APPENDIX K

WATER QUALITY ANALYSIS AND TRENDS

APPENDIX K

WATER QUALITY ANALYSIS AND TRENDS

Current Water Quality Data

Data from the stations listed in Table 3-10 were analyzed to determine the current water quality of Lake Lanier and its headwaters. The data were collected over an 8-year period (1992 to 2000) and provide a good representation of conditions in the lake over various seasons and under different meteorological conditions. To analyze a large data set that spans an 8-year period, however, "lumping" of water quality data is required and only general water quality conclusions can be drawn from this approach.

Lake Lanier and its headwaters were divided into eight sections to analyze the available current water quality. Tables K-1 to K-8 summarize the available data.

Results of the Clean Lakes Study Category I Stations

Physical Characteristics. Water transparency was measured by using Secchi disk depths and two photic sensors. Aqualand Marina and Buford Dam had the greatest Secchi depths and photic zone depths, indicating the greatest transparency. Clarks Bridge and Wilkie Bridge, the riverine sections of the lake, showed the highest levels of turbidity and total suspended solids, which is indicative of siltation. The average surface pH measurements were higher than the composite pH values, and in general surface and composite pH levels were highest when chlorophyll a levels were highest. Clarks Bridge and Wilkie Bridge had the highest concentrations of plankton biomass, which coincide with the highest chlorophyll a concentrations. Hardness and alkalinity were within expected levels based on the geology of the Lake Lanier watershed.

Pathogens. Fecal coliform bacteria were reported only rarely in the Category I stations.

Eutrophication. Nutrients sampled included total phosphorus, nitrate plus nitrite, total Kjeldahl nitrogen (TKN), and ammonia, and they were often below the level of detection. Based on the available data, nitrate-nitrite levels were highest at Flat Creek/Balus Creek and ammonia levels

were highest at the Wilkie Bridge station. Biochemical oxygen demand (BOD) was highest at Clarks Bridge and lowest at Buford Dam Pool. Total organic carbon concentrations were fairly uniform for all stations; the only elevated levels were at Clarks Bridge.

Metals. The Clean Lakes Study concluded that lead and mercury were entering Lake Lanier from urban, industrial, and residential; atmospheric deposition; and from former gold mines.

Results of the Clean Lakes Study: Category II Stations

Physical Characteristics. All pH measurements at Category II stations met the water quality standard. The mean pH values ranged from 6.78 to 7.58. Alkalinity in most tributaries was slightly higher than that in the Category I open water stations. Two stations—Limestone and Flat Creek—reported two and three times the normal background levels of alkalinity, respectively. The study suggests that the high levels might be due to the water pollution control plant at Flat Creek and the urban environment surrounding Limestone Creek.

Pathogens. The Clean Lakes Study found that although fecal coliforms were often undetectable in Lake Lanier, the counts in some tributaries could exceed the USEPA recommended value for primary contact waters.

Metals. The Clean Lakes Study concluded that the tributaries entering Lake Lanier have low concentrations of trace metals comparable to 100 percent forested watersheds in North Carolina.

Nutrients. Nutrients sampled included phosphorus, ammonia, nitrite plus nitrate, TKN, and total organic carbon. Flat Creek had the highest levels of phosphorus, ammonia, TKN, and organic carbon. Nitrate-nitrite levels were highest at Six Mile Creek. Dissolved oxygen concentrations were acceptable at all stations, and the lowest concentrations occurred at Flat Creek. Flat Creek had also produced the highest chemical oxygen demand and conductivity.

Comparison of Historic and Current Water Quality

Chattahoochee River Headwaters. The historic water quality in the Chattahoochee River headwaters was determined by analyzing the available data at station 12030001. The current

water quality was determined by analyzing the available data at stations 12030001 and 12030101.

Physical Characteristics. Dissolved oxygen was measured 43 times. The minimum value was 5.0 mg/L, and the maximum value was 12.0 mg/L. All samples met the water quality standard for dissolved oxygen. A chart of the available dissolved oxygen data is included in later in this appendix. Dissolved oxygen levels have generally decreased since the time of the historic data.

Turbidity was measured 30 times, resulting in a minimum value of 2.5 Formazin Turbidity Units (FTU) measured using a Hach measuring apparatus (Hach FTU) and a maximum of 150.0 Hach FTU. The average value for turbidity was 13.83 Hach FTU. Although the average turbidity value has decreased, the maximum turbidity value has increased. Forty-two pH samples were collected. The minimum pH observed was 6.4 and the maximum was 7.99. All pH samples met the water quality standard and have not changed much since the time of the historic data.

Pathogens. Thirty-five fecal coliform samples were collected in current years. The lowest fecal coliform level was zero, while the maximum number of fecal coliforms observed was 2,300. The average geomean met the water quality standard for fecal coliforms. A chart of the available fecal coliform data is included later in this appendix. Levels of fecal coliform have decreased since the time the historic data were collected.

Eutrophication. The 5-day BOD has increased since the time of the historic data. The minimum current BOD was 0.1 mg/L, and the maximum was 0.91 mg/L. No chlorophyll *a* samples were taken at these sites. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled 11 times. These samples were used to calculate maximum total nitrogen values. All samples met the water quality standard but have increased since the time of the historic data. Total phosphorus was sampled 42 times, resulting in a minimum value of 0.02 mg/L and a maximum value of 0.25 mg/L. Total phosphorus has increased since the time of the historic data. The mean total nitrogen to total phosphorus ratio was 8.4.

Metals. No metals were historically or currently sampled at these sites.

Organics. No organics were historically or currently sampled at these sites.

Chestatee River Headwaters. The historic water quality in the Chestatee River headwaters was determined by analyzing the available data at station 02333500. The current water quality was determined by analyzing the available data at stations 12036501 and 02333500.

Physical Characteristics. Dissolved oxygen was measured 25 times, resulting in a minimum value of 6.7 mg/L and a maximum value of 13.0 mg/L. All samples met the water quality standard for dissolved oxygen and have decreased since the time of the historic data. Turbidity was measured 21 times. The minimum value was 1.7 Hach FTU, and the maximum was 13.0 Hach FTU. The average value for turbidity was 4.7 Hach FTU. No historic turbidity data were collected. Forty-six pH samples were collected. The minimum pH observed was 6.2 and the maximum was 7.6. All pH samples met the water quality standard and have not changed much since the time of the historic data.

Pathogens. Thirty-four fecal coliform samples were collected. The lowest fecal coliform level was zero, while the maximum number of fecal coliforms observed was 1,700. The average geomean met the water quality standard for fecal coliforms. A chart of the available fecal coliform data is included later in this appendix. Levels of fecal coliform have decreased since the time the historic data were collected.

Eutrophication. The 5-day BOD was sampled 18 times. The mean value has generally decreased since the time of the historic data. The minimum BOD was 0.3 mg/L, and the maximum was 5.7 mg/L. Chlorophyll *a* was sampled 21 times, resulting in a minimum value of 1.8 µg/L and a maximum value of 5.1 µg/L. Historic chlorophyll *a* was not collected. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled 20 times. These samples were used to calculate maximum total nitrogen values, and all but one sample met the water quality standard. Nitrite plus nitrate values have generally increased since the time of the historic data. Total phosphorus was sampled 39 times, resulting in a minimum value of 0.02 mg/L and a maximum value of 0.21 mg/L. The mean value has generally decreased since the time of the historic data. The mean total nitrogen to total phosphorus ratio was 13.

Metals. Arsenic, copper, lead, and zinc were historically sampled in this watershed. All samples were found to be within water quality standards. No metals were sampled at the current stations.

Organics. No organics were historically or currently sampled at these stations.

Little River Headwaters. The current water quality in the Little River headwaters was determined by analyzing the available data at stations 1203141, 1203151, 1203181, and 02332830. No historic water quality data are available for the Little River headwaters.

Physical Characteristics. Dissolved oxygen was measured 126 times. The minimum value was 7.5 mg/L, and the maximum value was 11.6 mg/L. All samples met the water quality standard for dissolved oxygen. Turbidity was not sampled at these stations. To measure pH, 130 samples were collected. The minimum pH observed was 6.95 and the maximum was 7.55. All pH samples met the water quality standard.

Pathogens. Forty-seven fecal coliform samples were collected. The lowest fecal coliform level was zero, while the maximum number of fecal coliforms observed was 16,000. The average geomean exceeded the water quality standard for fecal coliforms. A chart of the available fecal coliform data is included later in this appendix.

Eutrophication. The 5-day BOD was sampled nine times. The minimum BOD was 0.2 mg/L and the maximum was 2.6 mg/L. Chlorophyll *a* was sampled once, resulting in a value of 12 mg/m^2. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled simultaneously 35 times. These samples were used to calculate maximum total nitrogen values, and all samples met the water quality standard. Total phosphorus was sampled 163 times, resulting in a minimum value of 0.02 mg/L and a maximum value of 0.53 mg/L. The mean total nitrogen to total phosphorus ratio was 20.3.

