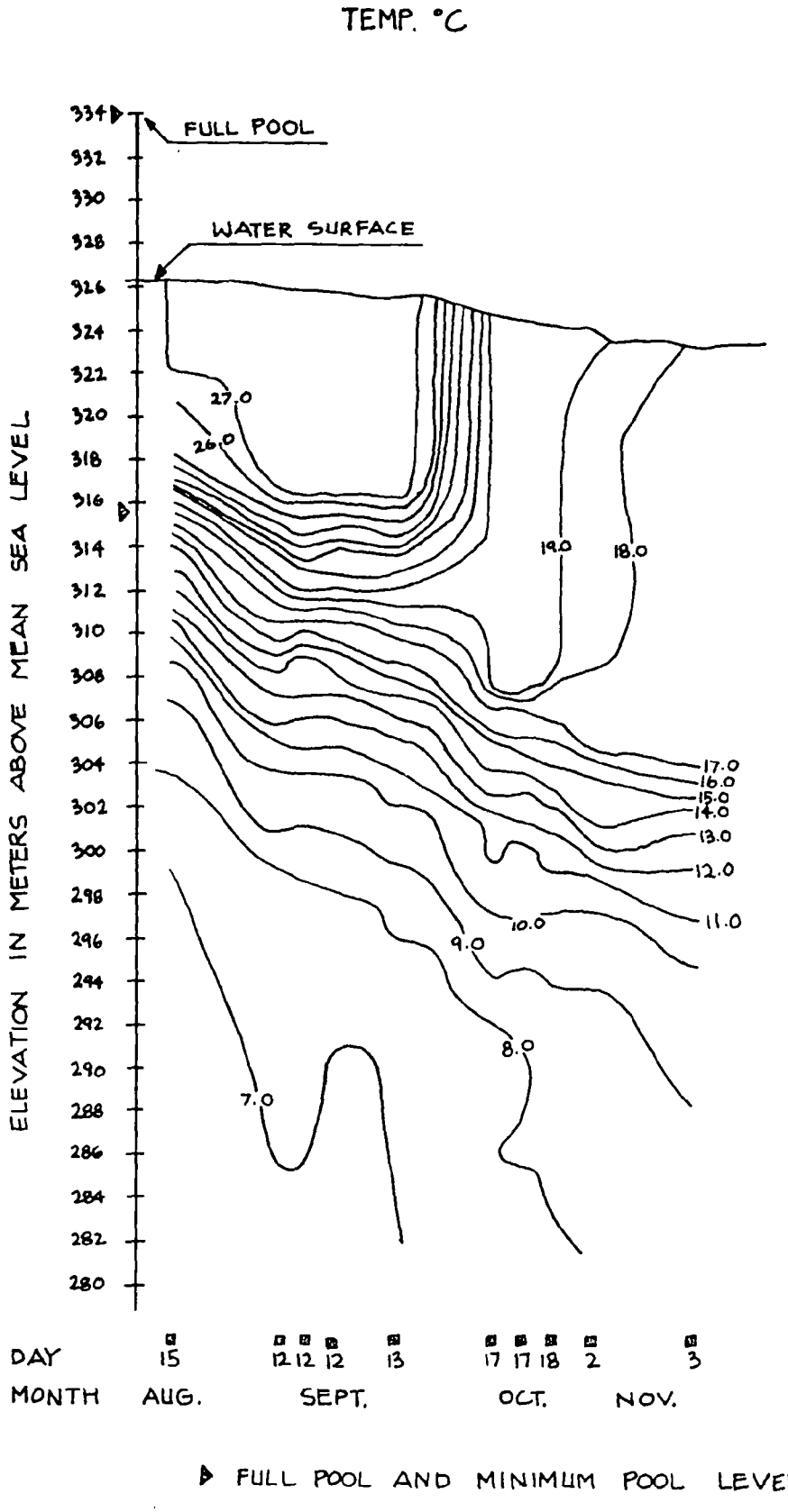


FIGURE 7

Lake Lanier Station 4 Isotherms, 1978

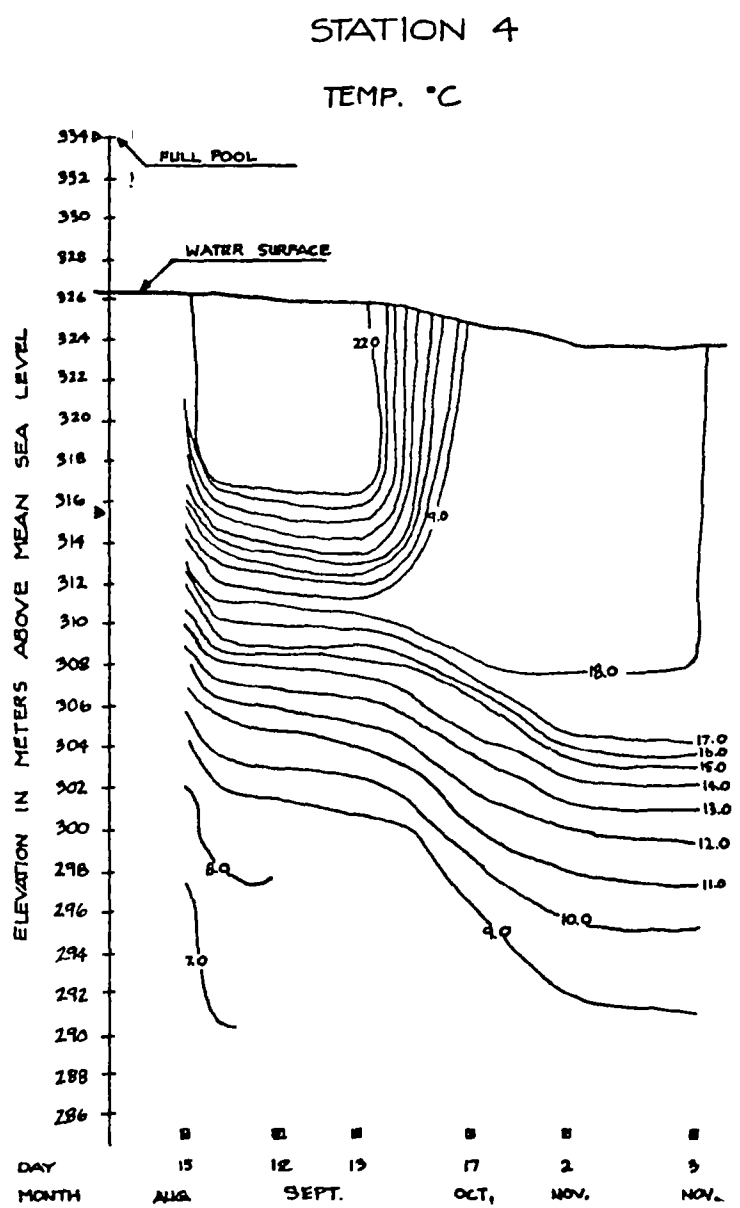


FIGURE 8

Lake Lanier Station 5 Temperature and Dissolved Oxygen Isopleths, 1978

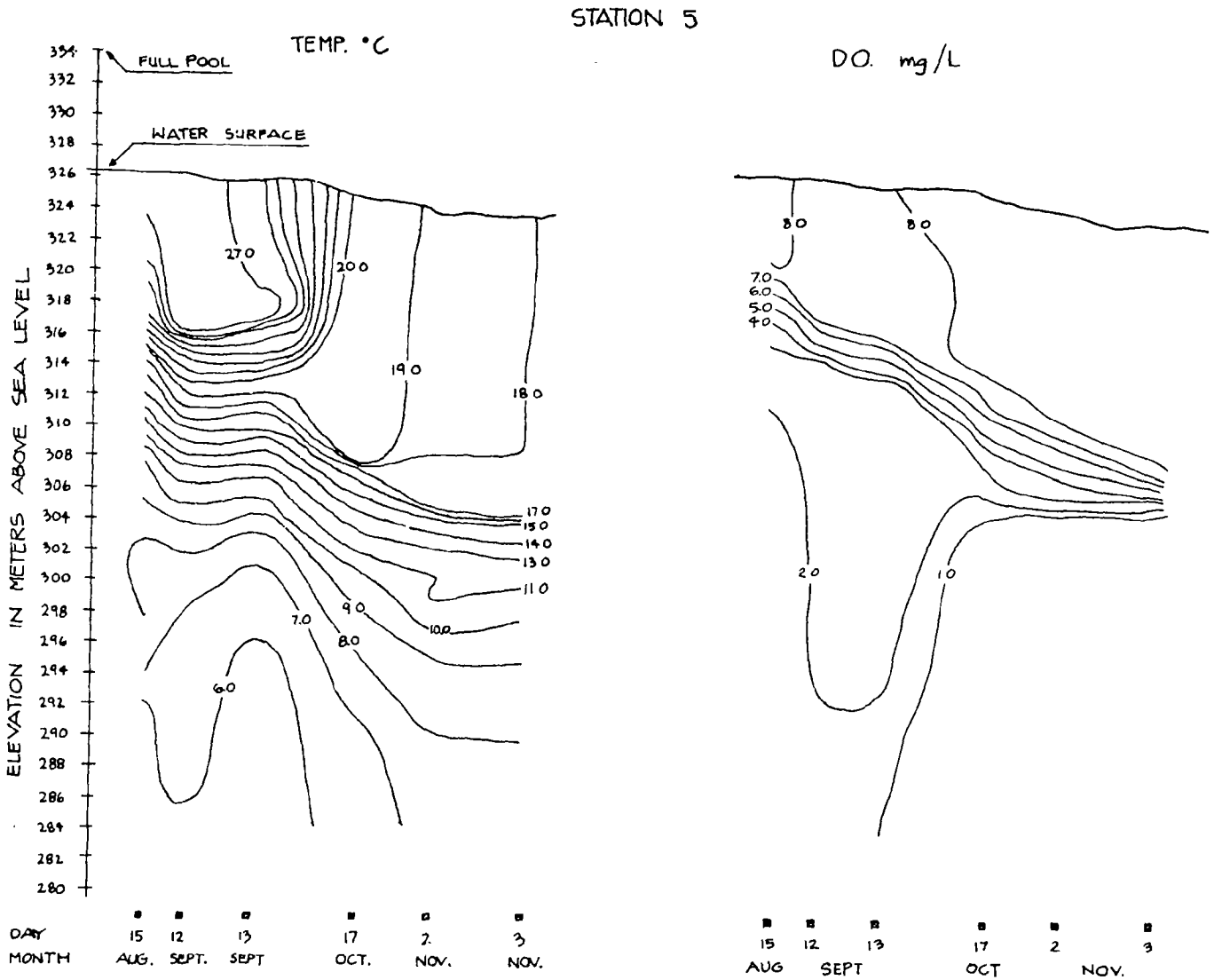


FIGURE 9

EFFECT OF PENSTOCK CLOSURE UPON THERMOCLINE
LAKE LANIER NOVEMBER, 1977 STATION 1

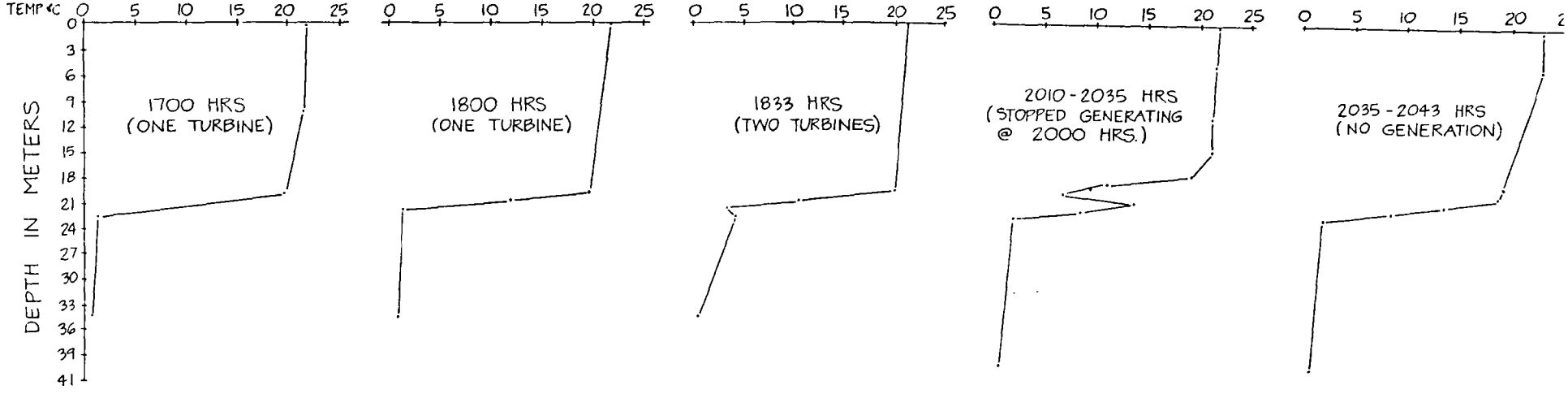


FIGURE 10

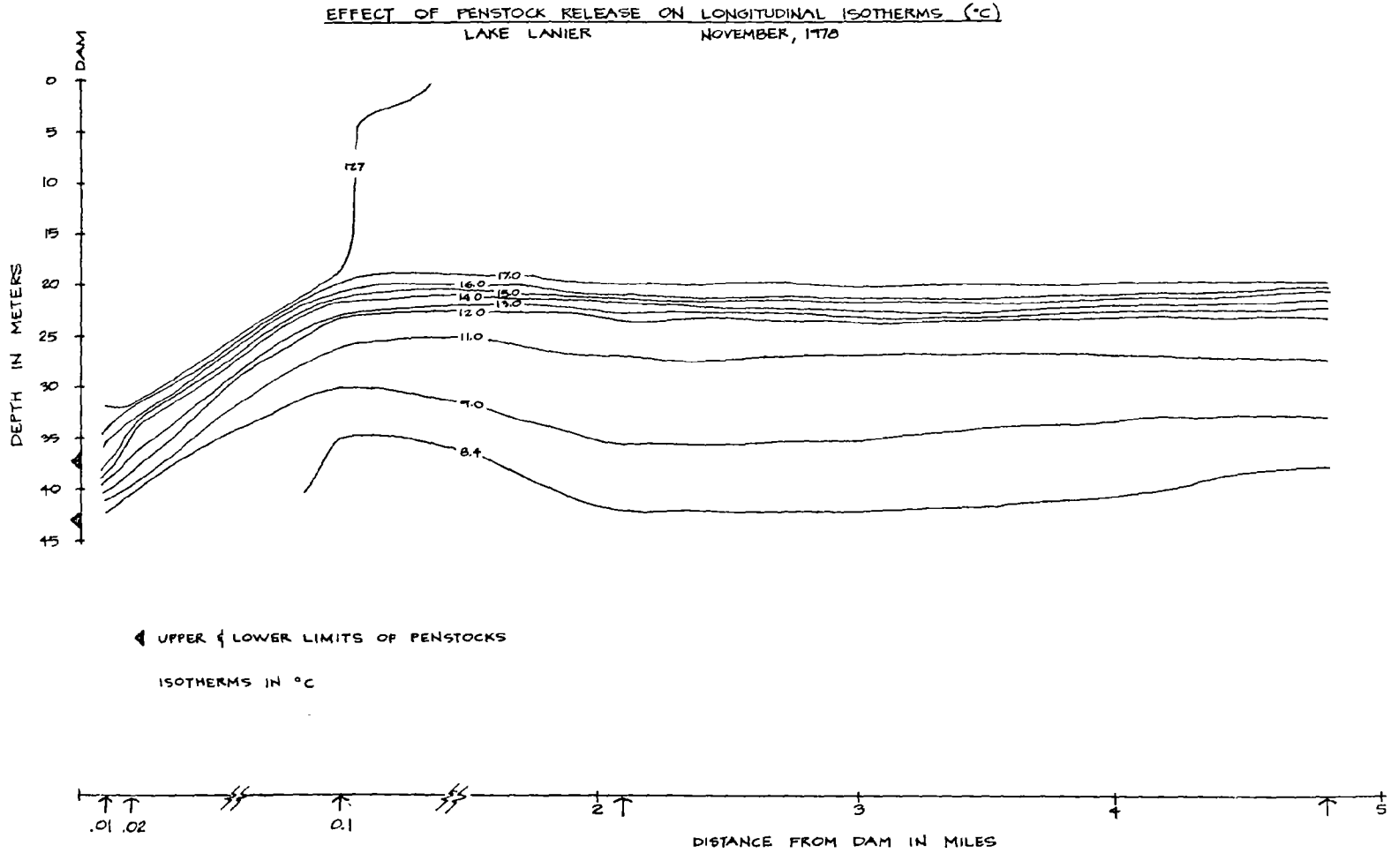

