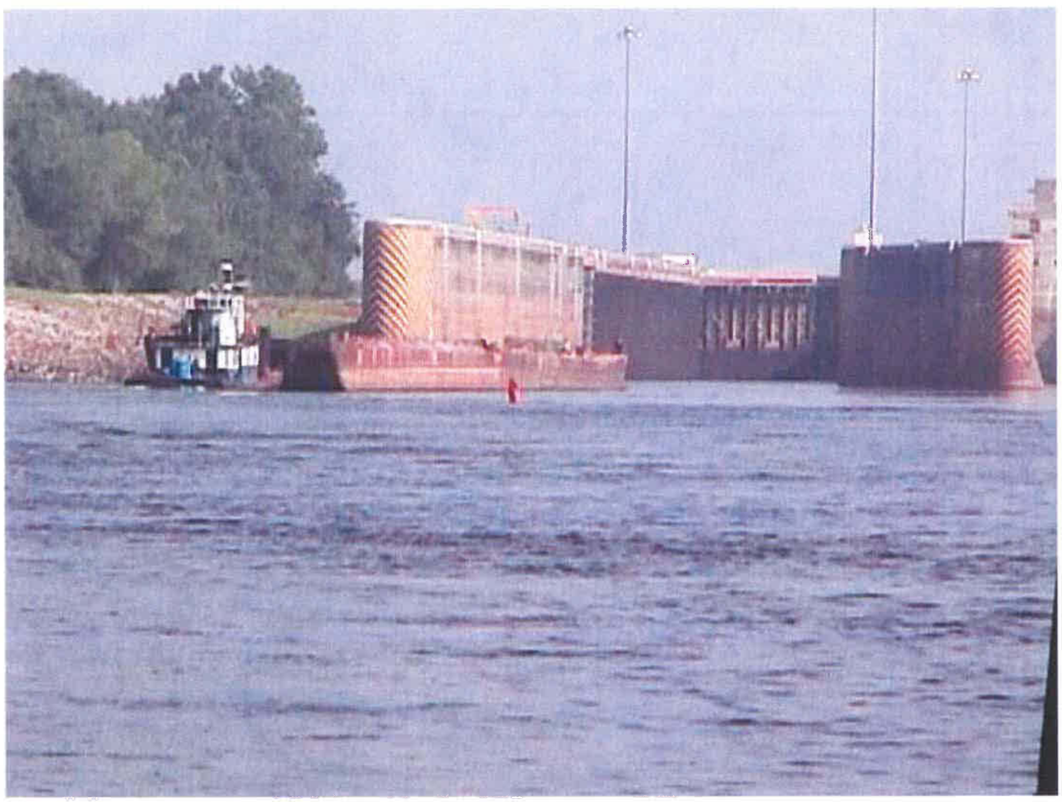
PLANT SCHOLZ
ENVIRONMENTAL MONITORING PROGRAM

Gulf Power Company
Jackson County, Florida

1993 to 2003



GULF POWER
A SOUTHERN COMPANY

PLANT SCHOLZ
ENVIRONMENTAL MONITORING PROGRAM

Gulf Power Company
Jackson County, Florida

1993 to 2003

Prepared By
Matthew T. Montz
Biologist

of

Earth Science and Environmental Engineering
Technical Services
Southern Company Services, Inc.
P. O. Box 2625
Birmingham, Alabama 35202

Reviewer: Dan V. Patel
Dan V. Patel, P.E.
Principal Engineer

Approval: D. W. Morris
D. W. Morris, Manager
Earth Science & Environmental Engineering

Date: 7/28/2004

DISCLAIMER:

SOUTHERN COMPANY SERVICES, INC. (AND ITS PARENT AND AFFILIATES) MAKES NO REPRESENTATIONS OR WARRANTIES AS TO THE USE OF THE INFORMATION OTHER THAN FOR ITS INTENDED USE, INCLUDING NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Any use of this report without the appropriate scientific, engineering and geological consulting review and advice is at the risk of the user. Notwithstanding disclosure of this report required in its initial submittal, all materials are intended to be internal to Southern Company Services, Inc., its parent and affiliates, and are not intended for release to nonemployees of Southern Company Services, Inc. (and its parent and affiliates) or to other third parties without appropriate confidentiality restrictions and appropriate consulting scientific, engineering or geological advice.

ACKNOWLEDGMENTS

The Plant Scholz Environmental Monitoring Program was initiated during the summer of 1993. The collecting and processing of samples and resulting data was accomplished with the assistance of a number of individuals, without whose talents and cooperation a report of this quality would not have been possible.

I would like to express my special appreciation to J. O. Vick, R. M. Markey, R. A. Terry, and especially to J. H. Neese (General Office) for their much-valued assistance in making these studies a success.

I am also indebted to D. W. Morris, Manager of Earth Science and Environmental Engineering Group and D. V. Patel for their technical reviews, and to J. H. Tackett (retired) for his pioneering work during 1993-1996.

CONTENTS

Page

APPENDICIES

LIST OF TABLES

Table

LIST OF TABLES

Table

LIST OF FIGURES

1. SUMMARY

Gulf Power Company owns and operates the 89,000 kilowatt coal-fired Scholz Electric Generating Facility located on the Apalachicola River, just a few miles south of the city of Chattahoochee in Jackson County, Florida, (Figure 1-1). This facility currently has a State of Florida Industrial Wastewater Permit (# FL0002283) to discharge waters to the Apalachicola River (Appendix A). The permit expires April 12, 2004. In accordance with the Florida Department of Environmental Protection's (FDEP) Industrial Wastewater Permit requirements, annual small-scale in-stream biological assessment studies (Biological Integrity Tests) were required to be conducted on the Apalachicola River to determine the effects of treated cooling water discharged from Gulf Power Company's Plant Scholz. For these specific purposes tests were conducted on the river, above and below Plant Scholz by the FDEP in 1990. No adversities were indicated from the results of those tests (FDEP, 1990).

Thus far, study results indicate that relatively high water quality conditions exist in the entire study area; from the Apalachicola River, just below Jim Woodruff Lock and Dam to the vicinity of I-10 bridge, 7.3 miles downstream. The only significant biological changes observed thus far in the study area have been: (1) the incidence in 1993 of decreased biological stability (species diversity) and increased productivity in the upstream portion of the study area nearest Jim Woodruff Lock and Dam (this is most likely due to unnatural fluctuating stream flow velocities resulting from the operation of Jim Woodruff Dam, and accelerated phytoplankton productivity which originates from the enriched, quiescent waters of Lake Seminole); and (2) the general decrease in biological stability (10%) and productivity (45%) in the study area which accompanied severe flooding during the 1994 study period.

Since monitoring activities began in 1993, the biological stability and productivity of bottom-dwelling fishfood populations in the Apalachicola River indicate that water quality conditions have been essentially unaffected by the discharge of cooling water from Plant Scholz. Neither the population species diversity value (Shannon-Weaver Index) nor the total number (productivity) of benthic animals per unit area at any of the other test stations have been in excess of 25 percent of the minimum control station values for the study area.