Metals. No metals were sampled at these sites.

Organics. No organics were sampled at these sites.

Lake Lanier–Chattahoochee River Arm. Station 12030121 sampling results were considered to be representative of current water quality conditions in the Chattahoochee River arm of Lake Lanier. No historic water quality data are available for the Chattahoochee River arm of Lake Lanier.

Physical Characteristics. Dissolved oxygen was not sampled at this station. Turbidity was sampled 18 times. The minimum result for turbidity was 1.6 Hach FTU, while the maximum result was 16.0 Hach FTU. Eighteen pH samples were collected. The minimum pH observed was 6.98 and the maximum was 8.0. All pH samples met the water quality standard.

Pathogens. Nine fecal coliform samples were collected. The lowest fecal coliform level was zero, while the maximum number of fecal coliforms observed was 40. The geomean met the water quality standard for fecal coliforms.

Eutrophication. The 5-day BOD was sampled 18 times. The minimum BOD was 0.2 mg/L and the maximum was 3.0 mg/L. Chlorophyll *a* was sampled 18 times, resulting in a minimum value of 1.16 µg/L and a maximum value of 11.84 µg/L. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled simultaneously 16 times. These samples were used to calculate maximum total nitrogen values, and all samples met the water quality standard. Total phosphorus was sampled 17 times, resulting in a minimum value of 0.02 mg/L and a maximum value of 0.14 mg/L. The mean total nitrogen to total phosphorus ratio was 11.5.

Metals. No metals were sampled at this station.

Organics. No organics were sampled at this station.

Lake Lanier–Chestatee River Arm. Station 12037001 sampling results were considered to be representative of current water quality conditions in the Chestatee River arm of Lake Lanier. No historic water quality data are available for the Chestatee River arm of Lake Lanier.

Physical Characteristics. Dissolved oxygen was not sampled at this station. Turbidity was sampled 20 times. The minimum result for turbidity was 1.8 Hach FTU, while the maximum result was 7.4 Hach FTU. Nineteen pH samples were collected. The minimum pH observed was 6.3 and the maximum was 7.89. All pH samples met the water quality standard.

Pathogens. Eleven fecal coliform samples were collected. The lowest fecal coliform level was zero, while the maximum number of fecal coliforms observed was 85. The geomean met the water quality standard for fecal coliforms. A chart of the available fecal coliform data is included later in this appendix.

Eutrophication. The 5-day BOD was not sampled at this station. Chlorophyll *a* was sampled 19 times, resulting in a minimum value of 0.74 µg/L and a maximum value of 7.27 µg/L. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled simultaneously 18 times. These samples were used to calculate maximum total nitrogen values, and all samples met the water quality standard. Total phosphorus was sampled 18 times, resulting in a minimum value of 0.02 mg/L and a maximum value of 0.12 mg/L. The mean total nitrogen to total phosphorus ratio was 10.

Metals. No metals were sampled at this station.

Organics. No organics were sampled at this station.

Lake Lanier–Little River Arm. Station 1203171 sampling results were considered to be representative of current water quality conditions in the Little River arm of Lake Lanier. No historic water quality data are available for the Little River arm of Lake Lanier.

Physical Characteristics. Dissolved oxygen was sampled 12 times at this station. The minimum dissolved oxygen observed was 8.1 mg/L, while the maximum observed was 10.2 mg/L. All samples met the water quality standard. A chart of the available dissolved oxygen data is included later in this appendix. Turbidity was not sampled at this station. Twelve pH samples were collected. The minimum pH observed was 7.01 and the maximum was 7.47. All pH samples met the water quality standard.

Pathogens. Twelve fecal coliform samples were collected. The lowest fecal coliform level was 50, while the maximum number of fecal coliforms observed was 2,060. The geomean exceeded the water quality standard for fecal coliforms. A chart of the available fecal coliform data is included later in this appendix.

Eutrophication. The 5-day BOD was not sampled at this station, and chlorophyll *a* was not sampled. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled simultaneously 11 times. These samples were used to calculate maximum total nitrogen values, and all samples met the water quality standard. Total phosphorus was sampled a total of 11 times, resulting in a minimum value of 0.04 mg/L and a maximum value of 0.15 mg/L. The mean total nitrogen to total phosphorus ratio was 11.

Metals. No metals were sampled at this station.

Organics. No organics were sampled at this station.

Lake Lanier–Middle Region. The historic water quality in the Middle Region of Lake Lanier was determined by analyzing the available data at station 12038001. The current water quality was determined by analyzing the available data at stations 12030201, 12038001, and 12038701.

Physical Characteristics. Dissolved oxygen was sampled 35 times at this station. The minimum dissolved oxygen observed was 0.3 mg/L, while the maximum observed was 11.9 mg/L. Dissolved oxygen levels have generally increased since the time of the historic data. Turbidity was sampled 85 times. The minimum result for turbidity was 1.0 Hach FTU, while the maximum result for turbidity was 25.0 Hach FTU. Turbidity values have generally decreased since the time of the historic data. Sixty-five pH samples were collected. The minimum pH observed was 6.3 and the maximum was 8.67. All pH samples met the water quality standard. No historic pH data were collected.

Pathogens. Seventy-five fecal coliform samples were collected. The lowest fecal coliform level was zero, while the maximum number of fecal coliforms observed was 170. The geomean met the water quality standard for fecal coliforms. A chart of the available fecal coliform data is included later in this appendix. Levels of fecal coliform have decreased since the time the historic data were collected.

Eutrophication. The 5-day BOD was sampled 56 times, with a minimum BOD of 0.2 mg/L and a maximum of 5.0 mg/L. Chlorophyll *a* was sampled 60 times, resulting in a minimum value of

0.36 µg/L and a maximum of 7.63 µg/L. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled simultaneously 16 times. These samples were used to calculate maximum total nitrogen values, and all samples met the water quality standard. Total phosphorus was sampled 87 times, resulting in a minimum value of 0.0 mg/L and a maximum value of 0.23 mg/L. The mean total nitrogen to total phosphorus ratio was 10.5.

Metals. Arsenic, cadmium, chromium, copper, lead, mercury, and zinc were historically and currently sampled. Of the historic data, cadmium, copper, lead, mercury, and zinc samples exceeded water quality standards. Current data show a decrease in water quality concentrations of all metals except arsenic. Current data also show that cadmium, copper, and mercury still exceed water quality standards.

Organics. No organics were historically or currently sampled at this station.

Lake Lanier–Lower Region. The historic water quality in the Lower Region of Lake Lanier was determined by analyzing the available data at station 12040001. The current water quality in the Lower Region of Lake Lanier was determined by analyzing the available data at stations 135001, 12039401, and 12040001.

Physical Characteristics. Dissolved oxygen was sampled 52 times at these stations. The minimum dissolved oxygen observed was 2.0 mg/L, while the maximum observed was 8.7 mg/L. Dissolved oxygen levels have generally increased since the time of the historic data. Turbidity was sampled 45 times. The minimum result for turbidity was 1.0 Hach FTU, while the maximum result was 7.9 Hach FTU. Turbidity values have generally decreased since the time of the historic data. To measure pH, 103 samples were collected. The minimum pH observed was 6.31 and the maximum was 8.1. All pH samples met the water quality standard. No historic pH data were collected.

Pathogens. Forty-three fecal coliform samples were collected. The lowest fecal coliform level was zero, while the maximum number of fecal coliforms observed was 20. The geomean met the water quality standard for fecal coliforms. A chart of the available fecal coliform data is

included later in this appendix. Levels of fecal coliform have decreased since the time the historic data were collected.

Eutrophication. The 5-day BOD was sampled 21 times, resulting in a minimum BOD of 0.0 mg/L and a maximum of 3.0 mg/L. Chlorophyll *a* was sampled 41 times. The minimum value was 0.39 µg/L and the maximum was 4.94 µg/L. Total Kjeldahl nitrogen and total nitrite plus nitrate were sampled simultaneously 43 times. These samples were used to calculate maximum total nitrogen values, and all samples met the water quality standard. Total phosphorus was sampled 42 times, resulting in a minimum value of 0.02 mg/L and a maximum value of 0.14 mg/L. The mean total nitrogen to total phosphorus ratio was 8.4.

Metals. No metals were sampled at this station.

Organics. No organics were historically or currently sampled at this station.