EFFECT OF PENSTOCK RELEASE ON LONGITUDINAL ISOTHERMS (°C)
LAKE LANIER NOVEMBER, 1978
DAM
DEPTH IN METERS
0
5
10
15
20
25
30
35
40
45
12.7
17.0
16.0
15.0
14.0
13.0
12.0
11.0
9.0
8.4
UPPER & LOWER LIMITS OF PENSTOCKS
ISOTHERMS IN °C
.01
.02
0.1
2
3
4
5
DISTANCE FROM DAM IN MILES

FIGURE 11

LAKE LANIER AND CHATTAHOOCHEE RIVER ARM
SEPTEMBER, 1978
TEMPERATURE DISTRIBUTION IN °C

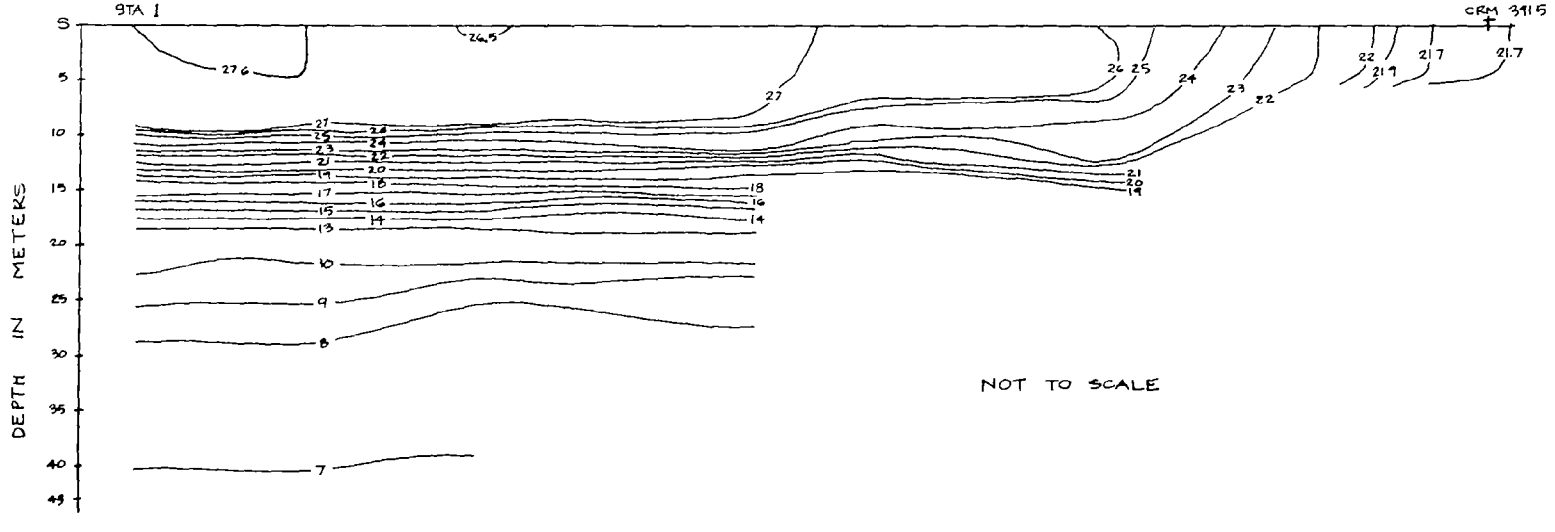
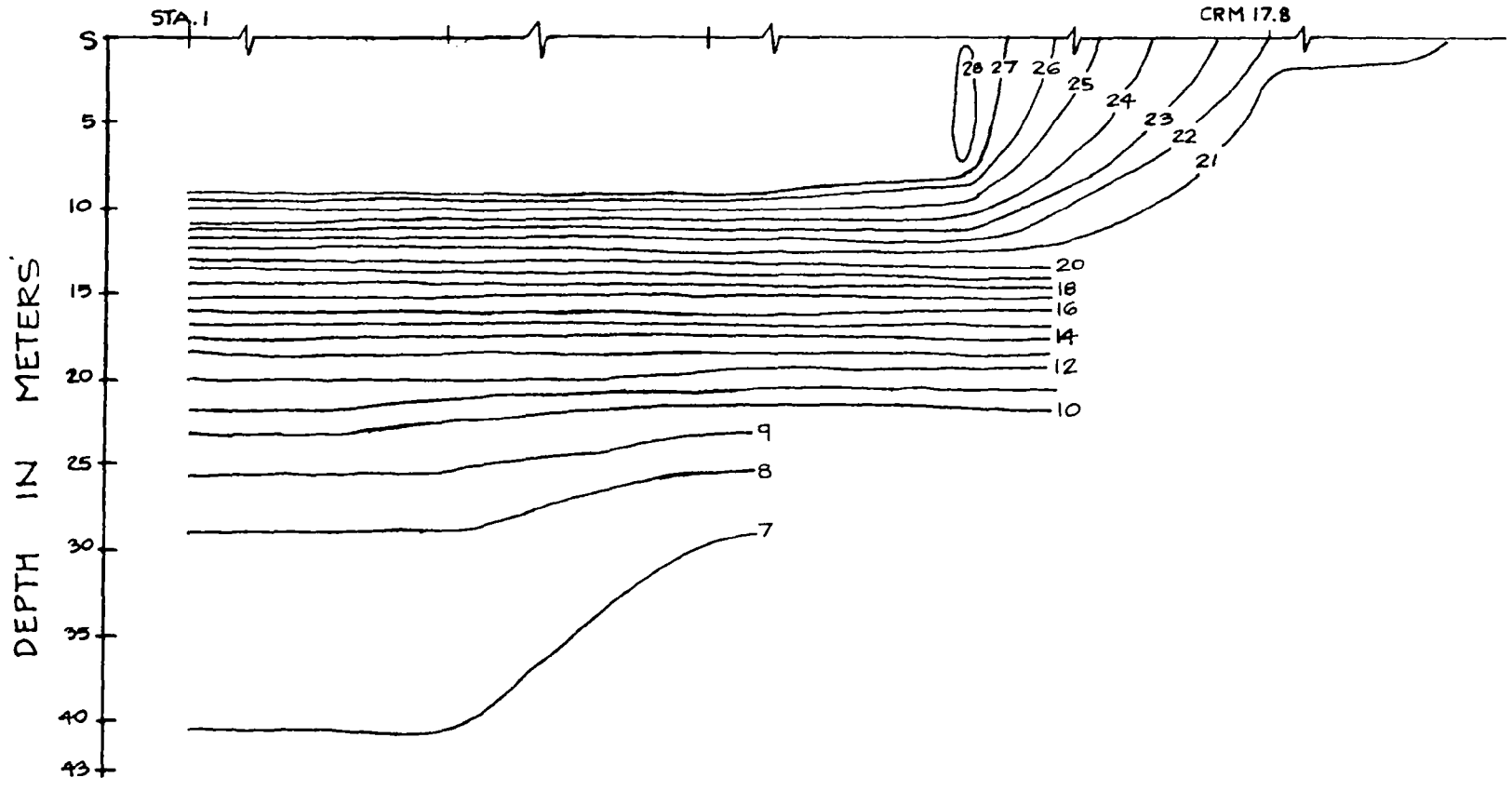