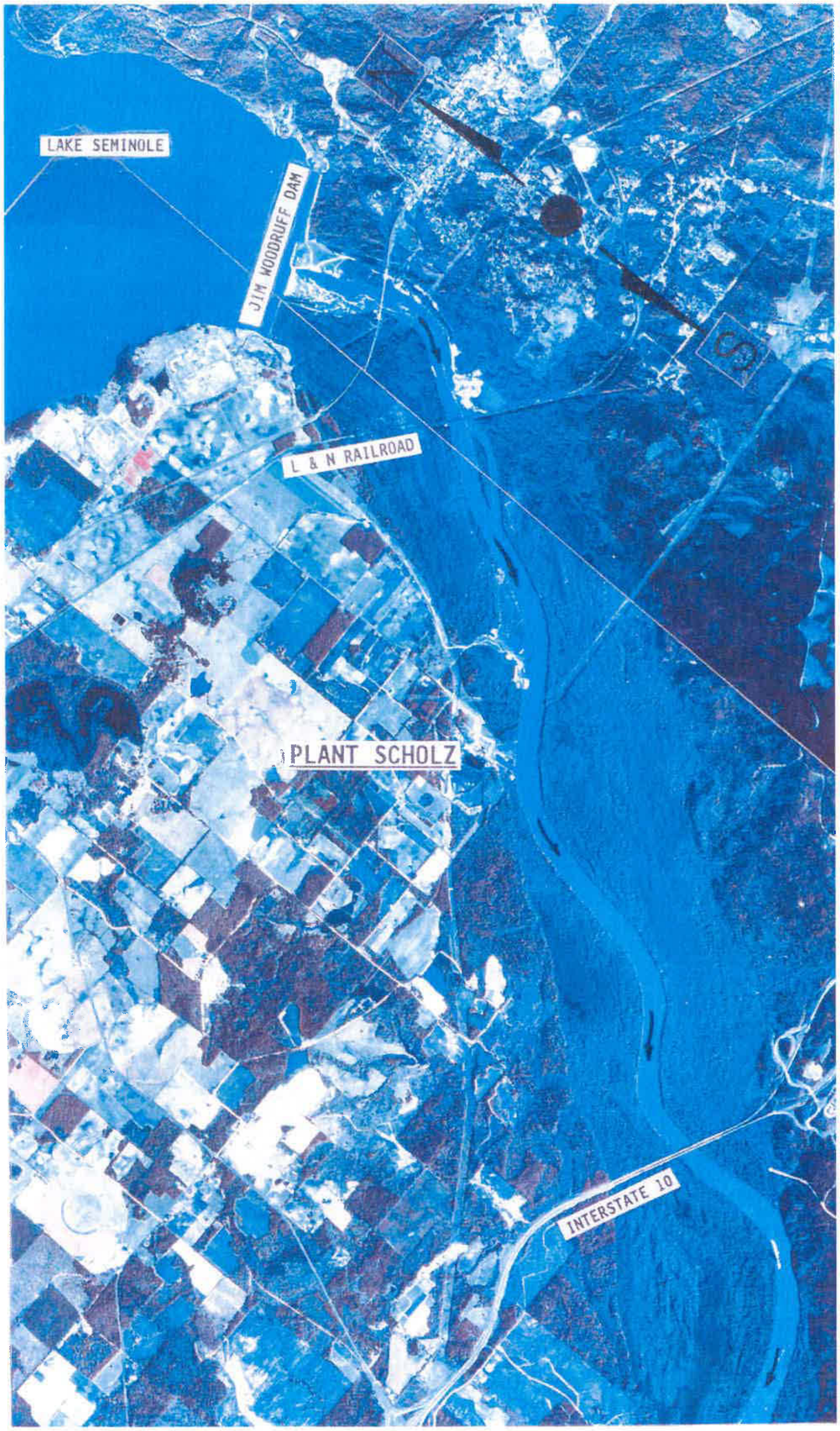
Based on data collected to date, no adversities have been indicated from the results of cooling water effluent toxicity tests conducted since monitoring activities began at Gulf Power Company's Plant Scholz. Likewise, the results of biological integrity tests conducted on the Apalachicola River above and below the confluence of the Plant Scholz cooling water discharge canal indicate that healthy water quality conditions have existed during each test period since 1993, i.e., the sum Shannon-Weaver diversity index of macroscopic bottom-dwelling invertebrate fishfood populations, just downstream from the discharge canal, were not reduced to less than 75 percent of established background levels.

As would be expected, water temperatures remain relatively constant throughout the study area; from Highway 90 bridge, near Jim Woodruff Dam, downstream past I-10 bridge. Plant Scholz has been on-line throughout much of the study periods. Temperature differentials, just upstream (AR4R) and downstream (AR5R) from the Plant Scholz cooling water canal, appear to be negligible.

Figure 1-1

Color Infrared Aerial Photo of Plant Scholz Study Area

November 1983 USGS Project NHAP 83



2. INTRODUCTION

Gulf Power Company owns and operates the coal-fired Scholz Electric Generating Facility located on the Apalachicola River, just a few miles south of the city of Chattahoochee in Jackson County, Florida. The USGS map coordinates for the exact location of this facility, utilizing a Lowrance Global Positioning System (GPS), are latitude N 30 degrees 40 minutes 7 seconds, and longitude W 84 degrees 53 minutes 14 seconds.

Plant Scholz is an 89,000-kilowatt, two-unit facility located approximately 3-4 miles downstream from Jim Woodruff Dam and Lake Seminole. This plant is the smallest in the Gulf Power Company system, and operates as a 24-hour standby facility where it is used for system reliability and peaking. Cooling water is taken from the Apalachicola River, (approximately 90,000 gallons per minute) circulated through a holding pond, and returned to the river at temperatures which comply with Environmental Protection Agency (EPA) and FDEP requirements for protecting fish and other aquatic life (Gulf, 1992).

Gulf Power Company currently has a State of Florida Industrial Wastewater Permit (# FL0002283) to discharge waters to the Apalachicola River. The permit expires April 12, 2004. In accordance with the FDEP's Industrial Wastewater Permit requirements, annual small-scale in-stream biological assessment studies (Biological Integrity Test) are required to be conducted on the Apalachicola River to determine the effects of treated cooling water discharged from Gulf Power Company's Plant Scholz. Prior to 1990, no previous tests had been conducted on the river for this specific purpose.

On January 7, 1992, a meeting was held between personnel of Southern Company Services (SCS) Earth Science and Environmental Engineering Department and Gulf Power Company's Environmental Affairs Department at the General Office in Pensacola, Florida, to discuss Gulf's environmental program, and ways in which SCS might be of assistance. Present were M. L. Gilchrist, J. O. Vick, M. F. Oaks, and R. A. Terry of Gulf Power Company, and D. W. Morris and J. H. Tackett from SCS. At this meeting, Gulf expressed the desire to upgrade their existing environmental programs at Plants Smith, Scholz, and Crist to include appropriate activities, which would broaden their knowledge of current environmental conditions at the plant sites. It was felt that this no-surprises approach by management would result in the establishment of water quality databases and routine monitoring regimes, which would serve to gather much of the "reasonable assurance" type of data needed in the foreseeable future.

It was decided that SCS should make a cursory inspection of each of the three facilities as soon as possible, preferably by March 1992, followed by a program proposal from SCS to Gulf for their consideration. Subsequently, a trip was made to each facility, in the company of Rachel Terry and Mike Oaks, during the period of March 2-6, 1992. In addition, literature searches were initiated at the following libraries: U. S. Army Corps of Engineers, Mobile; Florida Game and Freshwater Fish Commission, Tallahassee; and Northwest Florida Water Management District, Havana, during the period of March 7-10, 1992. Additional information was requested from the EPA and the FDEP through Gulf Power Company.

Immediately following these on-site inspections of the three study areas, a detailed proposal for a comprehensive environmental monitoring program at Plants Crist, Smith, and Scholz was submitted by SCS to Gulf Power Company and, after a brief period, was accepted. Shortly thereafter, a meeting was held in Pensacola on June 8, 1992, with FDEP personnel Glen Butts and Norm Morrissette to discuss the monitoring program. Present at the meeting were J. H. Tackett from SCS, and J. H. Neese from Gulf Power Company. Following detailed discussions regarding methods and procedures, a few slight modifications were made to the original proposal, which addressed the concerns of both Gulf and the FDEP.

In May, 1995, the FDEP was granted authority by the EPA to administer the NPDES permitting program. Effective that date, FDEP assumed permitting and enforcement authority for the NPDES permits issued by EPA for point source discharges from wastewater facilities to waters of the United States. Gulf Power Company's Plant Scholz currently has the combined State Industrial Wastewater permit to discharge waters to West Bay via Warren Bayou.

During the summer of 1993, an annual monitoring program was initiated at Gulf Power Company's Plant Scholz. Sixteen stations were designated and scheduled for sampling (Figure 2-1, Table 2-1, and Figure 2-2). Field studies are conducted during the warmest season of the year to coincide with periods of maximum power plant generation, and naturally stressed stream conditions, i.e., low flows and higher summer temperatures. Annually updated reports documenting results are submitted to Gulf Power Company within one year of each summer sampling period.

Figure 2-2

Location of Aquatic Sampling Stations

Jim Woodruff Dam, in background, and Highway 90 bridge in foreground.