Table K-1
Water Quality at Stations within Lake Lanier—Chattahoochee Arm

		Station 12030121			
Parameter	**Unit**	**Count**	**Mean**	**Minimum**	**Maximum**
Water Temperature	ºC	-	-	-	-
Dissolved Oxygen	mg/L	-	-	-	-
BOD	5-day, 20 ºC	18	1.54	0.20	3.00
pH	standard units	18	7.44	6.98	8.00
Turbidity	Hach FTU	18	5.54	1.60	16.00
Nitrogen Total	mg/L	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	17	0.61	0.10	2.00
Ammonia Total	mg/L	16	0.07	0.03	0.21
Nitrite plus Nitrate Total	mg/L	16	0.09	0.02	0.18
Nitrogen Total Organic	mg/L	-	-	-	-
Phosphorus Total	mg/L	17	0.07	0.02	0.14
Arsenic Total	ug/L	-	-	-	-
Cadmium Total	ug/L	-	-	-	-
Chromium Total	ug/L	-	-	-	-
Copper Total	ug/L	-	-	-	-
Lead Total	ug/L	-	-	-	-
Mercury Total	ug/L	-	-	-	-
Zinc Total	ug/L	-	-	-	-
Fecal Coliform	#	9	2.71	0.00	40.00
Chlorophyll a	ug/L	18	5.81	1.16	11.84
Chlorophyll a	mg/sq m	-	-	-	-

Table K-2
Water Quality at Stations within Chattahoochee River Headwaters

Parameter	Unit	Station 135001				Station 12039401				Station 12040001				All Stations			
		Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max
Water Temperature	ºC	54	11.78	10.10	13.60	-	-	-	-	3	24.33	21.80	28.60	57	18.06	10.10	28.60
Dissolved Oxygen	mg/L	49	2.76	2.00	5.60	-	-	-	-	3	8.40	7.90	8.70	52	5.58	2.00	8.70
BOD	5-day, 20 ºC	-	-	-	-	-	-	-	-	21	1.43	0.00	3.00	21	1.43	0.00	3.00
pH	standard units	59	6.44	6.31	6.75	20	7.13	6.88	7.43	24	7.24	6.82	8.10	103	6.94	6.31	8.10
Turbidity	Hach FTU	-	-	-	-	21	1.97	1.00	6.00	24	1.95	1.00	7.90	45	1.96	1.00	7.90
Nitrogen Total	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	19	0.25	0.10	0.60	24	0.44	0.10	3.60	43	0.34	0.10	3.60
Ammonia Total	mg/L	-	-	-	-	20	0.05	0.03	0.10	24	0.06	0.03	0.30	44	0.05	0.03	0.30
Nitrite plus Nitrate Total	mg/L	-	-	-	-	20	0.16	0.08	0.27	24	0.16	0.06	0.43	44	0.16	0.06	0.43
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus Total	mg/L	-	-	-	-	20	0.06	0.02	0.10	22	0.06	0.02	0.14	42	0.06	0.02	0.14
Arsenic Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fecal Coliform	#	-	-	-	-	20	1.00	0.00	0.00	23	1.94	0.00	20.00	43	1.47	0.00	20.00
Chlorophyll a	ug/L	-	-	-	-	20	1.50	0.44	4.00	21	1.31	0.39	4.94	41	1.41	0.39	4.94
Chlorophyll a	mg/sq m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table K-3
Water Quality at Stations within Little River Headwaters

Parameter	Unit	Station 12030141				Station 12030151				Station 12030181			
		Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max
Water Temperature	ºC	12	19.00	9.00	24.00	12	19.33	10.00	24.00	12	18.67	11.00	23.00
Dissolved Oxygen	mg/L	12	9.35	7.90	11.60	12	9.06	8.00	11.30	12	9.09	7.50	11.40
BOD	5-day, 20 ºC	-	-	-	-	-	-	-	-	-	-	-	-
pH	standard units	12	7.27	7.09	7.55	12	7.14	6.95	7.39	12	7.22	7.08	7.46
Turbidity	Hach FTU	-	-	-	-	-	-	-	-	-	-	-	-
Nitrogen Total	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	12	0.70	0.00	4.48	12	0.32	0.10	0.90	11	0.60	0.10	1.90
Ammonia Total	mg/L	12	0.05	0.03	0.17	12	0.09	0.03	0.56	12	0.04	0.03	0.10
Nitrite plus Nitrate Total	mg/L	12	1.31	0.04	1.89	12	0.90	0.50	1.21	12	1.06	0.82	1.70
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus Total	mg/L	12	0.11	0.03	0.20	12	0.12	0.07	0.25	12	0.11	0.02	0.19
Arsenic Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chromium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Copper Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Zinc Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fecal Coliform	#	12	548.10	220.00	1180.00	11	267.16	0.00	2,740.00	12	665.91	180.00	2,520.00
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chlorophyll a	mg/sq m	-	-	-	-	-	-	-	-	-	-	-	-

Table K-3 (continued)
Water Quality at Stations within Little River Headwaters

Parameter	Unit	Station 2332830				All Stations			
		Count	Mean	Min	Max	Count	Mean	Min	Max
Water Temperature	ºC	96	0.2	26	14.79479	132	14.30	9.00	24.00
Dissolved Oxygen	mg/L	90	7.1	13.6	9.406667	126	8.65	7.50	11.60
BOD	5-day, 20 ºC	9	0.2	2.6	1.122222	9	0.20	2.60	1.12
pH	standard units	94	6.2	7.3	6.779787	130	6.96	6.95	7.55
Turbidity	Hach FTU	-	-	-	-	-	-	-	-
Nitrogen Total	mg/L	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	117	0.57	0.10	5.00	152	0.55	0.00	5.00
Ammonia Total	mg/L	10	0.062	0.03	0.17	46	0.06	0.03	0.56
Nitrite plus Nitrate Total	mg/L	10	1.61	1.2	2	46	1.22	0.04	2.00
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	-	-
Phosphorus Total	mg/L	127	0.01	5.6	0.529031	163	0.09	0.02	0.53
Arsenic Total	ug/L	-	-	-	-	-	-	-	-
Cadmium Total	ug/L	-	-	-	-	-	-	-	-
Chromium Total	ug/L	-	-	-	-	-	-	-	-
Copper Total	ug/L	-	-	-	-	-	-	-	-
Lead Total	ug/L	-	-	-	-	-	-	-	-
Mercury Total	ug/L	-	-	-	-	-	-	-	-
Zinc Total	ug/L	-	-	-	-	-	-	-	-
Fecal Coliform	#	12	279.04	50	16,000	47	440.05	0.00	16,000.00
Chlorophyll a	ug/L	-	-	-	-	-	-	-	-
Chlorophyll a	mg/sq m	1	12	12	12	1	12.00	12.00	12.00

Table K-4
Water Quality at Stations within Lake Lanier Little River Arm

Parameter	Unit	Station 12030171			
		Count	Mean	Minimum	Maximum
Water Temperature	ºC	12	18.92	9.00	24.00
Dissolved Oxygen	mg/L	12	9.17	8.10	10.20
BOD	5-day, 20 ºC	-	-	-	-
pH	Standard units	12	7.17	7.01	7.47
Turbidity	Hach FTU	-	-	-	-
Nitrogen Total	mg/L	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	12	0.49	0.10	1.96
Ammonia Total	mg/L	12	0.06	0.03	0.30
Nitrite plus Nitrate Total	mg/L	11	0.61	0.39	0.78
Nitrogen Total Organic	mg/L	-	-	-	-
Phosphorus Total	mg/L	11	0.10	0.04	0.15
Arsenic Total	ug/L	-	-	-	-
Cadmium Total	ug/L	-	-	-	-
Chromium Total	ug/L	-	-	-	-
Copper Total	ug/L	-	-	-	-
Lead Total	ug/L	-	-	-	-
Mercury Total	ug/L	-	-	-	-
Zinc Total	ug/L	-	-	-	-
Fecal Coliform	#	12	718.79	50.00	2,060.00
Chlorophyll a	ug/L	-	-	-	-
Chlorophyll a	mg/sq m	-	-	-	-

Table K-5
Water Quality at Stations within Chestatee River Headwaters

Parameter	Unit	Station 12036501				Station 2333500				All Stations			
		Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max
Water Temperature	ºC	-	-	-	-	85	15.04824	0.4	24	85	15.04824	0.4	24
Dissolved Oxygen	mg/L	-	-	-	-	25	9.204	6.7	13	25	9.204	6.7	13
BOD	5-day, 20 ºC	-	-	-	-	18	1.083333	0.3	5.7	18	1.083333	0.3	5.7
pH	standard units	21	7.13	6.75	7.56	25	6.956	6.2	7.6	46	7.043238	6.2	7.6
Turbidity	Hach FTU	21	4.70	1.70	13.00	-	-	-	-	21	4.7	1.7	13
Nitrogen Total	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	20	0.66	0.10	4.80	-	-	-	-	20	0.662	0.1	4.8
Ammonia Total	mg/L	20	0.04	0.03	0.13	19	0.036316	0.01	0.11	39	0.040158	0.01	0.13
Nitrite plus Nitrate Total	mg/L	20	0.03	0.02	0.09	19	0.294737	0.2	0.5	39	0.164368	0.02	0.5
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus Total	mg/L	20	0.07	0.02	0.21	19	0.026316	0.02	0.1	39	0.048908	0.02	0.21
Arsenic Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chromium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Copper Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Lead Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Mercury Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Zinc Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Fecal Coliform	#	12	1.95	0.00	30.00	22	77.87	20	1700	34	39.90903	0	1,700
Chlorophyll a	ug/L	21	5.10	1.80	13.11	-	-	-	-	-	-	-	-
Chlorophyll a	mg/sq m	-	-	-	-	-	-	-	-	-	-	-	-