FIGURE 12

LAKE LANIER AND CHESTATEE ARM - SEPTEMBER 1978
TEMPERATURE DISTRIBUTION IN °C



NOT TO SCALE

APPENDIX A

LAKE LANIER 1978 WATER QUALITY DATA

STATION - 00

DATE	TIME	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780815	0830	8.9		30	5.30	6.60	7.0					
780912	1530	11.7	8	31	3.40			1.3	10.00K	200.00	110.00	10.00K
780912	1531	11.7	8	31	3.40			1.4	10.00K	215.00	123.00	10.00K
780912	2000	11.7	5	30	2.80			1.3	10.00K	215.00	127.00	10.00K
780912	2002	11.7	5	30	2.80			2.5	10.00K	234.00	146.00	10.00K
780913	0525	8.9	8	30	2.90			1.3	10.00K	310.00	193.00	10.00K
780913	0527	8.9	8	30	2.90			2.2	10.00K	338.00	189.00	10.00K
780913	1630	12.3	5	30	3.00			1.6	10.00K	172.00	104.00	10.00K
780913	1631	12.3		30	3.00			1.3	10.00K	186.00	110.00	10.00K
781017	0835	11.8		25	4.70	6.40	9.0	1.6	10.00K	290.00	187.00	10.00K
781017	0840							2.8	10.00K	310.00	187.00	10.00K
781017	1745	8.4		32	5.80	6.40	9.0	2.8	10.00K	692.00	427.00	10.00K
781017	1747							2.3	10.00K	683.00	435.00	10.00K
781017	2227							3.2	10.00K	398.00	280.00	10.00K
781017	2229	12.3		31	6.30	6.20	9.0					
781017	2230							1.3	10.00K	413.00	288.00	10.00K
781102	0855	9.5	17	34	1.40	6.60	9.0	1.0K	10.00K	1065.00	658.00	10.00K
781102	0856							1.0	10.00K	1075.00	616.00	10.00K
781102	0915	14.5	8	32	3.60	6.60	9.0	1.0K	10.00K	565.00	334.00	10.00K
781102	0916							1.0K	14.00K	89.00	26.00	23.00
781103	0845							1.6	10.00K	397.00	226.00	10.00K
781103	0847							1.3	10.00K	437.00	234.00	10.00K
781103	0950	15.6		30	3.60	6.40						
781103	1415							1.1	10.00K	408.00	234.00	10.00K
781103	1417							1.3	10.00K	379.00	226.00	15.00
781103	1445	16.1		31	4.40	6.60						

STATION # EL-01

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780815	1000	0	25.5		30	8.5	7.1	8					
780815	1000	5	25.5		31	5.2	6.7	8	2.6	10.00K	97	10.0K	80.00
780815	1000	10	21.8		30	3.2	6.4	8					
780815	1000	11	20.3			2.7							
780815	1000	12	18.1			2.4							
780815	1000	13	16.6			1.9							
780815	1000	14	13.3			1.6							
780815	1000	15	14.3		30	1.4	6.3	7	1.7	10.00K	58	44.0	98.00
780815	1000	16	13.3			1.3							
780815	1000	17	12.1			1.1							
780815	1000	18	10.8			1.1							
780815	1000	19	9.5			0.9							
780815	1000	20	9.2		30	0.8	6.1	7					
780815	1000	21	8.3			0.8							
780815	1000	25	7.2		31	0.7	6.2	7					
780815	1000	30	6.5		30	0.7	6.1	7	1.8	10.00K	174	85.0	118.00
780815	1000	35	6.4		31	0.7	6.2	7					
780815	1000	40	6.2			0.6							
780815	1000	43	6.2		32	0.6	6.1	7	2.0	10.00K	442	146.0	118.00
780816	0415	0	26.3		30	7.9	6.7	8					
780816	0415	5	26.3		29	8.6	6.1	9	2.3	20.00	71	10.0K	10.00K
780816	0415	10	23.3		30	6.6	5.9	9					
780816	0415	11	21.3			6.0							
780816	0415	12	19.7			5.5							
780816	0415	13	17.3			4.4							
780816	0415	14	16.3			3.5							
780816	0415	15	15.3		29	3.2	5.8	8	2.1	10.00K	53	10.0K	10.00K
780816	0415	16	14.3			2.9							
780816	0415	17	12.8			2.6							
780816	0415	18	11.3			2.4							
780816	0415	19	10.3			2.3							
780816	0415	20	9.8		28	2.1	5.8	9					
780816	0415	25	8.3		26	2.0	5.8	7					
780816	0415	30	7.3		26	1.7	5.7	8	2.0	10.00K	174	94.0	10.00K
780816	0415	35	6.8		26	1.6	5.7	8					
780816	0415	40	6.3		26	1.5	5.6	7					
780816	0415	45	6.3		26	1.5	5.6	7	1.8	10.00K	412	152.0	10.00K
780912	1440	30	7.7	4					1.3	110.00	234	150.0	42.00
780912	1448	35	7.1	8									
780912	1448	40	7.1	8		2.4							
780912	1448	42							1.6	113.00	672	262.0	52.00
780912	1448	43	6.5	7	31	1.9	6.2	9					
780912	1450	14	13.4	2	29	3.6	6.2	9	1.3	10.00K	53	10.0K	10.00K
780912	1458	0		2									
780912	1458	5	27.8	2	28	7.6	6.2	8	2.3	15.00	53	10.0K	10.00K
780912	1458	9	27.6										
780912	1458	10	25.0										
780912	1458	11	24.0										
780912	1458	12	21.9										
780912	1458	13	20.3										
780912	1458	15	17.3	2									
780912	1458	16	16.0										
780912	1458	17	14.9										
780912	1458	18	13.9										
780912	1458	19	12.9										
780912	1458	20	12.1	2									

STATION - LL-01

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780912	1458	21	11.3										
780912	1458	22	10.8										
780912	1458	25	9.2	4	29	3.7	6.2	8					
780912	1915	43	6.7	6	32	2.4	6.1	8	1.3	17.00	505	245.0	10.00K
780912	1923	30	7.8	8	30	3.3	6.1	7	1.3	10.00K	124	127.0	10.00K
780912	1923	35	7.6										
780912	1923	40	7.1										
780912	1932	15	17.9	3	31	3.7	6.0	8	1.6	12.00	72	10.0K	10.00K
780912	1932	16	17.1										
780912	1932	17	15.7										
780912	1932	18	14.4										
780912	1932	19	13.4										
780912	1932	20	12.4	2									
780912	1932	21	11.9										
780912	1932	22	11.3										
780912	1932	23	10.8										
780912	1932	24	10.2										
780912	1932	25	9.7	3									
780912	1937	5	28.1	2	31	8.2	6.2	8	3.0	10.00K	50K	10.0K	10.00K
780912	1937	9	27.3	2									
780912	1937	10	26.0										
780912	1937	11	22.9										
780912	1937	12	21.9										
780912	1937	13	20.9										
780912	1937	14	19.4										
780912	1957		28.1	2									
780913	0130	0	27.6		28	7.5	6.5	8					
780913	0130	1	28.1										
780913	0130	2	28.1										
780913	0220	7				7.7							
780913	0220	8				7.6							
780913	0220	9	27.4			4.7							
780913	0220	10	25.0	2	29	4.4	5.9	8					
780913	0220	11	24.4			4.1							
780913	0220	12	21.1			3.9							
780913	0220	13	19.5										
780913	0220	14	17.9										
780913	0220	15	17.1	2	29	3.6	6.0	8					
780913	0230	5		4	28	7.7	6.5	8	2.0	15.00	50K	10.0K	10.00K
780913	0230	16	15.4			3.6			1.3	10.00	53	10.0K	38.00
780913	0230	17	14.3			3.5							
780913	0230	18	13.5			3.5							
780913	0230	19	12.4			3.6							
780913	0230	20	11.9	2	28	3.6	6.2	8					
780913	0230	21	11.0			3.6							
780913	0230	22	10.5			3.5							
780913	0230	23	9.9										
780913	0230	24	8.8										
780913	0230	25	8.6	2	29	3.9	5.8	7					
780913	0230	26	8.1										
780913	0230	27	8.1										
780913	0230	28	7.6										
780913	0230	29	7.4										
780913	0230	30	7.1	4	28	3.1	5.8	8					
780913	0315	33							1.3	10.00K	377	186.0	56.00
780913	0315	35	6.7	6	29	2.1	5.7	8					