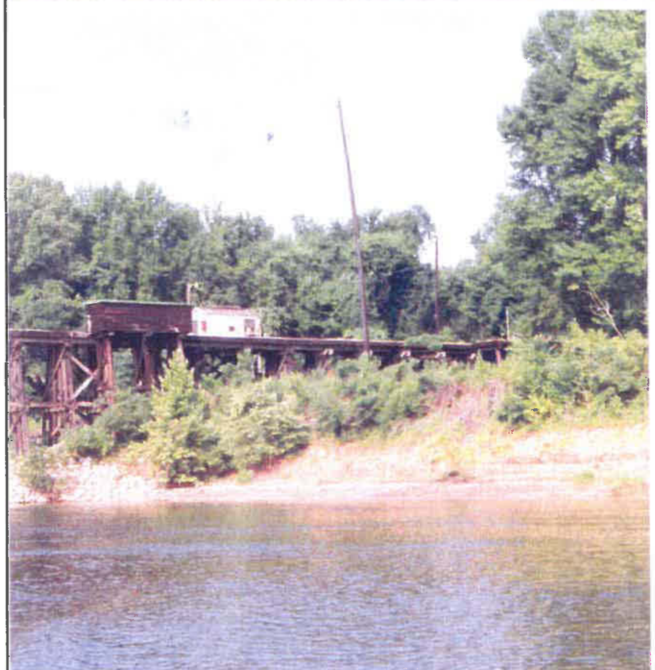
Apalachicola River Station AR1R

Apalachicola River Station AR1L

Figure 2-2

Location of Aquatic Sampling Stations

Gravel washing operations just upstream from Station AR2L



Apalachicola River Station AR2R

Apalachicola River Station AR2L

Figure 2-2

Location of Aquatic Sampling Stations

Apalachicola River
Station AR3L

Apalachicola River
Station AR3R

Apalachicola River
Station AR4L

Figure 2-2

Location of Aquatic Sampling Stations

Apalachicola River
Station AR4L

Plant Scholz Intake Canal

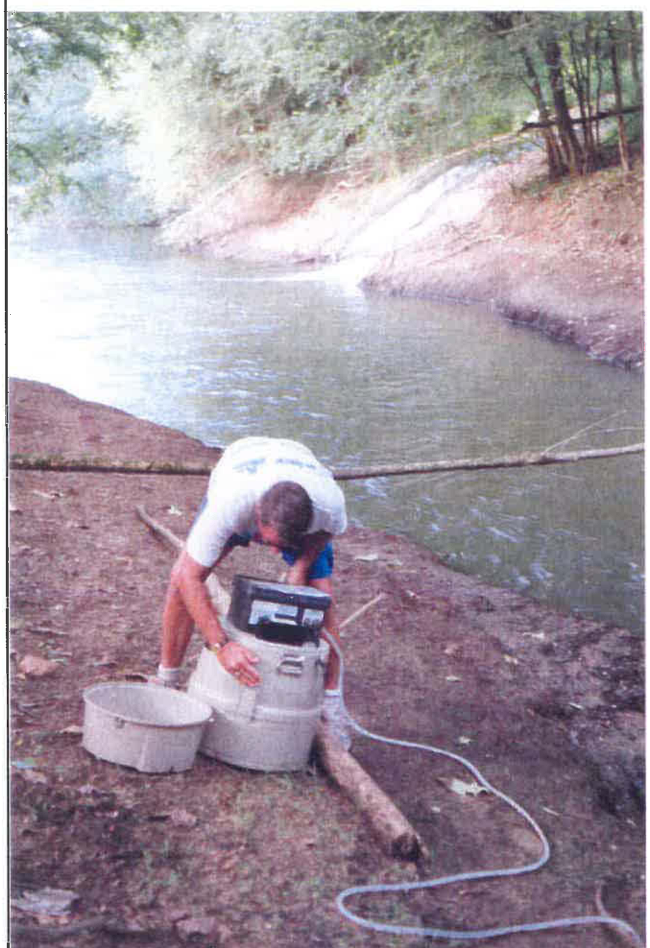
Apalachicola River
Station AR5R

Figure 2-2

Location of Aquatic Sampling Stations

Apalachicola River
Station AR5L

Plant Scholz Ash Pond Discharge – Station PSAP

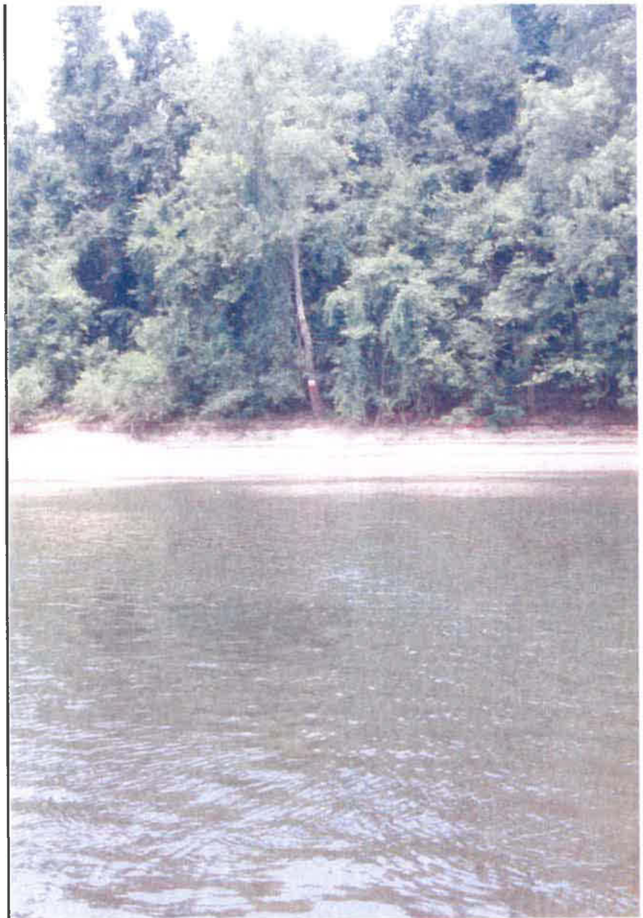


Plant Scholz Discharge
Canal – Station PSDC1

Plant Scholz Discharge Canal – Station PSDC2

Figure 2-2

Location of Aquatic Sampling Stations



Apalachicola River
Station AR6L

Apalachicola River Station
AR6R

Apalachicola River
Station AR7R (left) and
AR7L (right)

Figure 2-2

Location of Aquatic Sampling Stations

Apalachicola River
Station AR8R

Apalachicola River Station
AR8L

Plant Scholz

TABLE 2-1

Description of Aquatic Sampling Stations

Stations	Description
Apalachicola River (AR), Station 1, right side (R), looking downstream	0.88 kilometers (0.54 miles) downstream from Jim Woodruff Dam at Lake Seminole, and approximately 5.38 kilometers (3.34 miles) upstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 42' 03.14337" N and longitude 84° 51' 35.17615" W [(c)].
Apalachicola River (AR), Station 1, left side (L), looking downstream	Directly across the river from station AR1R, just beneath highway 90 bridge; latitude 30° 42' 04.99124" N and longitude 84° 51' 32.72114" W [(c)].
Apalachicola River (AR), Station 2, right side (R), looking downstream	2.38 kilometers (1.48 miles) downstream from Jim Woodruff Dam at Lake Seminole, 1.5 kilometers (0.93 miles) downstream from station AR1R, and approximately 3.75 kilometers (2.33 miles) upstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 41' 25.10030" N and longitude 84° 51' 50.61525" W[(c)].
Apalachicola River (AR), Station 2, left side (L), looking downstream	Directly across the river from station AR2R, just beneath the Louisville and Nashville railroad trestle; latitude 30° 41' 21.52376" N and longitude 84° 51' 46.13685" W[(c)].
Apalachicola River (AR), Station 3, right side (R), looking downstream	4.0 kilometers (2.49 miles) downstream from Jim Woodruff Dam at Lake Seminole, 1.63 kilometers (1.01 miles) downstream from station AR2R, and 2.0 kilometers (1.24 miles) upstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 40' 42.78585" N and longitude 84° 52' 19.65864" W[(c)].
Apalachicola River (AR), Station 3, left side (L), looking downstream	Directly across the river from station AR3R; latitude 30° 40' 40.46723" N and longitude 84° 52' 13.81500" W[(c)].
Apalachicola River (AR), Station 4, right side (R), looking downstream	6.0 kilometers (3.73 miles) downstream from Jim Woodruff Dam at Lake Seminole, approximately 1.88 kilometers (1.17 miles) downstream from station AR3R, and 0.13 kilometers (0.08 miles) upstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 40' 00.09120" N and longitude 84° 53' 07.48799" W[(c)].
Apalachicola River (AR), Station 4, left side (L), looking downstream	Directly across the river from station AR4R; latitude 30° 39' 58.40382" N and longitude 84° 53' 00.82954" W[(c)].
Apalachicola River (AR), Station 5, right side (R), looking downstream	6.13 kilometers (3.81 miles) downstream from Jim Woodruff Dam at Lake Seminole, approximately 0.25 kilometers (0.16 miles) downstream from station AR4R, and just downstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 39' 57.30546" N and longitude 84° 53' 11.86752" W[(c)].