Table K-6
Water Quality at Stations within Lake Lanier Chestatee River Arm

Parameter	Unit	Station 12037001			
		Count	Mean	Minimum	Maximum
Water Temperature	ºC	-	-	-	-
Dissolved Oxygen	mg/L	-	-	-	-
BOD	5-day, 20 ºC	-	-	-	-
pH	standard units	19	7.04	6.30	7.89
Turbidity	Hach FTU	20	2.91	1.80	7.40
Nitrogen Total	mg/L	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	19	0.62	0.10	2.80
Ammonia Total	mg/L	19	0.06	0.03	0.16
Nitrite plus Nitrate Total	mg/L	18	0.07	0.02	0.29
Nitrogen Total Organic	mg/L	-	-	-	-
Phosphorus Total	mg/L	18	0.06	0.02	0.12
Arsenic Total	ug/L	-	-	-	-
Cadmium Total	ug/L	-	-	-	-
Chromium Total	ug/L	-	-	-	-
Copper Total	ug/L	-	-	-	-
Lead Total	ug/L	-	-	-	-
Mercury Total	ug/L	-	-	-	-
Zinc Total	ug/L	-	-	-	-
Fecal Coliform	#	11	2.81	0.00	85.00
Chlorophyll a	ug/L	19	2.73	0.74	7.27
Chlorophyll a	mg/sq m	-	-	-	-

Table K-7
Water Quality at Stations within Lake Lanier Middle Section

Parameter	Unit	Station 12030201				Station 12038001				Station 12038701				All Stations			
		Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max
Water Temperature	ºC	-	-	-	-	32	16.35	7.40	29.00	-	-	-	-	32	16.35	7.40	29.00
Dissolved Oxygen	mg/L	-	-	-	-	35	8.29	0.30	11.90	-	-	-	-	35	8.29	0.30	11.90
BOD	5-day, 20 ºC	-	-	-	-	56	1.08	0.20	5.00	-	-	-	-	56	1.08	0.20	5.00
pH	standard units	21	7.10	6.59	8.67	25	7.15	6.30	8.45	19	7.00	6.65	7.48	65	7.08	6.30	8.67
Turbidity	Hach FTU	20	2.99	1.70	7.60	45	2.45	1.00	25.00	20	2.58	1.00	8.40	85	2.67	1.00	25.00
Nitrogen Total	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	19	0.57	0.10	2.80	33	0.26	0.10	1.10	19	0.38	0.02	1.70	71	0.40	0.02	2.80
Ammonia Total	mg/L	19	0.08	0.03	0.30	50	0.07	0.03	0.60	19	0.10	0.03	0.20	88	0.09	0.03	0.60
Nitrite plus Nitrate Total	mg/L	19	0.19	0.02	2.00	51	0.21	0.02	0.95	20	0.25	0.15	0.34	90	0.22	0.02	2.00
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus Total	mg/L	19	0.06	0.02	0.10	49	0.05	0.00	0.19	19	0.06	0.02	0.23	87	0.06	0.00	0.23
Arsenic Total	ug/L	-	-	-	-	1	36.00	36.00	36.00	-	-	-	-	1	36.00	36.00	36.00
Cadmium Total	ug/L	-	-	-	-	1	1.00	1.00	1.00	-	-	-	-	1	1.00	1.00	1.00
Chromium Total	ug/L	-	-	-	-	1	10.00	10.00	10.00	-	-	-	-	1	10.00	10.00	10.00
Copper Total	ug/L	-	-	-	-	1	7.00	7.00	7.00	-	-	-	-	1	7.00	7.00	7.00
Lead Total	ug/L	-	-	-	-	1	1.00	1.00	1.00	-	-	-	-	1	1.00	1.00	1.00
Mercury Total	ug/L	-	-	-	-	1	0.20	0.20	0.20	-	-	-	-	1	0.20	0.20	0.20
Zinc Total	ug/L	-	-	-	-	1	20.00	20.00	20.00	-	-	-	-	1	20.00	20.00	20.00
Fecal Coliform	#	11	1.52	0.00	20.00	44	6.18	0.00	170.00	20	1.26	0.00	10.00	75	2.99	0.00	170.00
Chlorophyll a	ug/L	21	3.62	0.96	7.63	19	2.37	0.36	5.07	20	2.61	0.38	5.02	60	2.87	0.36	7.63
Chlorophyll a	mg/sq m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

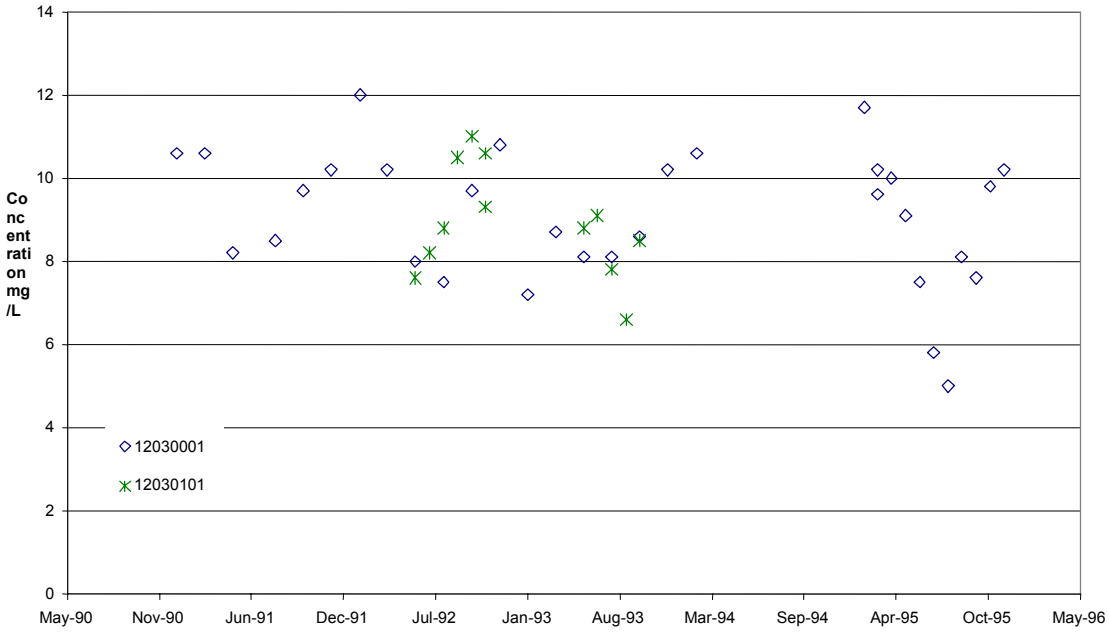
Table K-8
Water Quality at Stations within Lake Lanier Lower Section

Parameter	Unit	Station 135001				Station 12039401				Station 12040001				All Stations			
		Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max	Count	Mean	Min	Max
Water Temperature	ºC	54	11.78	10.10	13.60	-	-	-	-	3	24.33	21.80	28.60	57	18.06	10.10	28.60
Dissolved Oxygen	mg/L	49	2.76	2.00	5.60	-	-	-	-	3	8.40	7.90	8.70	52	5.58	2.00	8.70
BOD	5-day, 20 ºC	-	-	-	-	-	-	-	-	21	1.43	0.00	3.00	21	1.43	0.00	3.00
pH	standard units	59	6.44	6.31	6.75	20	7.13	6.88	7.43	24	7.24	6.82	8.10	103	6.94	6.31	8.10
Turbidity	Hach FTU	-	-	-	-	21	1.97	1.00	6.00	24	1.95	1.00	7.90	45	1.96	1.00	7.90
Nitrogen Total	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	19	0.25	0.10	0.60	24	0.44	0.10	3.60	43	0.34	0.10	3.60
Ammonia Total	mg/L	-	-	-	-	20	0.05	0.03	0.10	24	0.06	0.03	0.30	44	0.05	0.03	0.30
Nitrite plus Nitrate Total	mg/L	-	-	-	-	20	0.16	0.08	0.27	24	0.16	0.06	0.43	44	0.16	0.06	0.43
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus Total	mg/L	-	-	-	-	20	0.06	0.02	0.10	22	0.06	0.02	0.14	42	0.06	0.02	0.14
Arsenic Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fecal Coliform	#	-	-	-	-	20	1.00	0.00	0.00	23	1.94	0.00	20.00	43	1.47	0.00	20.00
Chlorophyll a	ug/L	-	-	-	-	20	1.50	0.44	4.00	21	1.31	0.39	4.94	41	1.41	0.39	4.94
Chlorophyll a	mg/sq m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