STATION - LL-01

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780913	0315	40	6.7	7	29	2.1	5.8	8					
780913	0340	43		7	29		5.7	8	1.3	10.00K	605	298.0	10.00K
780913	0340	45				2.1							
780913	1745	0	29.5	2	17	7.9	6.4	8	2.3	10.00K	96	10.0K	10.00K
780913	1745	5	28.1	2	34	7.5	6.4	8	2.0	10.00	72	14.0	10.00K
780913	1745	9	27.9			7.2							
780913	1745	10	25.5			4.1							
780913	1745	11	23.2			3.8							
780913	1745	12	21.7			3.7							
780913	1745	13	20.8			3.9							
780913	1745	14	19.4			3.7							
780913	1745	15	18.1			3.6							
780913	1745	16	16.8	2	30	3.5	6.2	8	1.3	10.00K	62	10.0K	10.00K
780913	1745	17	15.5			3.4							
780913	1745	18	14.1			3.6							
780913	1745	19	12.9			3.6							
780913	1745	20	12.4			3.5							
780913	1745	21	11.3			3.6							
780913	1745	22	10.8			3.8							
780913	1745	23	9.7			3.8							
780913	1745	24	9.2			3.9							
780913	1745	25	8.6			3.9							
780913	1745	26	8.5			3.9							
780913	1745	27	7.6			3.8							
780913	1745	28	7.6			3.8							
780913	1745	29	7.1			3.7							
780913	1745	30	7.1			3.7							
780913	1745	35	6.6			2.7							
780913	1745	36		5	27		6.3	7	1.0	10.00K	443	239.0	10.00K
780913	1745	40	6.5			2.6							
780913	1745	42							1.0	10.00K	496	268.0	10.00K
780913	1745	43	6.5	5	29	2.3	6.4	8					
781017	1015	0	19.5		27	8.0	6.5	9					
781017	1015	5	19.5		26		5.9	9					
781017	1015	10	19.5		27		5.8	10					
781017	1015	15	19.5		28		5.8	11					
781017	1015	17	19.2										
781017	1015	18	16.8										
781017	1015	19	15.7										
781017	1015	20	14.8		27	1.1	5.6	10					
781017	1015	21	13.3										
781017	1015	22	12.5										
781017	1015	23	12.1										
781017	1015	25	10.3		27		5.5	9					
781017	1015	30	8.5		27		5.6	9					
781017	1015	35	7.8		27		5.6	9					
781017	1015	40	7.3		28	0.1							
781017	1100	10							1.0	10.00K	202	26.0	15.00
781017	1114	20							1.5	10.00K	256	103.0	31.00
781017	1125	30							3.7	10.00K	369	292.0	23.00
781017	1140	40							2.0	10.00K	1178	557.0	15.00
781017	1900	0	19.7		25	8.3	6.1	9					
781017	1900	5	19.7										
781017	1900	10	19.7										
781017	1900	15	19.7										
781017	1900	16	19.7										

STATION - LL-01

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
781017	1900	17	18.7										
781017	1900	18	18.2										
781017	1900	19	16.1										
781017	1900	20	15.1										
781017	1900	21	14.1		27	1.5	6.1	9					
781017	1900	22	13.1										
781017	1900	23	12.7										
781017	1900	24	12.1										
781017	1900	25	11.1										
781017	1900	26	10.6										
781017	1900	27	10.1										
781017	1900	30	9.1										
781017	1900	35	8.1										
781017	1900	40	7.6		29	0.1	6.1	10					
781017	1920	10							1.6	10.00K	153	34.0	10.00K
781017	1925	20							1.6	10.00K	182	111.0	10.00K
781017	1930	30							2.9	10.00K	320	311.0	10.00K
781017	1935	40							4.2	10.00K	1232	520.0	34.00
781017	2320	10							4.0	10.00K	109	26.0	10.00K
781017	2325	20							3.2	10.00K	388	157.0	12.00
781017	2330	35							3.3	10.00K	1144	550.0	10.00K
781017	2335	41							3.9	657.00	2896	620.0	218.00
781018	0045	0	19.2		29	9.0	6.1	9					
781018	0045	5	19.2										
781018	0045	10	19.2			8.3							
781018	0045	15	19.2										
781018	0045	17	18.2			5.9							
781018	0045	18	16.2			3.6							
781018	0045	19	15.1										
781018	0045	20	15.1		39	2.3	6.1	10					
781018	0045	21	14.1										
781018	0045	22	12.6										
781018	0045	23	12.1										
781018	0045	24	11.6										
781018	0045	25	10.7			1.6							
781018	0045	26	10.1										
781018	0045	27	9.6										
781018	0045	30	8.6										
781018	0045	35	8.1										
781018	0045	40	8.1										
781018	0045	43	7.6		35	0.1	6.1	11					
781102	0930	0	17.9	2	29	8.1	5.7	7					
781102	0930	5	17.9	2		8.1							
781102	0930	10	18.0	2		8.1							
781102	0930	15	18.0	2		8.1							
781102	0930	18	18.0			8.0							
781102	0930	19	17.8			7.7							
781102	0930	20	15.7	2		0.9							
781102	0930	21	14.4			0.6							
781102	0930	22	13.4	4	34	0.4	5.7	10					
781102	0930	23	12.6			0.4							
781102	0930	24	11.5			0.3							
781102	0930	25	11.1	4		0.3							
781102	0930	26	10.3			0.3							
781102	0930	27	9.5										
781102	0930	28	9.3										

STATION - LL-01

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CAC03 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
781102	0930	29	9.2										
781102	0930	30	8.9	5		0.0							
781102	0930	31	8.6										
781102	0930	32	8.4										
781102	0930	33	8.4										
781102	0930	34	8.4										
781102	0930	35	8.3	9		0.0							
781102	0930	36	8.2										
781102	0930	37	8.2										
781102	0930	38	8.0										
781102	0930	39	8.2										
781102	0930	40	8.1	13		0.0							
781102	0930	41	8.1										
781102	0930	42	8.1										
781102	0930	43	8.1	13	36	0.0	5.7	10					
781102	1057	10							1.0K	11.00	79	26.0	23.00
781102	1102	22							1.0	10.00K	692	388.0	104.00
781102	1107	35							1.0K	10.00K	1095	675.0	17.00
781102	1113	40							1.0K	10.00K	1865	793.0	10.00K
781102	1135	0	18.9			8.4							
781102	1135	5	18.6			8.3							
781102	1135	10	18.4			8.0							
781102	1135	15	18.2			7.9							
781102	1135	19	17.9			7.8							
781102	1135	20	15.4			7.5							
781102	1135	21	15.0			2.2							
781102	1135	22	14.5			0.1							
781102	1135	23	12.7			0.0							
781102	1135	24	11.8			0.0							
781102	1135	25	11.2			0.0							
781102	1135	26	10.5			0.0							
781102	1135	27	10.0										
781102	1135	28	9.3										
781102	1135	29	9.0										
781102	1135	30	8.9			0.0							
781102	1135	35	8.4			0.0							
781102	1135	40	8.4			0.0							
781102	1135	43	8.3			0.1							
781103	0915	0	17.6			8.1							
781103	0915	5	17.7			8.0							
781103	0915	10	17.7			8.0							
781103	0915	15	17.7			7.9							
781103	0915	19	17.7			7.6							
781103	0915	20	16.9			5.5							
781103	0915	21	14.5			0.6							
781103	0915	22	13.6			0.3							
781103	0915	23	12.3			0.3							
781103	0915	24	11.3			0.3							
781103	0915	25	11.1			0.3							
781103	0915	26	10.3										
781103	0915	27	9.7										
781103	0915	28	9.3										
781103	0915	29	9.2										
781103	0915	30	8.9			0.1							
781103	0915	35	8.4			0.1							

STATION - LL-01

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
781103	0915	40	8.3			0.1							
781103	0915	44	8.3			0.1							
781103	0935	10							1.5	20.00K	77	28.0	10.00K
781103	0938	22							1.2	10.00K	340	265.0	10.00K
781103	0945	35							1.5	10.00K	1399	728.0	10.00K
781103	0947	44							1.3	10.00K	1825	812.0	10.00K

STATION - LL-02

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CAC03 MG/L
780815	1400	0	26.8		30	8.40	7.30	8.0
780815	1400	5	26.3		31	2.65	7.30	8.0
780815	1400	10	22.9		31	1.80	6.70	9.0
780815	1400	11	21.2			1.70		
780815	1400	12	18.3			1.45		
780815	1400	13	17.1			1.30		
780815	1400	14	15.8			1.25		
780815	1400	15	15.1		31	1.20	6.30	9.0
780815	1400	16	13.4			1.15		
780815	1400	17	12.1			1.20		
780815	1400	18	10.8			1.20		
780815	1400	19	10.2			1.15		
780815	1400	20	9.2		29	1.15	6.25	8.0
780815	1400	21	8.6			1.15		
780815	1400	25	7.5		29	1.15	6.25	7.5
780912	1330	0	27.6					
780912	1330	5	27.8					
780912	1330	9	27.6					
780912	1330	10	25.7					
780912	1330	11	23.6					
780912	1330	12	22.4					
780912	1330	13	21.3					
780912	1330	14	20.3					
780912	1330	15	18.3					
780912	1330	16	17.3					
780912	1330	17	14.9					
780912	1330	18	14.5					
780912	1330	19	13.0					
780912	1330	20	12.4					
780912	1330	21	11.9					
780912	1330	25	9.7					
780912	1330	30	8.1					
780912	1630	0	27.2	2				
780912	1630	5	27.2	2				
780912	1630	9	27.2					
780912	1630	10	25.2	2				
780912	1630	11	23.5					
780912	1630	12	22.0	2				
780912	1630	13	20.1					
780912	1630	14	18.5					
780912	1630	15	17.5					
780912	1630	16	16.7					
780912	1630	17	15.5					
780912	1630	18	14.5					
780912	1630	19	13.5					
780912	1630	20	12.5					
780912	1630	21	11.7					
780912	1630	22	10.7					
780912	2359	0	27.3	2				
780912	2359	1	27.4					
780912	2359	5	27.6	2				
780912	2359	9	26.9					
780912	2359	10	24.9	2				
780912	2359	11	23.1					
780912	2359	12	21.5					