TABLE 2-1 (Cont.)

Description of Aquatic Sampling Stations

Apalachicola River (AR), Station 5, left side (L), looking downstream	Directly across the river from station AR5R; latitude 30° 39' 49.24851" N and longitude 84° 53' 14.33129" W[c].
Apalachicola River (AR), Station 6, right side (R), looking downstream	8.13 kilometers (5.05 miles) downstream from Jim Woodruff Dam at Lake Seminole, and approximately 1.88 kilometers (1.17 miles) downstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 39' 06.58189" N and longitude 84° 53' 32.21609" W[c].
Apalachicola River (AR), Station 6, left side (L), looking downstream	Directly across the river from station AR6R; latitude 30° 39' 01.03761" N and longitude 84° 53' 27.20899" W[c].
Apalachicola River (AR), Station 7, right side (R), looking downstream	10.63 kilometers (6.60 miles) downstream from Jim Woodruff Dam at Lake Seminole, 2.5 kilometers (1.55 miles) downstream from station AR6R, and approximately 4.38 kilometers (2.72 miles) downstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 37.972 minutes N, and longitude 84° 54.321 minutes W[c]. (Poor GPS readings)
Apalachicola River (AR), Station 7, left side (L), looking downstream	Directly across the river from station AR7R, and just beneath the Interstate 10 highway bridge; latitude 30° 37' 59.25950" N and longitude 84° 54' 15.01004" W[c]. (Poor GPS readings)
Apalachicola River (AR), Station 8, right side (R), looking downstream	11.75 kilometers (7.30 miles) downstream from Jim Woodruff Dam at Lake Seminole, 1.13 kilometers (0.70 miles) downstream from station AR7R, and 5.5 kilometers (3.42 miles) downstream from the mouth of the Plant Scholz cooling water discharge canal; latitude 30° 37' 25.91735" N and longitude 84° 54' 12.08110" W[c].
Apalachicola River (AR), Station 8, left side (L), looking downstream	Directly across the river from station AR8R; latitude 30° 37' 26.79125" N and longitude 84° 54' 17.22669" W[c].
Plant Scholz Discharge Canal #1 (PSDC #1)	Located just upstream from the confluence of the ash pond discharge; latitude N 30 degrees 40.155 minutes, and longitude W 84 degrees 53.174 minutes[c].
Plant Scholz Ash Pond Discharge (PSAP)	The ash pond discharge is located on the Plant Scholz cooling water discharge canal, just south of the plant; latitude N 30 degrees 40.126 minutes, and longitude W 84 degrees 53.190 minutes[c].
Plant Scholz Discharge Canal #2 (PSDC #2)	Located downstream from the ash pond discharge, and just upstream from confluence with the Apalachicola River; latitude N 30 degrees 40.096 minutes, and longitude W 84 degrees 53.320 minutes[c].

a Annual monitoring stations
b. Biological Integrity Test stations
c. USGS map coordinates Global Positioning System (GPS)

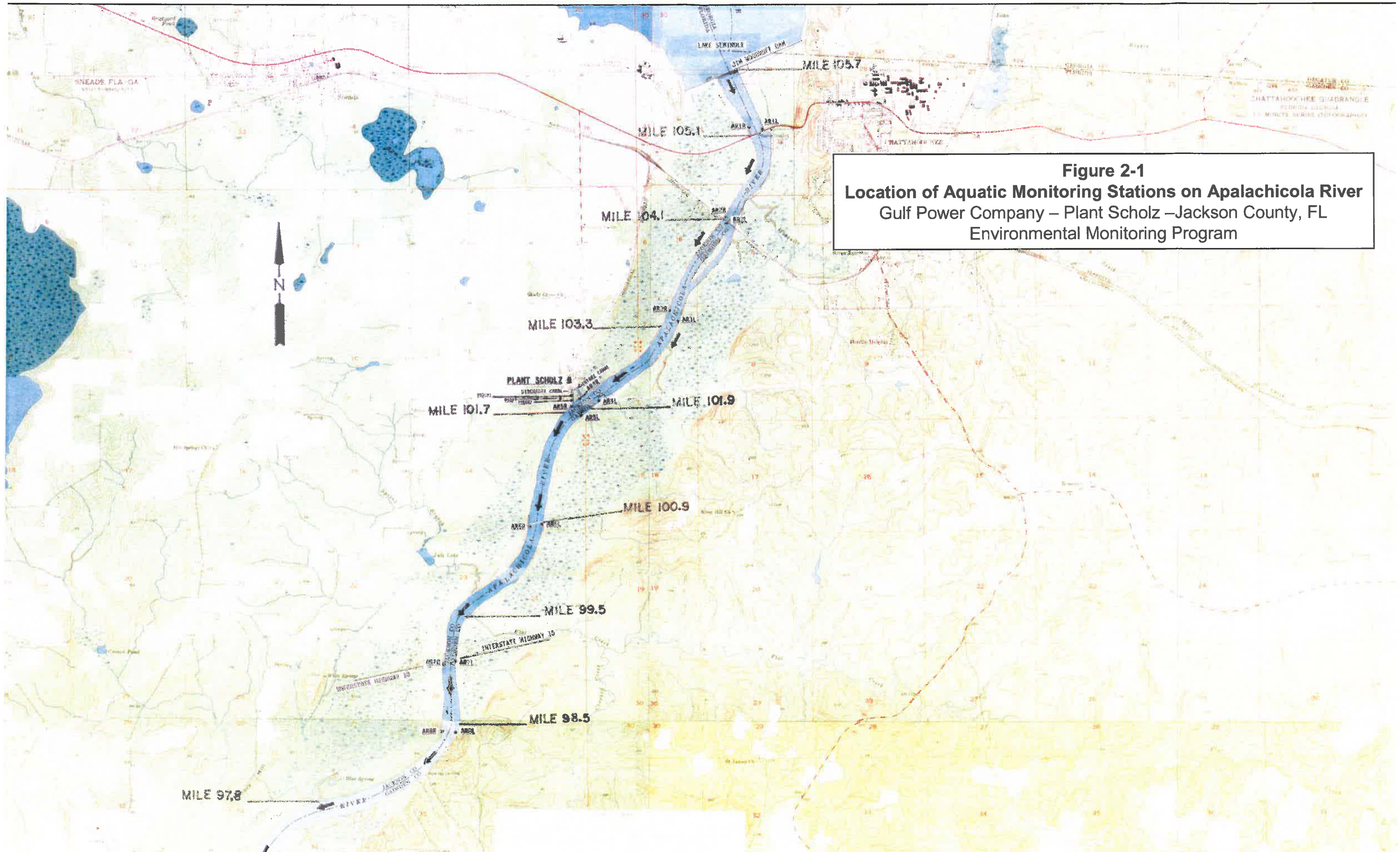


Figure 2-1
Location of Aquatic Monitoring Stations on Apalachicola River
Gulf Power Company – Plant Scholz –Jackson County, FL
Environmental Monitoring Program

3. WATER QUALITY MONITORING PROGRAM

Description of the Study Area and Aquatic Sampling Stations

The Apalachicola River is 107 miles long, and is the largest river on the entire Gulf Coast of Florida. The Apalachicola River is one of four alluvial rivers in the panhandle of Florida. Alluvial rivers are characterized as having broad floodplains that are dominated by a variable seasonal flow, substantial annual flooding and a heavy sediment load. The Apalachicola has a drainage basin of 19,600 square miles, and lies entirely within the lower Coastal Plain Province. It is the only river in Florida to stretch from the Piedmont in the southern Appalachians to the Gulf of Mexico (Stanford, et al., 1979).