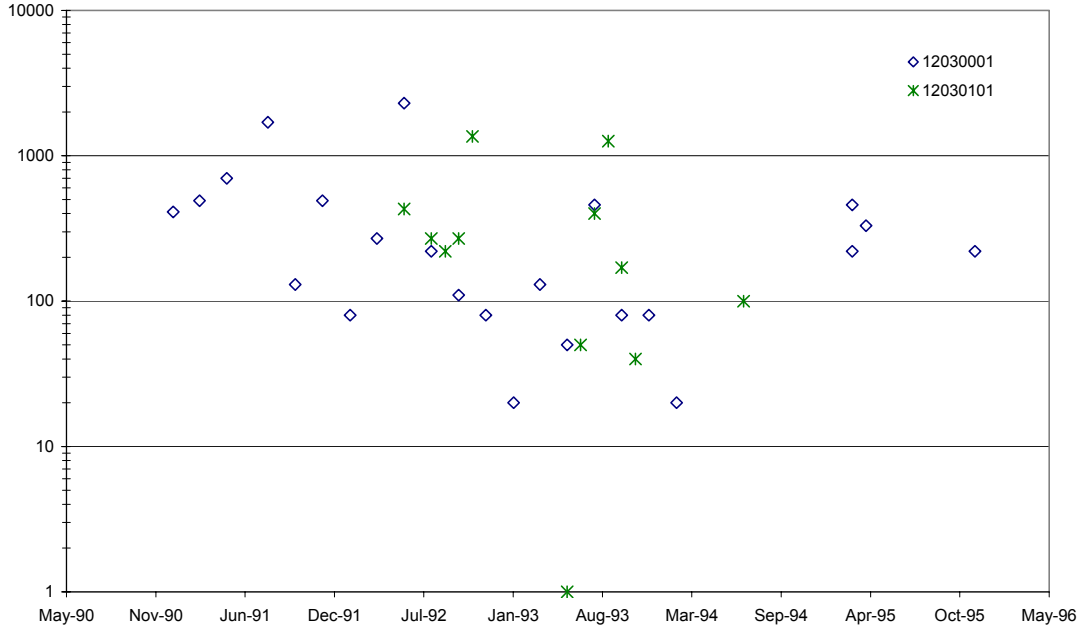
Dissolved Oxygen And Fecal Coliform Charts

Lake Lanier was divided into eight sections to analyze the available dissolved oxygen and fecal coliform data to determine whether any localized trends were shown.

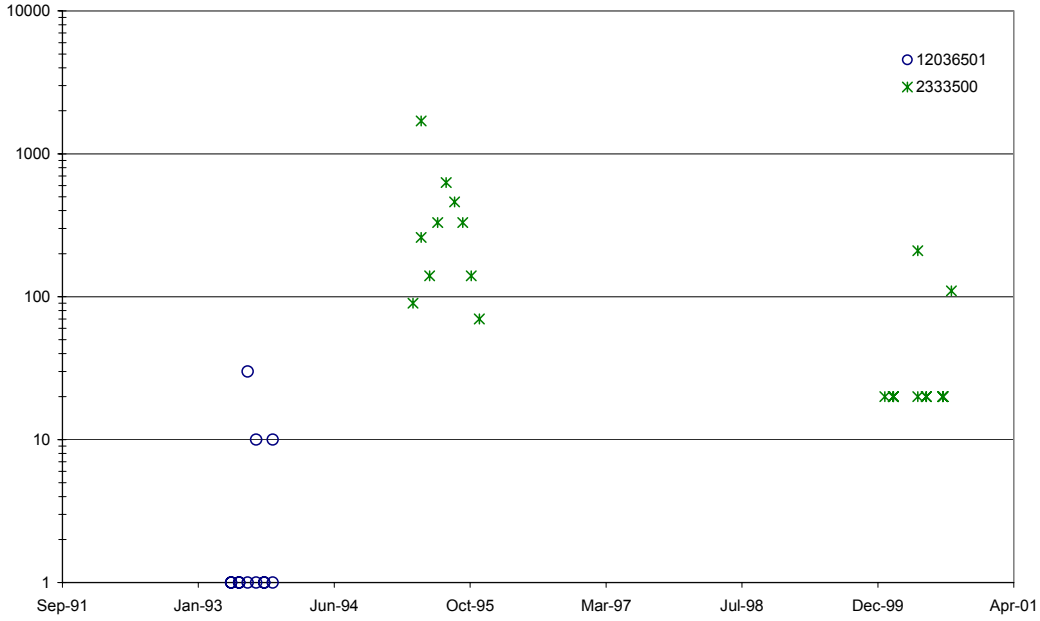
Dissolved Oxygen
Chattahoochee River Headwaters



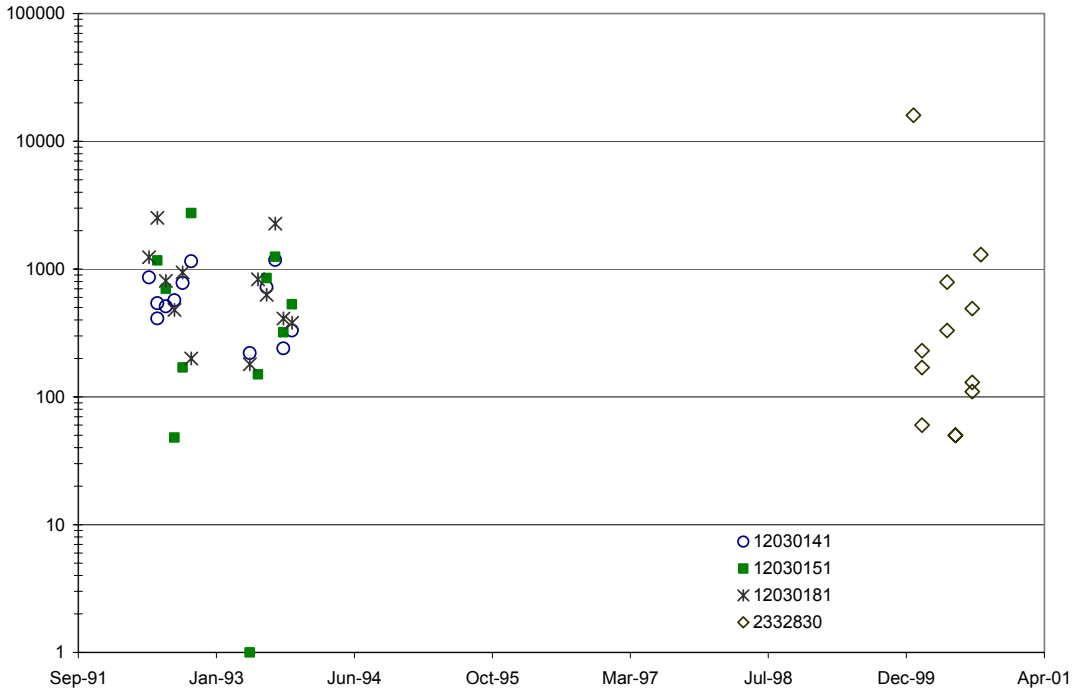
Fecal Coliform Counts
Chattahoochee River Headwaters



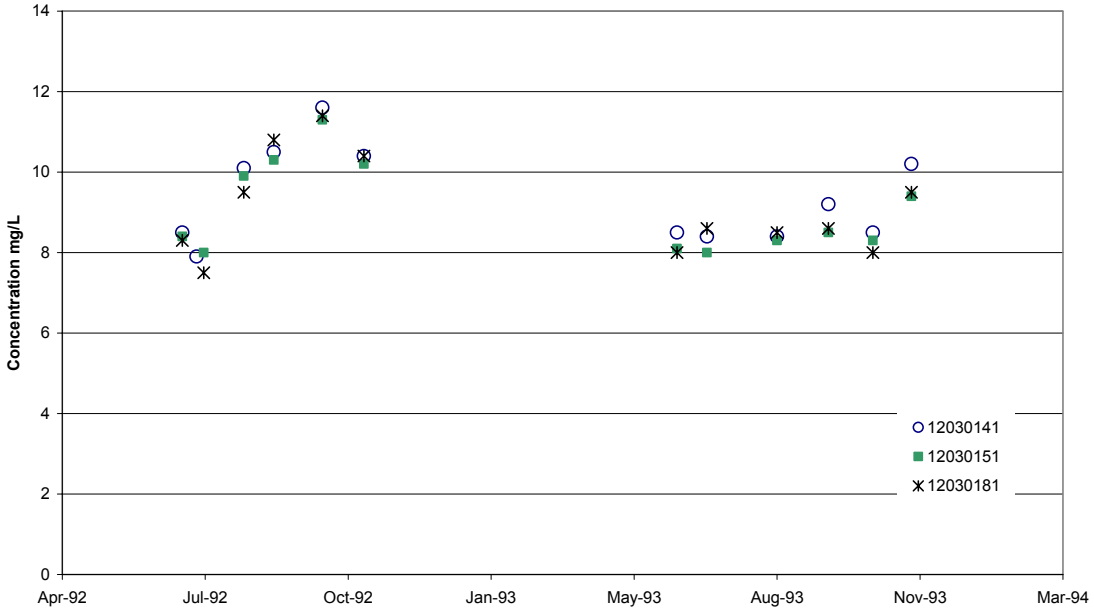
Fecal Coliform Counts
Chestatee River Headwaters