STATION - LL-02

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L
780912	2359	13	20.3					
780912	2359	14	19.0					
780912	2359	15	18.0	2				
780912	2359	16	16.8					
780912	2359	17	14.9					
780912	2359	18	13.7					
780912	2359	19	12.8					
780912	2359	20	12.1	2				
780912	2359	21	11.2					
780912	2359	22	10.5					
780912	2359	23	9.9					
780912	2359	24	9.3					
780912	2359	25	8.9	2				
780912	2359	26	8.3					
780912	2359	27	8.1					
780913	1435	0	28.9	1				
780913	1435	5	28.1	1				
780913	1435	9	27.1					
780913	1435	10	25.2	2				
780913	1435	11	23.5					
780913	1435	12	22.3					
780913	1435	13	20.8					
780913	1435	14	19.4					
780913	1435	15	18.3	2				
780913	1435	16	17.1					
780913	1435	17	16.0					
780913	1435	18	14.9					
780913	1435	19	13.9					
780913	1435	20	12.5	2				
780913	1435	21	11.9					
780913	1435	22	10.8	2				
780913	1435	23	10.1					
780913	1435	24	9.6					
780913	1435	25	9.2					
781017	1410	0	19.5					
781017	1410	5	19.5					
781017	1410	10	19.4					
781017	1410	15	19.4					
781017	1410	17	19.4					
781017	1410	18	17.0					
781017	1410	19	15.7					
781017	1410	20	14.7					
781017	1410	21	13.4					
781017	1410	22	12.6					
781017	1410	30	12.6					
781017	2045	0	18.7					
781017	2045	5	18.9					
781017	2045	10	19.2					
781017	2045	15	19.2					
781017	2045	17	19.2					
781017	2045	18	17.7					
781017	2045	19	16.1					
781017	2045	20	15.1					
781017	2045	21	14.1					
781017	2045	22	13.1					

STATION - LL-02

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L
781017	2045	23	11.6					
781102	1355	0	19.3	2		8.30		
781102	1355	5	18.6	2				
781102	1355	10	18.4	2				
781102	1355	15	18.3	2		8.30		
781102	1355	19	17.7			7.20		
781102	1355	20	15.2	2		0.90		
781102	1355	21	14.1			0.30		
781102	1355	22	13.5			0.50		
781102	1355	23	12.6			0.50		
781102	1355	24	12.0			0.50		
781102	1355	25	11.1	1		0.60		
781102	1355	26	10.5			0.45		
781102	1355	30	9.2			0.15		
781102	1355	31	8.8	43		0.10		
781103	1050	0	17.8			8.40		
781103	1050	5	17.8			8.30		
781103	1050	10	17.8			8.10		
781103	1050	15	17.8			7.90		
781103	1050	19	17.9			7.90		
781103	1050	20	15.9			1.00		
781103	1050	21	14.1			0.20		
781103	1050	22	13.1			0.20		
781103	1050	23	12.3			0.25		
781103	1050	24	11.7			0.25		
781103	1050	25	11.2			0.30		
781103	1050	29	9.3			0.15		

STATION - LL-03

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L
780815	1400	0	27.1		29	8.4	7.4	8
780815	1400	1	27.1			4.3		
780815	1400	5	26.4		29	0.6	7.6	9
780815	1400	7	25.3					
780815	1400	8	25.3			0.3		
780815	1400	9	23.2			0.1		
780815	1400	10	20.5		31	0.1	6.8	8
780815	1400	11	18.3			0.0		
780815	1400	12	16.4			0.0		
780815	1400	13	15.4			0.0		
780815	1400	14	14.4			0.0		
780815	1400	15	13.1		30	0.0	6.6	8
780815	1400	16	11.5			0.0		
780815	1400	17	10.4			0.0		
780815	1400	18	9.8			0.0		
780815	1400	19	9.2			0.0		
780815	1400	20	8.8		30	0.0	6.4	8
780815	1400	25	7.4		30	0.0	6.4	7
780815	1400	30	6.5		29	0.0	6.2	8
780815	1400	35	6.3		30	0.0	6.4	7
780815	1400	40	6.2		29	0.0	6.3	8
780815	1400	43	6.2			0.0		
780815	1400	45	6.2		29	0.0	6.3	7
780912	1330	0	27.6					
780912	1330	5	27.6					
780912	1330	9	27.1					
780912	1330	10	25.5					
780912	1330	11	23.7					
780912	1330	12	21.4					
780912	1330	13	20.3					
780912	1330	14	18.9					
780912	1330	15	17.3					
780912	1330	16	16.3					
780912	1330	17	14.9					
780912	1330	18	13.8					
780912	1330	19	12.9					
780912	1330	20	12.1					
780912	1330	21	11.0					
780912	1330	22	10.5					
780912	1330	23	9.7					
780912	1330	25	9.1					
780912	1330	30	7.8					
780912	1330	35	7.3					
780912	1330	40	7.1					
780912	1330	43	6.7					
780912	1630	0	27.8	2				
780912	1630	5	27.8	2				
780912	1630	9	27.6					
780912	1630	10	25.7	2				
780912	1630	11	24.5					
780912	1630	12	22.6					
780912	1630	13	21.3					
780912	1630	14	19.2					
780912	1630	15	17.9	2				
780912	1630	16	15.5					
780912	1630	17	13.9					

STATION - LL-03

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L
780912	1630	18	13.4					
780912	1630	19	12.9					
780912	1630	20	11.8	2				
780912	1630	21	11.0					
780912	1630	22	10.2					
780912	1630	23	9.7					
780912	1630	25	8.8	3				
780912	1630	30	7.8	4				
780912	1630	35	7.3	7				
780912	1630	40	7.1	10				
780912	1630	43	6.7	5				
780912	2359	0	27.6	2				
780912	2359	5	27.9	2				
780912	2359	9	27.1	2				
780912	2359	10	25.6					
780912	2359	11	23.6					
780912	2359	12	21.9					
780912	2359	13	21.0	2				
780912	2359	14	19.3					
780912	2359	15	17.3					
780912	2359	16	16.2					
780912	2359	17	14.4					
780912	2359	18	13.9	2				
780912	2359	19	12.6					
780912	2359	20	11.9					
780912	2359	21	10.7					
780912	2359	22	10.0					
780912	2359	23	9.7	2				
780912	2359	24	9.7					
780912	2359	25	9.0					
780912	2359	26	8.4					
780912	2359	27	8.3					
780912	2359	28	7.9	4				
780912	2359	29	7.6					
780912	2359	30	7.3					
780912	2359	31	7.1					
780912	2359	32	6.9					
780912	2359	33	6.8	6				
780912	2359	34	6.8					
780912	2359	35	6.8					
780912	2359	36	6.7					
780912	2359	37	6.7					
780912	2359	38	6.7	7				
780912	2359	39	6.5					
780912	2359	40	6.5					
780912	2359	41	6.5					
780912	2359	42	6.5					
780912	2359	43	6.5	7				
780912	2359	44	6.5					
780913	1435	0	29.2	2				
780913	1435	5	27.9	2				
780913	1435	9	27.5					
780913	1435	10	25.5	2				
780913	1435	11	24.0					
780913	1435	12	21.9					
780913	1435	13	20.5					

STATION - LL-03

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L
780913	1435	14	19.2					
780913	1435	15	18.1	1				
780913	1435	16	16.8					
780913	1435	17	15.7					
780913	1435	18	14.4					
780913	1435	19	13.7					
780913	1435	20	12.3	2				
780913	1435	21	1.2					
780913	1435	22	10.9					
780913	1435	23	10.2					
780913	1435	24	9.7					
780913	1435	25	9.4	2				
780913	1435	26	9.1					
780913	1435	27	8.6					
780913	1435	28	8.3					
780913	1435	29	8.1					
780913	1435	30	8.9	4				
780913	1435	31	7.6					
780913	1435	32	7.4					
780913	1435	33	7.3					
780913	1435	34	7.3					
780913	1435	35	7.2					
780913	1435	36	7.2					
781017	1330	0	19.4					
781017	1330	5	19.5					
781017	1330	10	19.5					
781017	1330	15	19.5					
781017	1330	17	19.3					
781017	1330	18	17.1					
781017	1330	19	16.1					
781017	1330	20	14.8					
781017	1330	21	13.9					
781017	1330	22	13.0					
781017	1330	25	11.1					
781017	1330	30	9.1					
781017	1330	35	8.1					
781017	1330	40	7.9					
781017	1330	42	7.6					
781017	2130	0	19.1					
781017	2130	5	19.2					
781017	2130	10	19.3					
781017	2130	15	19.3					
781017	2130	16	19.3					
781017	2130	17	19.3					
781017	2130	18	17.0					
781017	2130	19	16.1					
781017	2130	20	15.0					
781017	2130	21	13.9					
781017	2130	22	12.9					
781017	2130	23	12.0					
781017	2130	24	11.1					
781017	2130	25	10.3					
781017	2130	30	8.6					
781017	2130	35	7.9					
781017	2130	40	7.3					
			19.2					

STATION - LL-03

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L
781018	0120	5	19.2					
781018	0120	10	19.2					
781018	0120	15	19.2					
781018	0120	17	17.7					
781018	0120	18	17.7					
781018	0120	19	16.1					
781018	0120	20	15.1					
781018	0120	21	14.1					
781018	0120	22	13.1					
781018	0120	23	12.1					
781018	0120	24	11.6					
781018	0120	25	11.1					
781018	0120	30	9.1					
781018	0120	35	8.1					
781018	0120	40	8.1					
781018	0120	43	7.6					
781102	1305	0	19.1	2		8.0		
781102	1305	5	18.4	2		8.1		
781102	1305	10	18.3	2		8.1		
781102	1305	15	18.2	2		8.1		
781102	1305	19	17.7			7.2		
781102	1305	20	15.8	2		0.3		
781102	1305	21	14.4			0.1		
781102	1305	22	14.4			0.1		
781102	1305	23	13.8					
781102	1305	24	12.7			0.1		
781102	1305	25	11.0	2		0.1		
781102	1305	26	10.3					
781102	1305	27	9.7					
781102	1305	30	9.0	2		0.5		
781102	1305	35	8.5	2		0.3		
781102	1305	40	8.4	2		0.5		
781102	1305	42	8.3	15		0.4		
781103	1110	0	17.9			8.4		
781103	1110	19	17.6			7.6		
781103	1110	20	16.1			1.2		
781103	1110	21	14.3			0.4		
781103	1110	22	13.3			0.3		
781103	1110	23	12.7			0.3		
781103	1110	25	11.5			0.3		
781103	1110	30	9.4			0.2		
781103	1110	35	9.0			0.1		
781103	1110	40	8.6			0.1		
781103	1110	42	8.4			0.1		