Physical Features

The upper river corridor from Chattahoochee to Blountstown, in which our study area is located, cuts through sediments of Miocene Age. Much of this area is dissected by steep ravines, which begin abruptly at spring steepheads. The floodplain in this region is one to two miles wide, and the river itself has long, straight reaches and wide gentle bends. Natural riverbank levees are higher and wider here than the rest of the river, ranging up to 15 feet above the surrounding floodplain and from 400 to 600 feet wide. Since the river is more "contained" in the upper reaches, the fluctuation in water level is greater, ranging from 19-24 feet. The elevation of the river falls 40 feet in its course to Apalachicola Bay; its floodplain, which is the largest in Florida (173 square miles), broadens from one mile wide at just below Lake Seminole (Stanford, et al., 1979).

The Jim Woodruff Lock and Dam, 3.5 miles upstream from Plant Scholz, impounds the headwaters of the Apalachicola River, which forms at the confluence of the Chattahoochee and Flint Rivers at Lake Seminole. The primary purposes of the Lock and Dam are to aid in navigation, and to generate electric power. Other benefits include streamflow regulation, recreation and conservation (Stanford, et al., 1979).

The average width of the river in this area is approximately 180-260 yards wide, and ranges in depth from 9-21 feet; current speeds ranged between <0.5 fps to 1.0 fps. Current velocity characteristics play an important role in river ecology; influencing not only water chemistry, but also the population composition of native fauna and flora. The operation of Jim Woodruff hydroelectric dam, by the U. S. Army Corps of Engineers, and the accompanying alteration of natural stream flow rhythms significantly affects the physical, chemical, and biological character of the river. This can also be said of channel dredging activities, snag removal, and the construction of channel control structures (Stanford, et al., 1979).

Hydrological Features

The river is 21st in magnitude of flow volume among the rivers in the conterminous United States and is the largest in Florida. The mean annual discharge of the river at Chattahoochee, Florida, is 22,400 cubic feet per second (ft^3/s), while the mean annual discharge at the Sumatra gage is 25,000 ft^3/s. At mean discharge, the river ranges from 250 to 1,000 feet wide. The summer and fall are characterized by low flow conditions while the highest flows typically occur during the winter and spring. Seasonal river stage fluctuations are three times greater in the upper river than in the lower, and peak floods are most likely to occur during January through April. Over a typical year, daily flow can vary ten-fold. It is estimated that the Apalachicola discharge accounts for 35 percent of the total freshwater runoff from the West Coast of Florida (North Florida Water Management District (NFWMD), 1992).

The Apalachicola River is classified as an alluvial river and is the only river in Florida that has its origin in the Piedmont and Southern Appalachians. Characteristics of alluvial rivers include a heavy sediment load, turbid water, large watersheds, sustained periods of high flow, and substantial annual flooding. The majority of the rainfall affecting the river falls in Georgia and Alabama, where the majority of the ACF basin is located. The average rainfall in the Apalachicola basin in Florida is approximately 58 inches (NFWMD, 1992).

Chemical Features

In general, the water quality in the Apalachicola River Basin is good compared to other major river systems in the region. The primary reasons for this are the undeveloped nature of the basin, the retention of pollutants by upstream reservoirs acting as settling ponds, and the sedimentary nature of the river bottom. The state of Florida has classified the entire length of the river as Class III waters, having water standards intended to protect recreational use and the propagation and maintenance of a healthy well-balanced population of fish and wildlife (Cairns, et al., 1992).

The Apalachicola River is probably one of the most studied streams in the state of Florida. EPA Storage and Retrieval Database (STORET) water quality data was obtained for all locations pertinent to our study on April 3, 1992, from Mr. David Gowan of the FDEP in Tallahassee, Florida. A computer printout of this data for the Apalachicola River, from just below Jim Woodruff Dam (approximately river mile 105.5) downstream to river mile 97.0, is found in Appendix B.

Listed as follows are STORET water quality value ranges for selected parameters from the area just below Jim Woodruff Dam, Chattahoochee, Florida: temperature (°C), 9-30; dissolved oxygen (mg/l), 7.6-10.6; percent dissolved oxygen saturation (%), 80.4-102.6; pH (su), 6.3-6.9; alkalinity, as $CaCO_3$ (mg/l), 44-104; total hardness, as $CaCO_3$ (mg/l), 29-50; turbidity (NTU), 12-52; conductivity (umhos/cm), 70-190; total nitrogen (mg/l), .080-1.150; total phosphorus (mg/l), .09-.46; total organic carbon (mg/l), 5.0-5.8; aluminum (mg/l), 0-700; arsenic (mg/l) 1.0-7.0; calcium (mg/l), 9.3-18.1; chromium (mg/l), 4.0-20; copper (mg/l), 2-14; iron (mg/l), 280-2800; lead (mg/l), 0-26; magnesium (mg/l), 0-80; mercury (mg/l), .1-.7; nickel (mg/l), 1-29; potassium (mg/l), .3-2.4; selenium (mg/l), 0-7; sodium (mg/l), 3.2-13.2; sulfate (mg/l), 2-11; vanadium (mg/l), 6-6; and zinc (mg/l), 7-370.

A limited listing of selected trace metals found in sediments in the same above location is as follows: arsenic (mg/kg), 0.0-0.0; cadmium (mg/kg), 0.0-0.0; chromium (mg/kg), 0.0-2.0; manganese (mg/kg), 2-20; mercury (mg/kg), 0.0; and zinc (mg/kg), 2.1-20.

Biological Features - Terrestrial Vegetation

Fifteen percent of the Florida portion of the Apalachicola drainage basin is floodplain and the remaining portion consists of other palustrine, riverine, lacustrine, and terrestrial habitats. The identified upland habitats are: sandhills, clayhills, scrub, pine flatwoods, mixed hardwoods, titi swamps, bayheads, shrub bogs, cypress swamps, seepage bogs, savannas, bluffs and ravines, and caves. This diversity of habitat has resulted in high species richness in plant life within the Apalachicola watershed (NFWMD, 1992).

The eastern portion of the Apalachicola watershed, from Bristol north to Chattahoochee, is considered to be one of the primary conservatories of rare and endangered plants. Many species in this area lie at the extreme of the ranges of the eastern deciduous forests; others, such as Florida torreya, croomia, and Florida yew have long been isolated by displacement of Tertiary flora by present day flora (Leitman, et al., 1984). The Apalachicola Bluffs have been found to harvest the greatest number of endangered plant species of any area in Florida (NFWMD, 1992).

Of the 144,000 acres of floodplain on the Apalachicola River, approximately 85 percent are forested. This forested floodplain constitutes the largest within Florida. The major land use within the floodplain has, since the Civil War, been forestry. The area was actively timbered between 1870 and 1925 and has been logged once or twice since then. Re-growth has been rapid and much of the floodplain is now mature forest (NFWMD, 1992).

The mixed hardwood forest type is the largest association found in the Apalachicola floodplain, covering 43 percent of the area. In the upper and middle river sections, it is found across the entire floodplain covering 78 percent of the area, but is restricted to the natural levees in the lower, tidally influenced section of the river. The predominant species are water hickory, sweetgum, overcup oak, green ash, and sugarberry (NFWMD, 1992).

Biological Features - Aquatic

The Apalachicola River is the largest on the entire Gulf Coast of Florida. Because of its origin in the southern Appalachian Mountains and the adjacent Piedmont, the biology of the river valley is unique, resulting in a wide diversity of physical environments. The forested floodplain of the Apalachicola is the largest in Florida, covering approximately 173 square miles (NFWMD, 1992).

Amphibians and Reptiles

The Apalachicola watershed contains a wide diversity of habitats, resulting in the highest species density of amphibians and reptiles in North America, north of Mexico. The high species richness of the area includes rare, endangered, threatened and endemic species. The threatened American alligator *(Alligator mississippiensis)* is found along the banks of the river and tributaries, as well as in sloughs and backwaters. The Barbour's Map turtle *(Graptemys barbouri)* utilizes the rocky shoals of the upper river and is an endemic species to the Gulf Coastal Plain portion of the drainage basin. This species has suffered from the impoundment of its natural range by Jim Woodruff Dam and local harvesting. The alligator snapping turtle *(Macroclemys temmincki)* is threatened by commercial exploitation and loss of habitat to river channelization and drainage (Miller, et al., 1977). This is the largest freshwater turtle (weighing over 200 lb.) and is found in the oxbows, sloughs, tributaries, and main river channel. Another important or unique species found in the floodplain is the Florida red-bellied turtle *(Pseudemys nelsone)* (NFWMD, 1992).

Aquatic Vegetation

Submersed vegetation is relatively scarce on the Apalachicola River and is primarily found in the lower section of the river below navigation mile 10.0 where water velocity is slow. No submersed vegetation is found above navigation mile 35.0 (NFWMD, 1992).