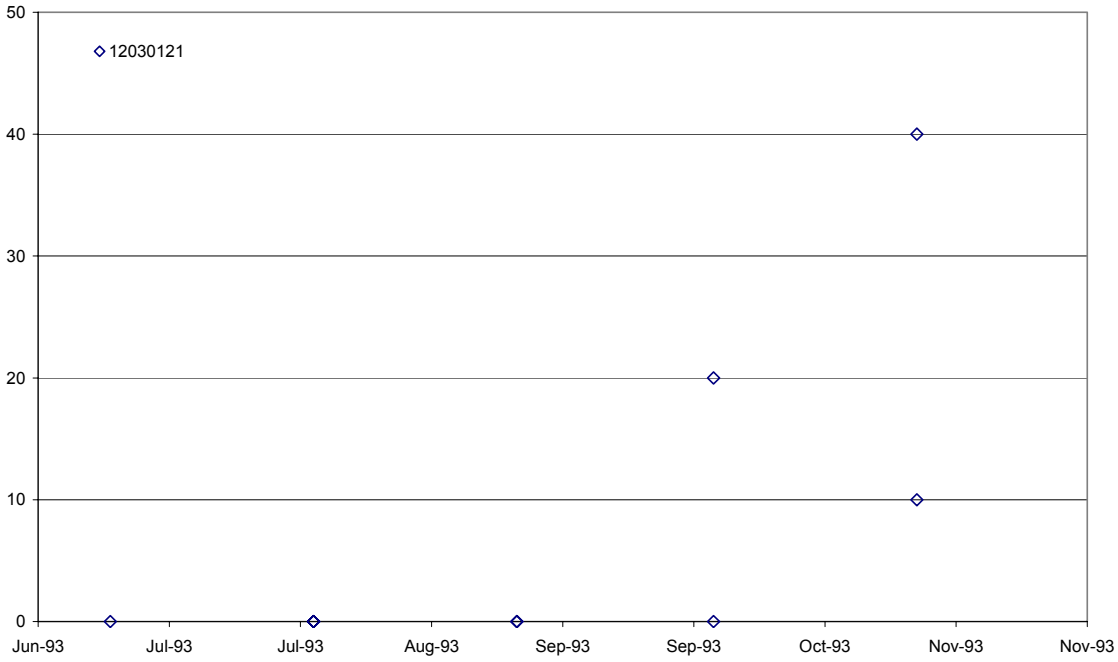
Fecal Coliform Counts
Little River Headwaters



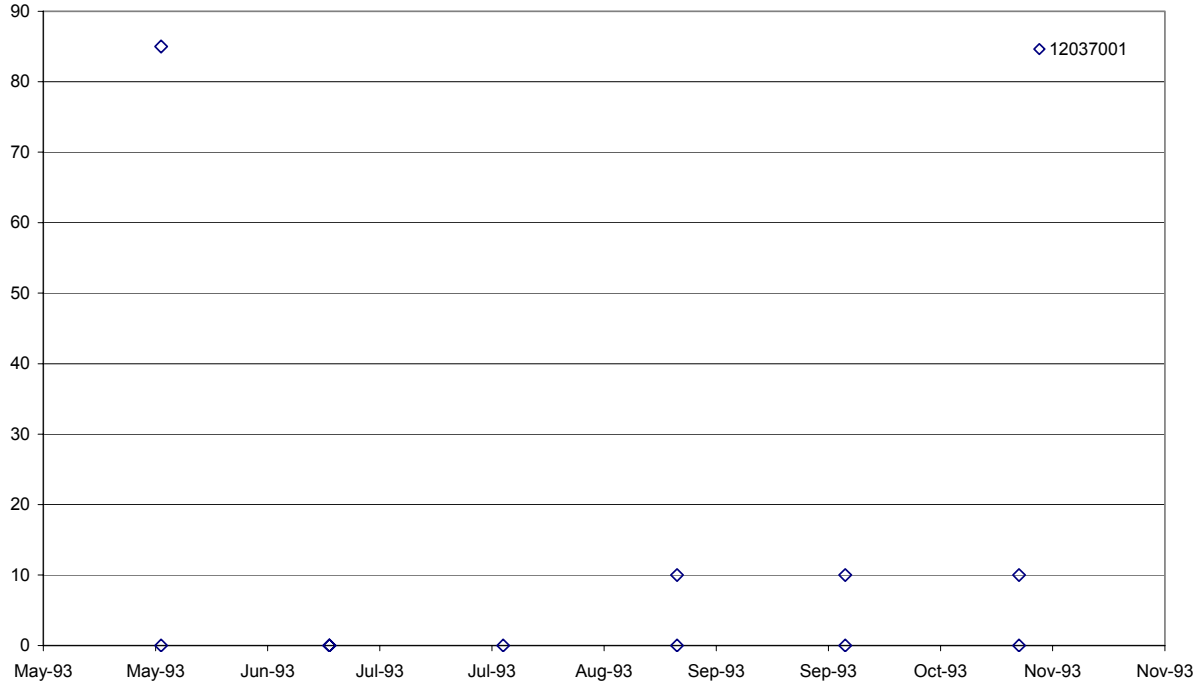
Dissolved Oxygen
Little River Headwaters



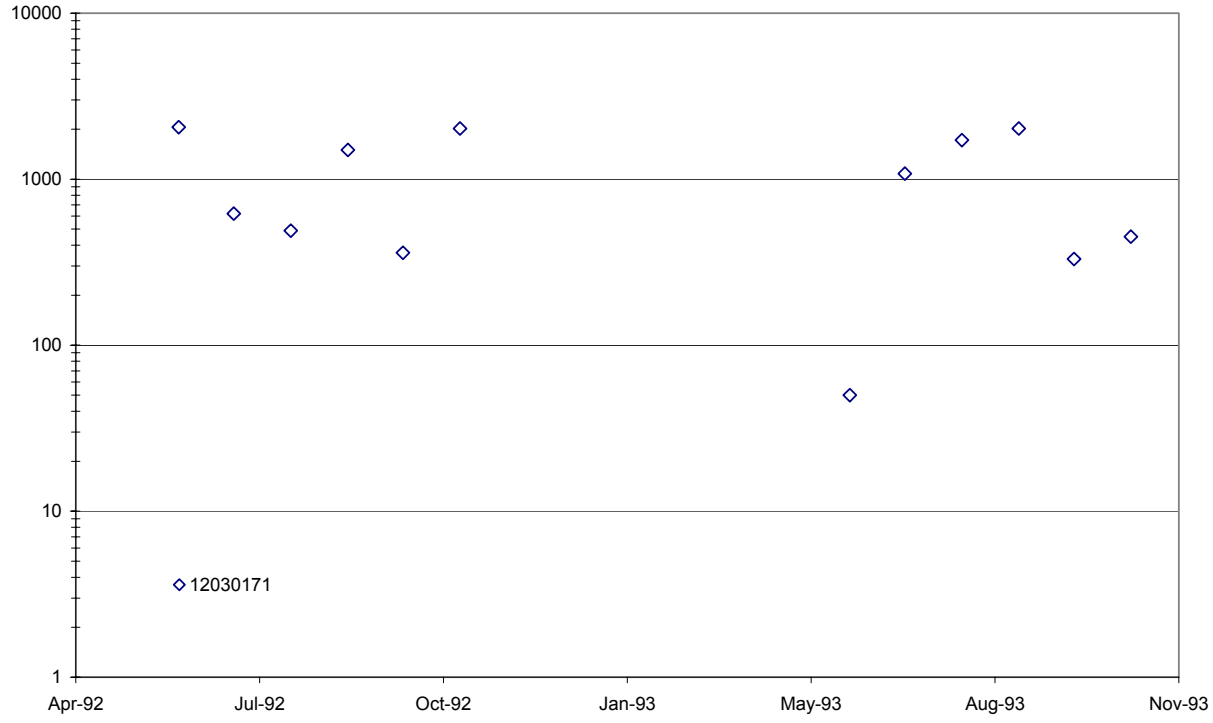
Fecal Coliform Counts
Lake Lanier - Chattahoochee River Arm