STATION - LL-04

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780816	1700	0	26.8		30	9.6	7.0	8					
780816	1700	5	26.3		30	8.5	7.1	8					
780816	1700	10	22.3		30	2.8	6.3	9					
780816	1700	11	20.3			1.5							
780816	1700	12	19.3			0.8							
780816	1700	13	18.1			1.2							
780816	1700	14	16.3			1.0							
780816	1700	15	15.3		30	0.9	6.2	8					
780816	1700	16	14.3			0.8							
780816	1700	17	13.3			0.8							
780816	1700	18	12.3			0.7							
780816	1700	19	11.3			0.4							
780816	1700	20	10.3		30	0.5	6.0	7					
780816	1700	21	9.3			0.5							
780816	1700	22	8.8			0.5							
780816	1700	23	8.3			0.4							
780816	1700	25	7.8		29	0.4	5.9	7					
780816	1700	30	6.8		29	0.4	5.8	7					
780816	1700	35	6.3		29	0.4	5.7	8					
780816	1700	40	6.3		29	0.4	5.7	8					
780912	0930	0	27.8	4									
780912	0930	1	27.8										
780912	0930	5	27.8	2									
780912	0930	9	27.8										
780912	0930	10	25.6	2									
780912	0930	11	24.0										
780912	0930	12	22.6										
780912	0930	13	20.3										
780912	0930	14	19.2										
780912	0930	15	18.1	2									
780912	0930	16	17.1										
780912	0930	17	16.0										
780912	0930	18	14.5										
780912	0930	19	13.1										
780912	0930	20	12.1	2									
780912	0930	21	11.0										
780912	0930	22	10.5										
780912	0930	25	8.7	2									
780912	0930	30	7.6	2									
780912	0930	35	7.1	5									
780912	0930	38	6.5	5									
780913	1230	0	27.8	1									
780913	1230	5	27.6	1									
780913	1230	9	27.4										
780913	1230	10	26.1	1									
780913	1230	11	24.5										
780913	1230	12	23.3										
780913	1230	13	21.0										
780913	1230	14	19.2										
780913	1230	15	18.3	3									
780913	1230	16	16.9										
780913	1230	17	15.5										
780913	1230	18	14.2										
780913	1230	19	13.5										
780913	1230	20	12.4	3									
[illegible]	[illegible]	21	11.6										

STATION - LL-04

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780913	1230	22	10.8										
780913	1230	23	9.9										
780913	1230	24	9.6										
780913	1230	25	8.8	4									
780913	1230	26	8.7	2									
780913	1230	27	8.6										
780913	1230	28	8.1										
781017	1500	0	18.7										
781017	1500	5	18.7										
781017	1500	10	18.7										
781017	1500	15	18.7										
781017	1500	16	18.7										
781017	1500	17	17.1										
781017	1500	18	15.0										
781017	1500	19	14.4										
781017	1500	20	14.1		29		5.6	9					
781017	1500	21	13.1										
781017	1500	22	12.3										
781017	1500	23	11.7										
781017	1500	25	10.7										
781017	1515	20							2.9	10.00K	192	119.0	10.00K
781102	1535	0	19.3	2		8.3							
781102	1535	5	18.6			8.3							
781102	1535	10	18.3			8.2							
781102	1535	15	18.3	2		8.1							
781102	1535	16				8.1							
781102	1535	17				8.0							
781102	1535	18				8.0							
781102	1535	19	17.1	2		5.8							
781102	1535	20	15.5	2		0.1							
781102	1535	21	14.3										
781102	1535	22	13.4										
781102	1535	23	12.5			0.5							
781102	1535	24	11.8										
781102	1535	25	11.3			0.5							
781102	1535	30	9.4										
781102	1535	33	8.8	13		0.5							
781103	1240	0	18.6			8.1							
781103	1240	5	18.2			8.1							
781103	1240	10	18.0			8.1							
781103	1240	15	18.0			8.1							
781103	1240	19	17.7			6.4							
781103	1240	20	15.9			0.9							
781103	1240	21	14.2			0.4							
781103	1240	23	12.7			0.1							
781103	1240	25	11.3			0.1							
781103	1240	30	9.3			0.1							
781103	1240	35	8.6			0.1							
781103	1240	38	8.4			0.1							

STATION - LL-05

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780815	2200	0	26.3		30	8.3	7.1	8					
780815	2200	5	26.8		30	8.6	6.9	8	2.7	26.00	53	10.0K	10.00K
780815	2200	8	24.3										
780815	2200	9	24.3										
780815	2200	10	22.3		29	3.5	6.2	8					
780815	2200	11	20.3			3.0							
780815	2200	12	18.3			2.5							
780815	2200	13	17.3			2.3							
780815	2200	14	16.3			2.2							
780815	2200	15	15.3		29	2.0	5.9	8	1.7	10.00K	50K	18.0	10.00K
780815	2200	16	13.8			1.9							
780815	2200	17	13.3			1.8							
780815	2200	18	11.8			1.7							
780815	2200	19	10.8			1.6							
780815	2200	20	10.3		29	1.5	5.8	7					
780815	2200	25	8.3		30	1.4	5.8	7					
780815	2200	30	7.3		30	1.3	5.8	7	1.7	10.00K	304	139.0	10.00K
780815	2200	35	6.8		30	1.3	5.8	8					
780815	2200	40	6.3			1.2							
780815	2200	45	6.3			1.0			1.8	1.00K	261	126.0	10.00K
780912	1040		27.6	2		7.4							
780912	1150	5	27.6	2	30	6.3	6.4	8	2.2	10.00K	57	10.0K	10.00K
780912	1150	9	27.6										
780912	1150	10	27.1	2									
780912	1150	11	24.0										
780912	1150	12	22.4										
780912	1150	13	20.8										
780912	1150	14	19.2										
780912	1150	15	18.1	2	30		6.4	7					
780912	1200	16	16.9						1.6	10.00K	72	21.0	29.00
780912	1200	17	15.5										
780912	1200	18	14.1										
780912	1200	19	12.9										
780912	1200	20	12.1	2									
780912	1200	21	11.3										
780912	1200	22	10.3										
780912	1200	23	9.7										
780912	1200	24	9.2										
780912	1200	25	8.7	4									
780912	1200	30	7.6	4									
780912	1207	32			24				1.3	10.00K	367	249.0	15.00
780912	1207	35	7.1	6									
780912	1207	40	7.1	7									
780912	1215	43	6.6	7	25	1.4	6.4	8	1.6	19.00	734	351.0	47.00
780913	0630		26.5	2	35	7.8	6.4	7					
780913	0715	5	27.1	2	30	7.5	6.2	8	2.0	10.00K	50K	10.0K	10.00K
780913	0715	8	27.3			7.4							
780913	0715	9	27.4			7.3							
780913	0715	10	25.1	2	31	5.0	6.1	7					
780913	0715	11	23.4			1.1							
780913	0718	12	21.7	6	31	0.8	6.1	7	1.3	17.00	262	14.0	74.00
780913	0718	13	20.3			1.7							
780913	0718	14	18.9			1.8							
780913	0718	15	17.2			1.9							
780913	0718	16	16.3			1.9							
780913	0718	17	14.4			2.2							

STATION - LL-05

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780913	0722	18	13.6	2	32	2.3	6.0	7	1.0	15.00	72	28.0	20.00
780913	0722	19	12.4			2.6							
780913	0722	20	2.9	1	31	6.2	2.0	6					
780913	0722	21	10.5			2.9							
780913	0722	22	9.7			2.8							
780913	0722	23	8.8			2.9							
780913	0722	24	8.6			2.8							
780913	0722	25	7.9	3	34	2.8	6.2	6					
780913	0722	30	6.9	9	35	2.5	6.4	8	2.7	17.00	724	506.0	27.00
780913	0722	33	6.7			2.0							
780913	0805	35	6.5	5	35	1.7	6.2	9	2.3	10.00K	539	275.0	
780913	0805	37	6.5			1.6							
780913	0805	38	6.5			1.5							
780913	0805	39	6.5			1.5							
781016	1110	0	19.9										
781016	1110	1	20.0										
781016	1110	5	20.0										
781016	1110	10	20.1										
781016	1110	15	20.1										
781016	1110	16	20.1										
781016	1110	17	16.7										
781016	1110	18	15.7										
781016	1110	19	14.7										
781016	1110	20	14.0										
781016	1110	25	9.7										
781016	1110	30	8.4										
781016	1110	35	7.9										
781016	1110	37	7.6										
781017	1600	0	19.6		27	8.6	5.6	9					
781017	1600	5	19.4										
781017	1600	10	19.4		27	8.5	5.7	9	3.7	10.00K	187	26.0	10.00K
781017	1600	15	19.4										
781017	1600	17	19.3										
781017	1600	18	16.6										
781017	1600	19	15.4										
781017	1600	20	14.3		28	0.9	5.5	9					
781017	1600	21	13.5										
781017	1600	22	12.6										
781017	1600	23	11.9										
781017	1600	25	10.3										
781017	1600	30	8.7		29	0.1	5.5	10					
781017	1600	35	7.7		29	0.1	5.6	11					
781017	1600	40	7.4			0.1							
781102	1435	0	18.9	2	29	8.3	5.7	9					
781102	1435	5	18.3			8.3							
781102	1435	10	18.3	2		8.2							
781102	1435	15	18.2			8.1							
781102	1435	16				8.1							
781102	1435	17				8.1							
781102	1435	18				8.1							
781102	1435	19	17.3			4.8							
781102	1435	20	15.0			0.4							
781102	1435	21	13.9	2	30		5.6	7					
781102	1435	22	12.9			0.1							
781102	1435	23	12.3			0.1							
[illegible]	1435	24	11.7										

STATION - LL-05

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L	007 SULFI MG.
781102	1435	25	12.0			0.1								
781102	1435	30	9.5	2		0.1								
781102	1435	32		12										
781102	1435	35	8.8	15		0.2								
781102	1435	40	8.5	22	32	0.3	5.7	14						
781102	1450	10							1.7	10.00K	104	22.0	10.00K	
781102	1455	21							1.7	10.00K	202	241.0	10.00K	
781102	1500	30							1.0K	10.00K	1320	805.0	10.00K	
781102	1503	40							1.3K	10.00K	2640	974.0	10.00K	0.
781103	1138	35							1.0	10.00K	1072	889.0	10.00K	
781103	1320	0	18.6			8.1								
781103	1320	5	18.3			8.2								
781103	1320	10	18.0			8.2								
781103	1320	15	18.0			8.1								
781103	1320	18	17.8			7.9								
781103	1320	19	17.3			4.5								
781103	1320	20	15.0			0.3								
781103	1320	21	14.1			0.3								
781103	1320	22	13.1			0.1								
781103	1320	23	12.4			0.1								
781103	1320	24	12.0			0.1								
781103	1320	25	11.3			0.1								
781103	1320	30	9.5			0.1								
781103	1320	35	8.8			0.1								
781103	1330	10							2.2	10.00K	168	41.0	10.00K	
781103	1332	21							2.1	10.00K	320	319.0	10.00.	
781103	1335	30							2.0	10.00K	1212	728.0	10.00K	