Fisheries

The Apalachicola River basin has the greatest number of freshwater fish species in Florida, with 86 species identified. Included in the identified species are eight diadromous species, four endemic species, seven introduced species, and two marine species that are commonly found throughout the system. The upper river area near the Jim Woodruff Dam tailrace is the most productive fishery on the river. This is primarily due to the availability and variety of productive habitat, augmentation of populations with releases from Lake Seminole during high water, and blockage of migratory fish by the dam (NFWMD, 1992).

The three endemic species are the bluestripe shiner *(Notropis callitaenia)*, the grayfin redhorse *(Moxostoma spp.)*, and the shoal bass *(Micropterus spp.)*. The bluestripe shiner prefers the sandy bottoms of the river, rarely enters the smaller creeks, and avoids soft organic bottoms. The grayfin redhorse is usually found in white, clear to turbid waters, in slow to moderate current, over sand and gravel bottoms with little vegetation, and can be found in all major tributaries to the river. The shoal bass prefers moderate to swift currents, usually over a rock or bedrock bottom, and is primarily found in the upper river (NFWMD, 1992).

The eight diadromous fish found on the river can be further divided into anadromous and catadromous species. The five anadromous species are Atlantic needlefish *(Strongylura marina)*, Gulf of Mexico sturgeon *(Acipenser oxyrhynchus desotoi)*, Alabama shad *(Alosa alabamae)*, skipjack herring *(Alosa chrysochloris)*, and striped bass *(Morone saxatilis)*. The Atlantic sturgeon, Gulf sturgeon, and striped bass historically migrated upstream in large numbers. However, in the last decade the populations of these species have dramatically declined. Important habitats for these species appears to be rock, deep holes in mid-river, the tailrace of the Jim Woodruff Dam, and deep, still waters of oxbow lakes before most of these were filled in or altered (NFWMD, 1992).

The three catadromous species include the American eel *(Anguilla rostrada)*, mountain mullet *(Agonostomus monticola)*, and hogchoker *(Trinectes maculatus)*. The American eel is the most abundant and found in tremendous concentrations at the base of the Jim Woodruff Dam (NFWMD, 1992).

The principal freshwater game species found in the Apalachicola River include largemouth bass *(Micropterus salmoides)*, bluegill *(Lepomis machrohirus)*, redbreasted sunfish *(Lepomis auritus)*, redear sunfish *(Lepomis microlophus)*, black crappie *(Pomoxis migromaculatus)*, and the hybrid sunshine bass *(M. saxitilis x M. chrysops)*. The major food species harvested on the river include channel catfish *(Ictalurus punctatus)*, white catfish *(Ictalurus catus)*, striped mullet *(Mugil* *cephalus)*, southern flounder *(Paralichthys lethostigma)*, and American eel. The stripped mullet and southern flounder are actually marine species which have invaded the river (NFWMD, 1992).

The introduced species within the Apalachicola River are the carp *(Cyprinus carpio)*, white bass *(Morone chrysops)*, green sunfish *(Lepomis cyanellus)*, orange-spotted sunfish *(Lepomis humilis)*, yellow perch *(Perca lavenscens)*, and sauger *(Stizostedion canadense)*. Nearly all of the species were originally stocked in the Chattahoochee or Flint Rivers and have subsequently moved downstream. Except for the carp, all species are more or less restricted to the area immediately below the Jim Woodruff Dam (NFWMD, 1992).

The habitat richness and diversity within the Apalachicola River has resulted in the wide diversity of fish species within the system. The substrate composition of the river and the shoreline features has combined to help determine the amount and type of food available, and adequacy as a spawning and nursery area. Six distinctive habitat types have been identified within the river: steep natural bank, gently sloping natural bank, dike field, sandbar, rock, and submersed vegetation. Additionally, snags play a major role in determining habitat usage and significantly affect the productivity of the areas. Snags provide much needed cover for fish and are an important substrate for invertebrates, which fish feed on. Certain habitats such as dike fields, rock, submersed vegetation, and gently sloping banks attract more desirable gamefish and foodfish; whereas, sandbars and steeper sloping banks support rough and forage fish populations (NFWMD, 1992).

The diversity of gamefish and foodfish in the Apalachicola River has resulted in a profitable sportfishing industry in the basin. The mainstay of the sport fishery has been the numerous species of bass and sunfishes in the river such as: striped bass, white bass, and catfish (NFWMD, 1992).

The commercial fishery for sturgeon in the river had steadily declined until in the late 1950's the combination of greatly reduced catches and competition from Russian imports all but closed down the industry in the Apalachicola basin. Since 1984, the State of Florida has prohibited the taking of sturgeon for any reason due to the drastic drop in population. However, an abundance of catfish in the river has supported a commercial industry for many decades. The production fluctuates drastically, partially due to local demands, but mostly due to variable supply. At present, the fishery has deteriorated due to fewer commercial fishermen and a smaller harvest. The channel catfish is the most desired species, but white catfish and several species of bullhead are also taken (NFWMD, 1992).

Invertebrates

The Apalachicola River drainage basin contains the largest number of species of freshwater gastropods and bivalves, and the most mollusk species endemic to the region. The drainage basin supports over 50 species of mollusks and 20 species of gastropods, 16 of which are gill breathers (prosobranchs). All the eggs of the gastropods, (except the apple snail, *Pomacea paludosa*), are deposited into the water and subject to fluctuations in water flows and quality. The apple snails attach their eggs to tree limbs, branches and trunks (NFWMD, 1992).

There are several species of mollusks and gastropods that are endemic to the drainage basin, while additional species are considered to be rare and endangered. Eight species of mollusks are considered endemic to the drainage basin and they are: *Goniobasis albanyensis, G. athearnia, G. boykiniana, G. catenoides, Lioplax pilsbryi, Elliptio chipolaensis, E. nigella,* and *Lampsilis binominatus.* Of these, five are gastropods and the remaining are bivalves (mussels). Six bivalve species are considered rare and endangered and they are: *Elliptoideus sloatianus, Megalonaias neisleri (boykinianan), Alasmidonta triangulata, Lampsilis medionidus penicillatus,* and *Pleurobema pyriforme.* Heard (1977) appends the list to include *Anodonta cataracta, A. couperiana, Anodontoides radiatus, Elliptio crassidens, E. nigella, Glebula rotundata, Quincuncina infucata, Strophitus subvexus,* and *Villosa villosa* which are bivalves and the gastropods *Goniobasis albanyensis, G. boykiniana, G. catenoides, Lioplax choctawhatchensis, Pomatiopsis lapidaria,* and *Somatogyrus substriatus* (NFWMD, 1992).

The molluscan populations within the Apalachicola drainage basin have been in decline and, in some instances, extinction. Coincidental to the local extinction and reduced numbers of mussels, the introduction and subsequent domination of the Asiatic clam *(Corbicula fluminia)* has occurred. Several factors can be attributed to the reduced populations: habitat alteration, reservoir construction, siltation due to dredging, pollution, and agricultural runoff (NFWMD, 1992).

The Apalachicola River basin provides a wide diversity of habitats and large tracts of undisturbed areas in which wildlife species can survive and propagate. Some of the species are endemic and are found nowhere else in the world. Also, many species need large areas in which to roam and will not survive in small, contained areas. Because the Apalachicola River basin contains such a diversity of habitats and has contributions from neighboring bio-geographical areas, it may have more species of plants and animals than anywhere else in temperate North America (Edmiston and Tuck, 1987). The high species richness of the area includes many rare, threatened, endangered, of special concern, and endemic species. The Apalachicola River basin plays a major role in protecting and preserving these species and, to that end, should be managed in such a way as to continue to provide the habitat diversity and richness that is essential to their survival (NFWMD, 1992).

Stream Use and Potential Wastewater Sources

In general, the water quality in the Apalachicola River basin is good compared to other major river systems in the region. The primary reasons for the relatively high water quality within the basin are the undeveloped nature of the basin, the retention of pollutants by upstream reservoirs acting as settling ponds, and the sedimentary nature of the river bottom. *The entire river, including the Chipola River, has been designated an Outstanding Florida Water (OFW) which means that the water quality conditions of the river become standards for which all future water quality-related activities will be judged. The OFW designation is an administrative tool which allows no further water quality degradation from existing conditions and includes a determination that a waterbody is of exceptional recreational or ecological significance (NFWMD, 1992).*

The State of Florida classifies all its surface waters by their designated uses. Each of the classes has specific water quality standards for parameters such as bacterial levels, metals, pesticides, herbicides, and dissolved oxygen, which are designed to protect and maintain the use of the waterbody. Within the Apalachicola River basin, there is only one Class I waterbody. The City of Chattahoochee as a drinking water source uses Mosquito Creek, a tributary. The creek is classified

Class I from U. S. Highway 90 north to the state line and is afforded the greatest protection of any other water classification (NFWMD, 1992).