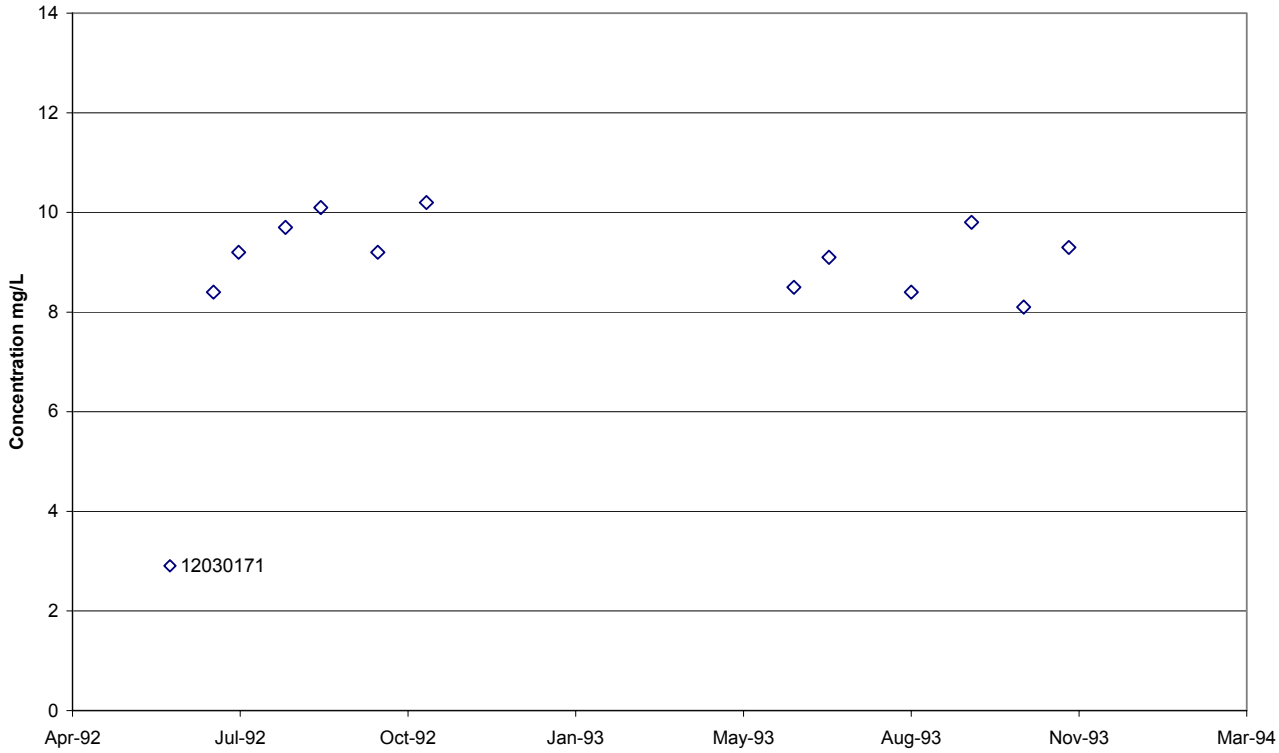
Fecal Coliform Counts
Lake Lanier - Chestatee River Arm



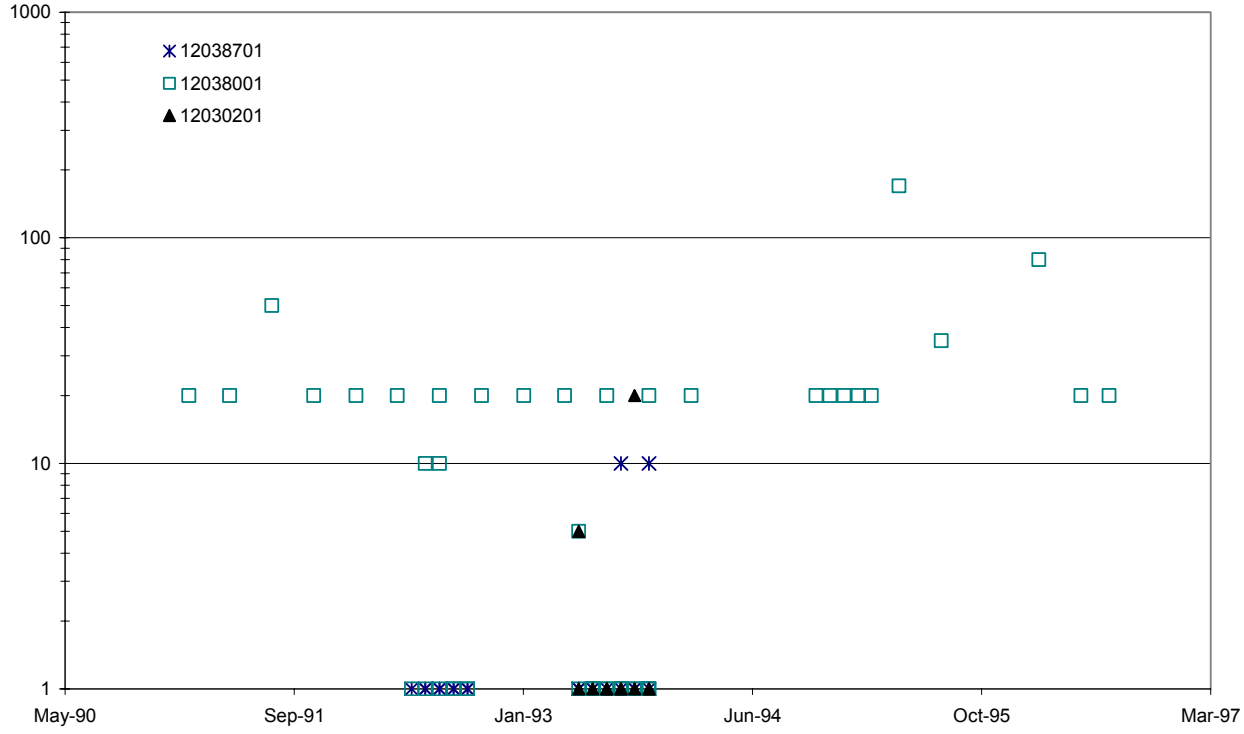
Fecal Coliform Counts
Lake Lanier - Little River Arm



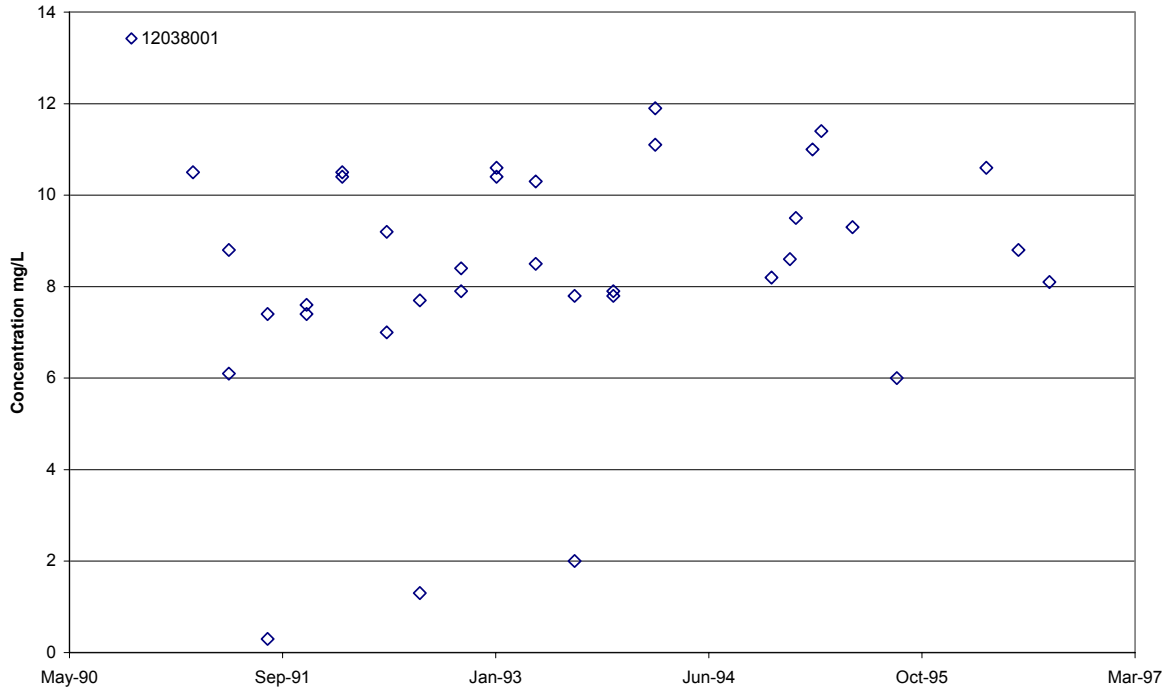
Dissolved Oxygen
Lake Lanier - Little River Arm