STATION - HWY 60

DATE	TIME	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L	01019 CD MUD WET WGTM G/KG-CD
780706	1300	25.0	7	26	6.6	8						
780706	1305		7		6.5	8						
780706	1310		7									
780807	1130	21.9	75	25	6.5	7	5.3	10.00K	6977	162.0	10.00	
780807	1135		80		6.6	8	12.0	10.00	7527	170.0	10.00K	
780807	1145		72									
780808	1030	20.1	72	28	6.5	4	8.0	10.00K	5875	140.0	10.00	
780808	1035		72		6.5	3	6.3	10.00	5723	146.0	64.00	
780808	1040		72									
780809	1230		155	23	6.4	7	4.2	17.00	15390	253.0	13.00	
780809	1235		155		6.4	7	5.0	30.00		328.0	38.00	1215.00
780809	1240		175									
780810	1046	19.3	85	20	6.2	5	5.7	10.00K	7660	178.0	10.00K	
780810	1050		64		6.3	4	6.0	13.00	7926	189.0	10.00K	
780810	1055		85									
780811	1110	19.9	30	22	6.5	7	2.5	10.00K	2874	76.0	10.00K	
780811	1115		30		6.5	7	3.2	10.00K	2988	76.0	10.00K	
780811	1120		32									
780905	1125	21.3	7	27	6.4	10	1.6	10.00K	481	15.0	10.00K	
780905	1130		7		6.4	8	1.3	10.00K	420	21.0	10.00K	
780905	1135		7									
780906	1255	20.9	6	26	6.5	7	1.0K	10.00K	448	18.0	10.00K	
780906	1300		7		6.4	7	1.3	10.00K	420	24.0	10.00K	
780906	1305		6									
780907	1050	20.3	6	25	6.5	8	1.6	10.00K	396	15.0	10.00K	
780907	1055		7		6.9	8	1.3	10.00K	429	10.0K	10.00K	
780907	1100		6									
780908	1205	20.8	8	26	6.6	8	1.0	10.00K	491	15.0	10.00K	
780908	1210		8		6.3	8	1.3	10.00K	486	11.0	10.00K	
780908	1215		6									
780909	0935	20.5	6	24	6.1	8	1.0	10.00K	743	21.0	10.00K	
780909	0940		6		6.1	8	1.0	10.00K	567	10.0K	10.00K	
780909	0945		6									
781010	1047	12.2	4	20	6.1	9	1.3	10.00K	647	141.0	10.00K	
781010	1050	12.2	6	20	6.1	8	1.0K	10.00K	475	19.0	10.00K	
781010	1055		9									
781011	1000		8				3.4	10.00K	571	13.0	10.00K	
781011	1003		8	20	6.2	9	1.0K	10.00K	571	16.0	10.00K	
781011	1010	12.2	6	20	6.2	8						
781012	1230	14.2	11	24	6.0	9	1.9	10.00K	876	29.0	10.00K	
781012	1235		8	30	6.1	8	2.6	10.00K	740	21.0	10.00K	
781012	1240		8									
781013	1100	15.2	8	22	5.7	8	1.9	10.00K	556	16.0	10.00K	
781013	1105		8	22	5.7	8	2.8	10.00K	538	18.0	10.00K	
781013	1110		8									
781014	0925	14.2	8	22	6.0	9	1.6	10.00K	628	22.0	10.00K	
781014	0930		8	21	5.9	8	1.9	10.00K	628	22.0	10.00K	
781014	0935		8									

STATION - HWY 52 BRIDG

DATE	TIME	00010 WATER TEMP CENT	00070 TURB. JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00680 T ORG C C MG/L	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
780706	1000		14								
780706	1005		12								
780706	1010		11								
780807	0930	22.6	475	25	6.1	5	12.0	36.00	34820	559.0	46.00
780807	0935	22.6	475		6.1	6	11.0	27.00	34820	457.0	42.00
780807	0945		475								
780808	0915	21.2	160	25	6.5	5	6.3	10.00	9408	140.0	10.00K
780808	0920		160		6.2	5	7.9	17.00	9978	162.0	10.00K
780808	0925		160								
780809	0935	21.9	54	25	6.4	6	8.4	10.00K	3678	76.0	10.00K
780809	0940		60		6.4	6	4.0	10.00	3482	76.0	10.00K
780809	0945		54								
780810	0930	19.9	105	21	6.2	5	4.5	13.00	6369	124.0	10.00K
780810	0935		105		6.2	5	5.0	10.00	6369	124.0	10.00K
780810	0941		120								
780811	0936	20.7	44	23	6.5	6	4.2	10.00	2798	71.0	10.00K
780811	0941		44		6.6	6	3.4	10.00	2722	55.0	10.00K
780811	0946		35								
780905	1010	21.4	7	28	6.2	8	2.0	10.00K	553	24.0	10.00K
780905	1015		7		6.3	8	1.3	10.00K	577	18.0	10.00K
780905	1017		7								
780906	1005	21.7	7	27	6.3	9	1.0	10.00K	534	31.0	10.00K
780906	1010		8		6.2	7	1.3	10.00K	524	21.0	10.00K
780906	1015		7								
780907	0925	20.3	9	28	6.5	9	2.0	10.00K	581	28.0	10.00K
780907	0930		8		6.4	8	1.3	10.00K	529	18.0	10.00K
780907	0935		8								
780908	0930	20.8	8	27	6.3	8	1.3	10.00K	462	21.0	10.00K
780908	0935		8		6.3	8	1.0	10.00K	510	18.0	10.00K
780908	0940		8								
780909	0820	20.5	6	32	6.2	9	1.3	10.00K	534	31.0	10.00K
780909	0825		6		6.2	8	1.3	10.00K	524	21.0	10.00K
780909	0830		4								

STATION - BOLLING BRDG

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT
780911	1410	0	27.9
780911	1410	1	28.1
780911	1410	2	28.1
780911	1410	3	28.1
780911	1410	4	28.1
780911	1410	5	28.1
780911	1410	6	28.1
780911	1410	7	28.1
780911	1410	8	27.2
780911	1410	9	25.5
780911	1410	10	24.5
780911	1410	11	23.4
780911	1410	12	22.4
780911	1410	13	20.5
780911	1410	14	19.3
780911	1410	15	17.2
780911	1410	16	15.9
780911	1410	17	14.9
780911	1410	18	13.7
780911	1410	19	12.4
780911	1410	20	11.3
780911	1410	21	10.6
780911	1410	22	9.8
781019		0	19.2
781019		1	19.2
781019		2	19.2
781019		3	19.2
781019		4	19.2
781019		5	19.2
781019		6	19.2
781019		7	19.2
781019		8	19.2
781019		9	19.2
781019		10	19.2
781019		11	19.2
781019		12	19.2
781019		13	19.2
781019		14	19.2
781019		15	15.7
781019		16	17.2
781019		17	16.1
781019		18	15.1
781019		19	14.1
781019		20	13.3
781019		21	12.6
781019		22	12.1
781019		23	11.6
781019		24	11.1
781019		25	10.6
781019		27	10.1

STATION - WILKIE BRIDG

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT
780915	1100	0	25.7
780915	1100	1	26.1
780915	1100	2	26.3
780915	1100	3	26.3
780915	1100	4	26.3
780915	1100	5	26.3
780915	1100	6	26.3
780915	1100	7	25.4
780915	1100	8	24.5
780915	1100	9	24.3
780915	1100	10	24.2
780915	1100	11	23.9
780915	1100	12	23.7
780915	1100	13	23.5
781019		0	18.2
781019		5	18.2
781019		6	17.7
781019		7	17.1
781019		8	17.1
781019		9	15.7
781019		10	14.7
781019		11	14.1

STATION - BROWNS BRIDG

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT
780911	1505	0	28.2
780911	1505	1	28.3
780911	1505	2	28.3
780911	1505	3	28.3
780911	1505	4	28.1
780911	1505	5	28.1
780911	1505	6	28.1
780911	1505	7	28.1
780911	1505	8	27.0
780911	1505	9	26.2
780911	1505	10	24.3
780911	1505	11	24.6
780911	1505	12	20.2
780911	1505	13	19.4
780911	1505	14	18.7
780911	1505	15	17.3
780911	1505	16	15.9
780911	1505	17	14.9
780911	1505	18	13.7
780911	1505	19	12.7
780911	1505	20	11.6
780911	1505	21	10.5
780911	1505	22	9.6
780911	1505	23	8.6
780911	1505	24	8.5
780911	1505	25	7.9
780911	1505	26	7.9
780911	1505	27	7.6
780911	1505	28	7.6
780911	1505	29	7.6
780911	1505	30	7.4
780911	1505	31	7.4
780911	1505	32	7.3
781019		0	19.7
781019		5	19.7
781019		10	19.3
781019		15	19.2
781019		16	18.2
781019		17	16.9
781019		18	15.1
781019		19	14.1
781019		20	13.3

STATION - LANIER BRIDG

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT
780911	1440	0	27.7
780911	1440	1	27.8
780911	1440	2	27.8
780911	1440	3	27.8
780911	1440	4	27.8
780911	1440	5	27.8
780911	1440	6	27.8
780911	1440	7	26.7
780911	1440	8	25.7
780911	1440	9	25.0
780911	1440	10	24.1
780911	1440	11	23.3
780911	1440	12	22.2
780911	1440	13	20.3
780911	1440	14	18.8
780911	1440	15	17.1
780911	1440	16	15.8
780911	1440	17	14.6
780911	1440	18	13.2
780911	1440	19	12.2
780911	1440	20	11.2
781019		0	19.9
781019		5	19.7
781019		10	19.7
781019		14	19.2
781019		15	18.4
781019		16	16.7
781019		17	16.9
781019		18	15.9
781019		19	14.7
781019		20	13.7
781019		21	12.6
781019		22	12.1

STATION - THOMPSON BR

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT
780915	1020	0	26.0
780915	1020	1	26.3
780915	1020	2	26.3
780915	1020	3	26.5
780915	1020	4	26.4
780915	1020	5	26.4
780915	1020	6	26.4
780915	1020	7	25.2
780915	1020	8	24.6
780915	1020	9	24.0
780915	1020	10	23.2
780915	1020	11	21.7
780915	1020	12	20.1
780915	1020	13	18.7
780915	1020	14	17.3
780915	1020	15	16.6
781019		0	19.2
781019		5	19.2
781019		11	19.2

STATION - LONGSTREET B

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT
780915	0950	0	26.0
780915	0950	1	26.3
780915	0950	2	26.3
780915	0950	3	26.3
780915	0950	4	26.5
780915	0950	5	26.5
780915	0950	6	26.5
780915	0950	7	25.1
780915	0950	8	24.7
780915	0950	9	24.4
780915	0950	10	23.6
780915	0950	11	22.4
780915	0950	12	21.3
780915	0950	13	19.8
781019		0	19.2
781019		1	19.2
781019		2	19.2
781019		3	19.2
781019		5	19.2
781019		10	19.2
781019		15	19.2
781019		16	19.2