All other waters within the river basin are Class III waters, including Apalachicola and Chipola Rivers, Dead Lake, Lake Wimico, Lake Seminole, and all other creeks, ponds, or surface waters. Class III water standards are intended to protect recreational use and the propagation and maintenance of a healthy well-balanced population of fish and wildlife (NFWMD, 1992).

There are several potential sources within the basin, which could affect water quality. These are out-of-state influences entering the Apalachicola River at Jim Woodruff Dam, point discharges into the river and its tributaries, barge traffic, dredging activities, and non-point source runoff such as stormwater and septic tank seepage during wet conditions. Currently, the point sources in the basin are small compared to the river flow, and primarily affect the tributaries into which they are permitted to discharge. Non-point sources have had limited regulation within the basin. Although urbanized areas within the basin are relatively small, runoff from the steeper terrain in the upper basin could become a problem. Additionally, the large agriculture and silviculture operations in the basin could potentially have both short and long-term impacts on the system, as could road construction activities (NFWMD, 1992).

Some water quality problems have been documented in the Apalachicola River basin, particularly in its tributaries. The primary problems detected have been high fecal coliform counts and low dissolved oxygen below the sewage treatment plants and industrial discharges. Additionally, before entering Florida at the Apalachicola River, the Chattahoochee and Flint River systems receive numerous discharges from Atlanta and other urban areas, textile mills, paper mills, sewage treatment plants, steam power plants, a nuclear power plant, and extensive agricultural areas in Alabama and Georgia (NFWMD, 1992).

In a 1990 publication by the Northwest Florida Water Management District entitled, "Apalachicola River and Bay Project: Point Source Assessment of the Apalachicola River and Bay Drainage Basin", the permitted domestic and industrial facilities in the immediate study area are listed as follows: City of Chattahoochee; Florida State Hospital; Gulf Forest Work Camp; City of Sneeds; and Scholz Electric Generating Plant. In this publication, the Scholz facility is described, in part, as follows:

Plant Scholz is a major industrial discharger having a design flow of 129.6 mgd into the Apalachicola River through an 850-foot long canal. Plant Scholz was placed on 24-hour standby in 1953, and is used for system reliability and peaking. This facility operated a total of 139 days in 1993, and 60 days in 1992. There are four NPDES regulated points of discharge. The main discharge canal carries cooling water, bottom and fly ash sluice water, boiler blowdown, coal yard runoff, miscellaneous plant wastes, pre-treated metal cleaning waste, pre-treated sanitary wastewater, and stormwater overflow. Additionally, the switchyard stormwater is directly discharged into the plant intake canal and into the river floodplain. The ash disposal is a concern at all coal-fired power plants. Scholz disposes of approximately 48 tons per day into a series of ash ponds and the sluice water flows through an open ditch into the main discharge canal (NFWMD, 1990).

Numerous studies have been conducted in Florida on the Apalachicola River over the years. While a number of these reports are biological in nature, most have concentrated on various aspects of fisheries and related problem areas. Examples of these problem areas are: the operation of Woodruff Dam, herbicide use in Lake Seminole, agricultural use of pesticides, dredging operations, snag removal, and the construction of numerous wooden and rock training dikes by the U. S. Army Corps of Engineers (Hill, et al., 1990; Florida Game and Fresh Water Fish Commission, 1986; Cox, et al., 1974; Bass, 1983; and Ager, et al., 1985.) Other reports have concerned physical (Allen, 1983), chemical (Elder, et al., 1984; NFWMD, 1982), resource management (NFWMD, 1992; FDEP, 1984; U. S. Army Corps of Engineers, 1985); resource inventory (Edmiston, et al., 1987), water quality management (FDEP, 1988; FDEP, 1986; FDEP 1988; FDEP, 1986). One limited biological assessment of water quality study has been conducted on the Apalachicola River in the study area. This limited study was conducted by the FDEP in August of 1990. No adverse effects were detected from either effluent screening toxicity tests, or in-stream macroscopic benthic invertebrate studies (FDEP, 1990).

Another potential source of water quality problems within the Apalachicola River basin is the use of the system as a navigation project. Spills of such commodities as fertilizers, petroleum products and chemical products, from barges traveling on the river, could have a deleterious impact on the river (NFWMD, 1990).

The maintenance of the navigation channel is also a source of some water quality problems. Short-term effects of dredging on water quality are increased turbidity, reduced dissolved oxygen, and release of noxious materials from the sediments, particularly nutrients into the water column. Long-term effects include release of biostimulants (phosphorus and nitrogen) and toxins (heavy metals, pesticides and herbicides) from dredged sediments to the water column (Leitman, et al., 1984). However, not all impacts of dredging are detrimental to water quality. In particular situations, dredging may lead to release of nutrients that stimulate plant growth that can be beneficial (NFWMD, 1990).

A study report by the Florida Game and Fresh Water Fish Commission (1986) states, "that the Apalachicola River, once thought to be the most productive river in northwest Florida and possibly the state, has experienced a series of physical alterations by the U. S. Army Corps of Engineers, which may have severely impacted and degraded the fish community. During the past 40 years, dredging and spoil disposal within and outside the river banks, rock removal from the river channel, dike construction to divert the flow of the river, and until recently, the indiscriminate removal of snags and fallen trees from the river have occurred. (And because of this) the fish community associated with the Apalachicola riparian habitats does not demonstrate the quality as it may once have had when compared to other river systems in Florida where a comparable magnitude of habitat degradation has not occurred."

Overall, the Apalachicola River is considered to be a "pristine" river system; however, current and past land use practices have impacted the river and will continue to as development pressures increase within the basin. Additional out-of-state development and growth within the State of Florida will increase the use of the system as a means to dispose of urban and industrial wastes. While at the same time, increasing the demands on the system as a source of freshwater for potable water, recreational activities, habitat for wildlife and plant species, and other uses. Unless development activities are regulated in such a way as to prevent degradation, additional development within the basin will also lead to increased non-point source discharges into the system, thus, increasing the likelihood of reduced water quality (NFWMD, 1990).

Currently, the point sources in the Apalachicola basin are small compared to the flow of the river, and primarily affect certain tributaries. Non-point sources have not been quantitatively evaluated, but due to the relatively undeveloped nature of the basin, are believed to be limited problem. However, recent work on trace elements, insecticides and herbicides has shown that further study of agricultural and silvicultural impacts, and uncontrolled non-point releases into the system may be warranted (NFWMD, 1990).

Methods and Materials

Physical and Chemical Analyses

Methods and materials used to obtain stream bottom profiles, continuous water temperature recordings, vertical mid-channel profiles, computerized water quality monitoring data, trace metal analyses of surface waters and stream bottom sediments, and routine chemical analyses of surface water (Figure 3-1) are as follows:

Stream Bottom Profiles and Daily Stream Flow Records

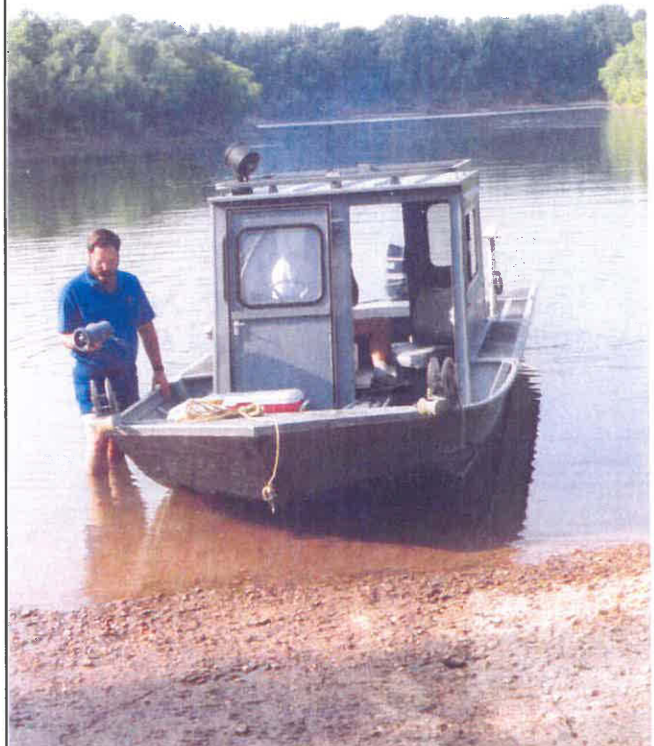
Cross-sectional stream bottom profiles were made on July 27, 1993, at numerous points throughout the Apalachicola River study area with a portable recording Raytheon Model DE-719 Fathometer Depth Sounder (Appendix C). Information derived from such profile records is useful in describing the physical character of the stream bottom and in selecting sampling stations. Stream flow conditions influence the physical, chemical, and biological character of streams to a great extent. Daily stream flow records for the Apalachicola River near Chattahoochee, Florida, were compiled from data furnished by the Water Resources Division of the U.S. Geological Survey office in Tallahassee, Florida.