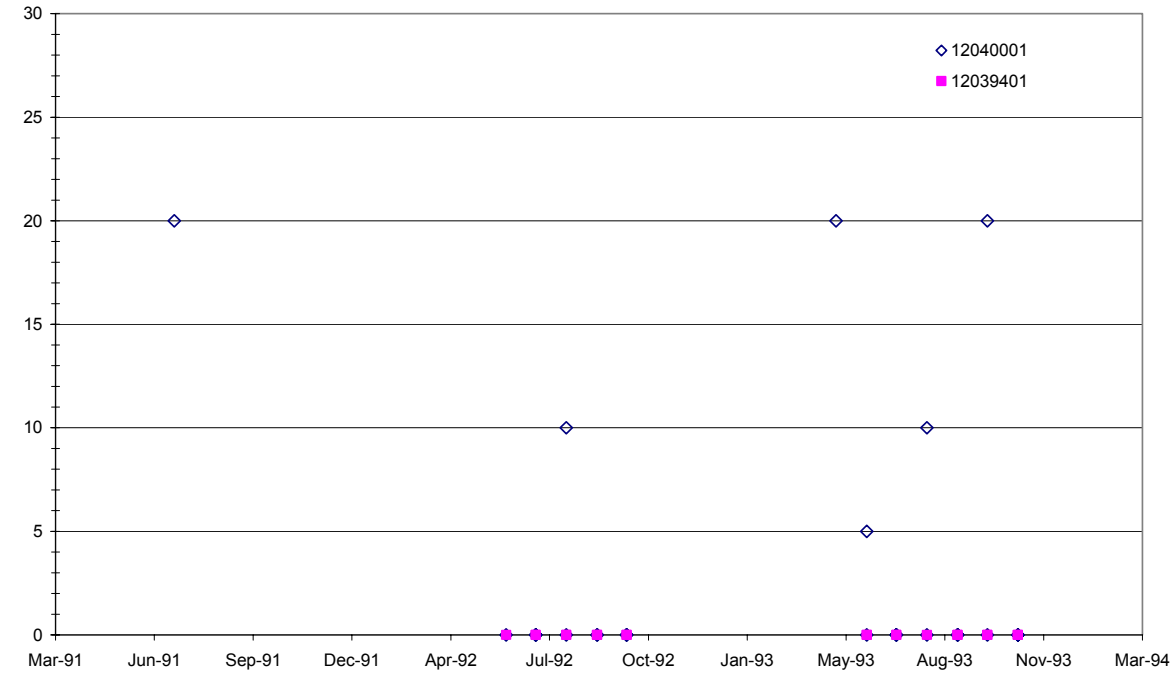
Fecal Coliform Counts
Lake Lanier - Middle Region



Dissolved Oxygen
Lake Lanier - Middle Region



Fecal Coliform Counts
Lake Lanier - Lower Region



Historic And Current Water Quality Comparison

Historical and current data from four stations, two in Lake Lanier and one each on the Chattahoochee and Chestatee River arms of the lake, were analyzed to determine the change in water quality in the lake and its headwaters.

These data are summarized in Table K-9 below for each station.

Summary of Water Quality Trends

Four monitoring stations had both historical and current water quality data. All available data on the above-mentioned parameters were assembled and are provided in Table K-9. Dissolved oxygen, BOD, nitrogen, phosphorus, and pathogen data were analyzed to determine whether any trends exist. The results of the analysis are discussed below by station.

Station 12030001: Chattahoochee River Headwaters. The dissolved oxygen range has increased, which indicates an increase in algal productivity (eutrophication). Phosphorus levels have also increased, but pathogen levels appear to have decreased.

Station 02333500: Chestatee River Headwaters. No data regarding dissolved oxygen are available. Phosphorus levels appear to have decreased, and nitrogen and pathogen levels have increased.

Station 12038001: Lake Lanier–Middle Region. As with Station 12030001, the dissolved oxygen range has increased, indicating an increase in algal productivity (eutrophication). BOD has also increased, as have nitrogen and phosphorus.

Station 12040001: Lake Lanier–Lower Region. No data regarding dissolved oxygen are available. Both phosphorus and nitrogen have increased, and pathogen levels have decreased.

Table K-9

Parameter	Unit	12030001						12038001					
		Minimum		Maximum		Average		Minimum		Maximum		Average	
		Historic	Current	Historic	Current	Historic	Current	Historic	Current	Historic	Current	Historic	Current
Water Temperature	ºC	4.00	-0.90	23.50	24.00	15.00	14.37	84.20	7.40	41.00	29.00	61.61	16.35
Dissolved Oxygen	mg/L	7.7	5.00	12.6	12.00	9.73	9.10	2.00	0.30	12.60	11.90	7.54	8.29
BOD	5-day, 20 ºC	0.20	0.10	1.40	1.80	0.73	0.91	0.10	0.20	1.70	5.00	0.64	1.08
pH	standard units	5.6	6.40	7.2	7.34	6.43	6.89	-	6.30	-	8.45	-	7.15
Turbidity	Hach FTU	6	2.50	74	150.00	20.07	13.83	4.00	1.00	21.00	25.00	7.60	2.45
Nitrogen Total	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	0.00	0.10	0.30	1.10	0.16	0.26
Ammonia Total	mg/L	0.02	0.03	0.03	0.09	0.02	0.04	0.02	0.03	0.14	0.60	0.04	0.07
Nitrite plus Nitrate Total	mg/L	0.11	0.04	0.26	0.53	0.18	0.34	0.02	0.02	0.50	0.95	0.15	0.21
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus Total	mg/L	0.02	0.02	0.15	0.25	0.04	0.07	0.02	0.00	0.03	0.19	0.02	0.05
Arsenic Total	ug/L	-	-	-	-	-	-	5.00	36.00	5.00	36.00	5.00	36.00
Cadmium Total	ug/L	-	-	-	-	-	-	50.00	1.00	50.00	1.00	50.00	1.00
Chromium Total	ug/L	-	-	-	-	-	-	50.00	10.00	50.00	10.00	50.00	10.00
Copper Total	ug/L	-	-	-	-	-	-	50.00	7.00	50.00	7.00	50.00	7.00
Lead Total	ug/L	-	-	-	-	-	-	400.00	1.00	400.00	1.00	400.00	1.00
Mercury Total	ug/L	-	-	-	-	-	-	400.00	0.20	400.00	0.20	400.00	0.20
Zinc Total	ug/L	-	-	-	-	-	-	110.00	20.00	110.00	20.00	110.00	20.00
Fecal Coliform	#	150.00	20.00	4300.00	2300.00	1832.67	199.84	30.00	0.00	30.00	170.00	30.00	6.18
Chlorophyll a	ug/L	-	-	-	-	-	-	-	0.36	-	5.07	-	2.37
Chlorophyll a	mg/sq m	-	-	-	-	-	-	-	-	-	-	-	-

Table K-9 (continued)

Parameter	Unit	12040001						02333500					
		Minimum		Maximum		Average		Minimum		Maximum		Average	
		Historic	Current	Historic	Current	Historic	Current	Historic	Current	Historic	Current	Historic	Current
Water Temperature	ºC	27.00	21.80	27.00	28.60	27.00	24.33	4.5	0.4	24.5	24	14.23	15.05
Dissolved Oxygen	mg/L	7.50	7.90	7.50	8.70	7.50	8.40	-	6.7	-	13	-	9.20
BOD	5-day, 20 ºC	0.60	0.00	0.60	3.00	0.60	1.43	0.6	0.3	3.5	5.7	1.79	1.08
pH	standard units	-	6.82	-	8.10	-	7.24	6.4	6.2	7.4	7.6	6.93	6.96
Turbidity	Hach FTU	6.20	1.00	6.20	7.90	6.20	1.95	-	-	-	-	-	-
Nitrogen Total	mg/L	-	-	-	-	-	-	0.14	-	2.8	-	0.92	-
Total Kjeldahl Nitrogen	mg/L	-	0.10	-	3.60	-	0.44	0.1	-	2.5	-	0.72	-
Ammonia Total	mg/L	-	0.03	-	0.30	-	0.06	0.01	0.01	0.15	0.11	0.07	0.04
Nitrite plus Nitrate Total	mg/L	0.10	0.06	0.10	0.43	0.10	0.16	0.1	0.2	0.3	0.5	0.21	0.29
Nitrogen Total Organic	mg/L	-	-	-	-	-	-	0	-	2.4	-	0.66	-
Phosphorus Total	mg/L	0.02	0.02	0.02	0.14	0.02	0.06	0.01	0.02	0.61	0.1	0.19	0.03
Arsenic Total	ug/L	-	-	-	-	-	-	1	-	1	-	1	-
Cadmium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Chromium Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Copper Total	ug/L	-	-	-	-	-	-	2	-	7	-	3.6	-
Lead Total	ug/L	-	-	-	-	-	-	3	-	10	-	4.67	-
Mercury Total	ug/L	-	-	-	-	-	-	-	-	-	-	-	-
Zinc Total	ug/L	-	-	-	-	-	-	20	-	20	-	20.00	-
Fecal Coliform	#	10.00	0.00	10.00	20.00	10.00	1.94	10.00	20	10.00	1700	10.00	77.87
Chlorophyll a	ug/L	-	0.39	-	4.94	-	1.31	-	-	-	-	-	-
Chlorophyll a	mg/sq m	-	-	-	-	-	-	-	-	-	-	-	-