STATION - CLARK

DATE	TIME	00003 DEPTH METERS	00010 WATER TEMP CENT
780915	0930	2	26.3
780915	0930	3	26.5
780915	0930	4	26.5
780915	0930	5	26.5
780915	0930	6	25.4
780915	0930	7	25.0
780915	0930	8	24.4
780915	0930	9	23.7
780915	0930	10	23.5
780915	0930	11	23.4
780915	0930	12	23.3
780915	0930	13	21.3
780915	0930	14	20.4
781019		0	18.2
781019		5	17.9
781019		6	17.9
781019		7	17.9
781019		8	16.7
781019		9	16.2
781019		10	15.7
781019		11	15.7
781019		12	15.7

STATION - BH-2*

DATE	TIME	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
781103		10.00K	869.00	612.00	733.00

*BH = Buford Hatchery

STATION - BH-3*

DATE	TIME	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
781103		10.00K	1203.00	652.00	430.00

*BH = Buford Hatchery

STATION - BH-4*

DATE	TIME	01042 COPPER CU,TOT UG/L	01045 IRON FE,TOT UG/L	01055 MANGNESE MN UG/L	01092 ZINC ZN,TOT UG/L
781103		10.00K	1095.00	654.00	622.00

BH = Buford Hatchery

LAKE LANIER STUDY, 1978
METALS IN FISH TISSUE

Date	Location	Species	Tissue	ug/g Dry Wt. Cu	Mn	Zn	Fe
12/5/78	Boggs Cr.	Rainbow	Whole	3.60	21.40	114.26	126.84
12/5/78	Boggs Cr.	Rainbow	Liver	55.00	<25.00	<50.00	1465.00
12/5/78	Boggs Cr.	Rainbow	Liver	56.00	<20.00	<40.00	729.00
12/5/78	Boggs Cr.	Rainbow	Liver	35.00	<12.50	80.00	1088.75
12/5/78	Town Cr.	Rainbow	Whole	5.18	26.89	120.22	157.70
12/5/78	Town Cr.	Rainbow	Liver	39.09	4.54	45.00	190.91
12/5/78	Town Cr.	Rainbow	Liver	0.30	<4.35	27.83	141.30
12/5/78	Dukes Cr.	Rainbow	Whole	2.17	32.50	123.35	166.64
12/5/78	Dukes Cr.	Rainbow	Liver	<3.85	<3.85	2.69	133.85
12/5/78	Dukes Cr.	Rainbow	Liver	7.06	<5.88	64.71	1168.82
15/5/78	Dukes Cr.	Rainbow	Liver	21.60	8.40	58.00	519.20
12/5/78	McClure Cr.	Rainbow	Whole	5.68	23.05	129.50	229.13
12/5/78	McClure Cr.	Rainbow	Liver	130.40	<4.67	55.42	273.75
12/5/78	McClure Cr.	Rainbow	Liver	257.59	<3.45	132.76	905.86
12/8/78	Chattahoochee	L.M.	Liver	1.75	2.01	59.79	975.71
12/8/78	Chattahoochee	L.M.	Liver	20.16	5.70	89.59	719.59
12/8/78	Chattahoochee	L.M.	Whole	2.41	12.04	54.01	72.19
12/8/78	Chattahoochee	L.M.	Whole	2.84	8.30	58.16	98.79
12/12/78	Chestatee	L.M.	Whole	2.30	6.73	72.00	35.51
12/12/78	Chestatee	L.M.	Whole	1.90	3.70	64.33	56.98
12/12/78	Chestatee	L.M.	Liver	<0.54	1.80	47.50	268.20
12/12/78	Chestatee	L.M.	Liver	6.38	5.44	79.94	692.56
11/2/78	Chattahoochee	Y. Perch		2.78	70.08	79.30	202.13
11/2/78	Chattahoochee	Y. Perch		3.02	61.34	88.77	89.38
11/2/78	Chattahoochee	Y. perch		2.32	109.44	86.90	83.03
11/2/78	Chattahoochee	Y. Perch		2.41	91.22	65.39	40.89
11/2/78	Chattahoochee	Br. Trout		5.07	35.87	87.75	133.62
11/2/78	Chattahoochee	Br. Trout		2.87	19.73	91.40	51.73

L.M. - Largemouth Bass
Y. Perch - Yellow Perch
Br. Trout - Brook Trout

7/3/78	Chattahoochee	Rainbow	1.58	2.00	41.15	66.92
7/3/78	Chattahoochee	Rainbow	17.38	4.81	123.60	469.00
7/3/78	Chattahoochee	Rainbow	1.81	3.04	42.30	23.50
7/3/78	Chattahoochee	Rainbow	1.69	3.46	53.80	35.15
7/5/78	Chestatee	L.M.	9.19	1.65	50.77	143.80
7/5/78	Chestatee	L.M.	2.58	66.15	66.20	106.20
7/5/78	Chestatee	L.M.	22.92	4.62	70.80	1069.00
7/5/78	Chestatee	L.M.	1.92	5.00	39.20	50.40
7/5/78	Dukes Cr.		61.50	0.64	81.20	1392.00
7/5/78	Dukes Cr.		34.85	3.62	73.80	873.00
7/5/78	Dukes Cr.		18.65	4.46	90.40	2585.00
7/5/78	Dukes Cr.		3.35	27.54	141.20	114.00
7/5/78	Plume Orchard		213.50	5.35	92.69	346.20
7/5/78	Plume Orchard		4.31	13.65	103.90	153.10
7/5/78	McClure Cr.		73.10	2.50	32.10	1442.00
7/5/78	McClure Cr.		358.10	0.88	68.10	496.00
7/5/78	McClure Cr.		42.30	4.12	68.10	465.00
7/5/78	McClure Cr.		9.61	12.88	93.80	100.81
7/5/78	Charlies Cr.		12.20			51.20
7/5/78	Charlies Cr.		29.20			84.40
7/5/78	Charlies Cr.		89.60			58.80
7/5/78	Charlies Cr.		4.20			86.50
6/30/78	Town Cr.		72.70	22.42	60.00	5342.00
6/30/78	Town Cr.		153.50	2.50	54.23	1196.00
6/30/78	Town Cr.		26.60	5.38	61.90	1131.00
6/30/78	Town Cr.		4.10	19.38	90.00	132.30
6/30/78	Town Cr.		45.00	1.88	32.96	2046.00
6/30/78	Town Cr.		118.50	8.19	99.23	1165.00
6/30/78	Town Cr.		23.20	0.65	74.23	977.00
6/30/78	Town Cr.		2.23	7.35	56.54	58.00

L.M. - Largemouth Bass
Y. Perch - Yellow Perch
Br. Trout - Brook Trout

7/5/78	Buford Hatchery	Rainbow	Whole	4.04	8.85	53.80	33.80
7/5/78	Buford Hatchery	Rainbow	Whole	2.15	8.65	48.08	41.50
7/5/78	Buford Hatchery	Rainbow	Liver	200.00	3.69	53.50	89.20
7/5/78	Buford Hatchery	Rainbow	Liver	144.23	6.27	81.50	199.20
10/78	Buford Hatchery	Rainbow	Whole	27.23	0.96	27.08	165.00
12/78	Buford Hatchery	Rainbow	Gill	17.2			
12/78	Buford Hatchery	Rainbow	Liver	350.6			
12/78	Buford Hatchery	Rainbow	Gill	9.6			
12/78	Buford Hatchery	Rainbow	Liver	498.0			
12/78	Buford Hatchery	Rainbow	Gill	16.2			
12/78	Buford Hatchery	Rainbow	Liver	369.80			
12/78	Buford Hatchery	Rainbow	Gill	10.50			
12/78	Buford Hatchery	Rainbow	Liver	371.30			
12/78	Buford Hatchery	Rainbow	Gill	17.00			
12/78	Buford Hatchery	Rainbow	Liver	284.00			
12/78	Buford Hatchery	Rainbow	Gill	10.40			
12/78	Buford Hatchery	Rainbow	Liver	484.00			
12/78	Buford Hatchery	Rainbow	Gill	48.2			
12/78	Buford Hatchery	Rainbow	Liver	422.1			
12/78	Buford Hatchery	Rainbow	Gill	16.8			
12/78	Buford Hatchery	Rainbow	Liver	317.1			
12/78	Buford Hatchery	Rainbow	Gill	3.4			
12/78	Buford Hatchery	Rainbow	Liver	816.0			
12/78	Buford Hatchery	Rainbow	Gill	7.8			
12/78	Buford Hatchery	Rainbow	Liver	598.9			
12/78	Buford Hatchery	Rainbow	Gill	8.1			
12/78	Buford Hatchery	Rainbow	Liver	520.3			
12/78	Buford Hatchery	Rainbow	Gill	11.8			
12/78	Buford Hatchery	Rainbow	Liver	305.8			
12/78	Buford Hatchery	Rainbow	Gill	2.5			
12/78	Buford Hatchery	Rainbow	Liver	736.2			
12/78	Buford Hatchery	Rainbow	Gill	10.0			
12/78	Buford Hatchery	Rainbow	Liver	508.6			
12/78	Buford Hatchery	Rainbow	Gill	12.7			
12/78	Buford Hatchery	Rainbow	Liver	354.0			
12/78	Buford Hatchery	Rainbow	Gill	14.3			
12/78	Buford Hatchery	Rainbow	Liver	492.8			
12/78	Buford Hatchery	Rainbow	Gill	4.3			
12/78	Buford Hatchery	Rainbow	Liver	504.1			
12/78	Buford Hatchery	Rainbow	Gill	1.5			
12/78	Buford Hatchery	Rainbow	Liver	624.8			
12/78	Buford Hatchery	Rainbow	Gill	17.8			

L.M. - Largemouth Bass
Y. Perch - Yellow Perch
Br. Trout - Brook Trout

12/78	Buford Hatchery	Rainbow	Liver	750.1
12/78	Buford Hatchery	Rainbow	Gill	8.7
12/78	Buford Hatchery	Rainbow	Liver	842.4
12/78	Buford Hatchery	Rainbow	Gill	17.9
12/78	Buford Hatchery	Rainbow	Liver	614.0
12/78	Buford Hatchery	Rainbow	Gill	24.3
12/78	Buford Hatchery	Rainbow	Liver	725.3
12/78	Buford Hatchery	Rainbow	Gill	5.5
12/78	Buford Hatchery	Rainbow	Liver	797.3
12/78	Buford Hatchery	Rainbow	Gill	2.4
12/78	Buford Hatchery	Rainbow	Liver	705.1

L.M. - Largemouth Bass
Y. Perch - Yellow Perch
Br. Trout - Brook Trout

8/93