Continuous Water Temperature Recordings

Beginning in 1993, surface water temperatures were recorded continuously in 16 locations for 30 days each sampling period by the use of Ryan TempMentors (prior to 1998) or Onset temperature logging devices. These self contained, computerized, battery-powered units feature a microprocessor with solid-state reliability and work with IBM-compatible computers. Accuracy is within plus or minus 0.3°C, and time within plus or minus 0.01 percent over temperature. The temperature recorders are located approximately 15.2 cm (6 in.) above the stream bottom at a depth of 0.9-m (3 ft) during low water conditions. Deployment is performed, by suspending the instruments from submerged sections of electrical conduit pipe. Substrates are attached to pipe that has either been driven into the stream bottom and sawed off (approximately 0.6 m above the bottom), or attached to heavy-gage metal eyebolts screwed into submerged logs or wooden pilings at each station for one 30-day period. To facilitate quick location and retrieval, a submerged stake connected by nylon rope to the conduit pipe is driven into the riverbed at the water's edge near a tree marked with orange survey tape. The Onset temperature logging devices are calibrated at the factory, and fitted with batteries which are replace annually. Instruments are set to collect data

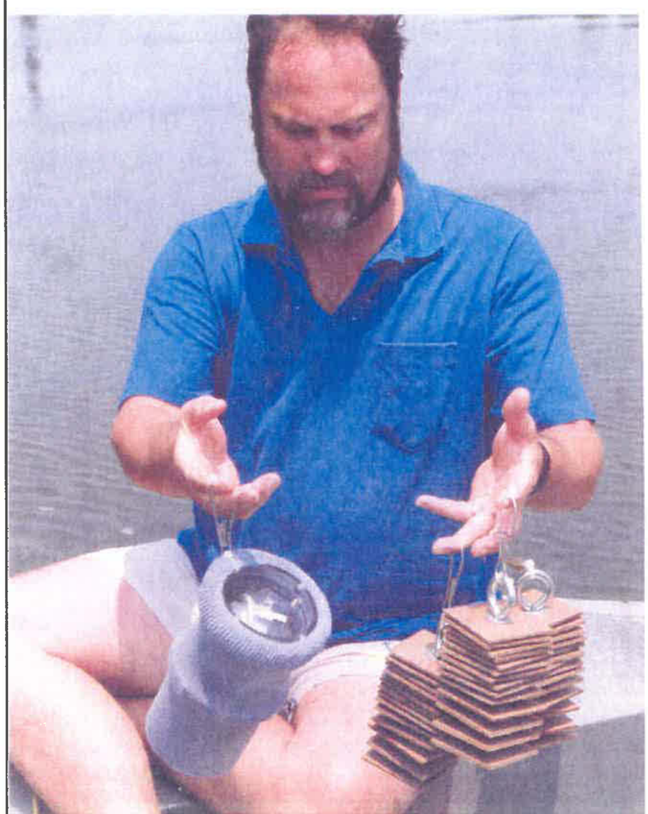
Figure3-1

Water Quality Monitoring Activities



Boat launch near Plant Scholz – L-R Joe Neese (Gulf) and Ron Ammons (SCS)

Overlook from Plant Scholz of Apalachicola River



Joe Neese (Gulf) holding Tempmentor and Hester-Dendy multiplate samplers.

Figure 3-1

Location of Aquatic Sampling Stations

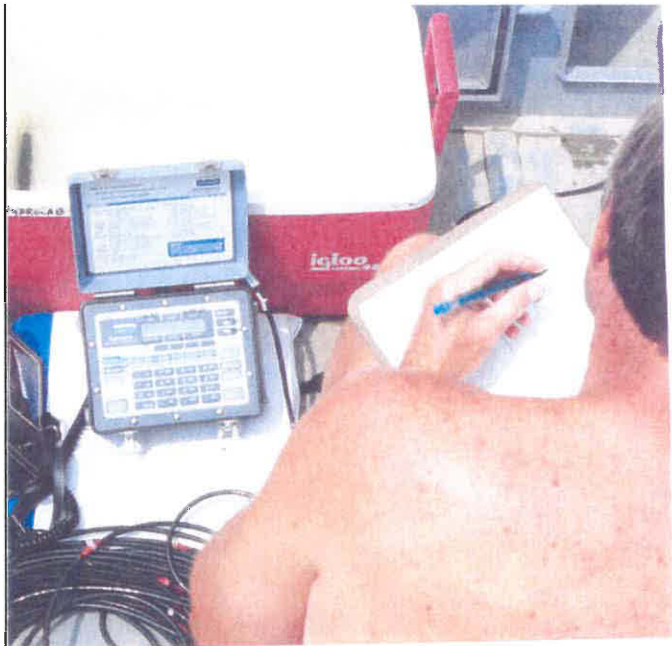
Hester-Dendy sampler collected in a draw string cotton bag.

Ron Ammons (SCS) cleaning a Hydrolab Datasonde

Collecting sediment with a petite Ponar dredge.

Figure 3-1

Location of Aquatic Sampling Stations



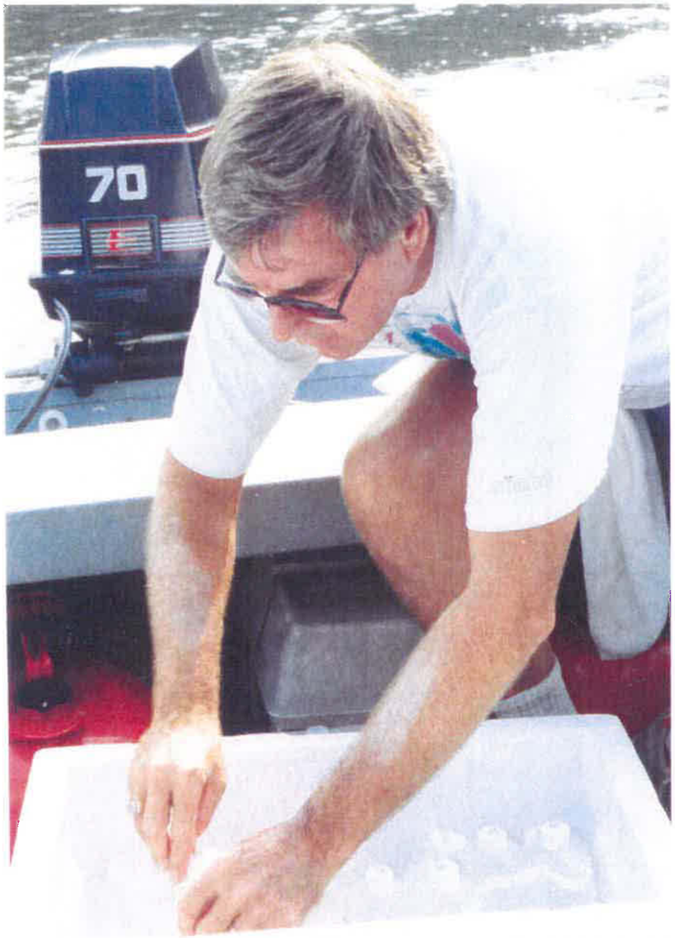
Taking vertical profile with Hydrolab Surveyor III

Ron Ammons (SCS) cleaning retrieved Tempmentor

Corbicula clam shells litter shoreline below dam.

Figure 3-1

Location of Aquatic Sampling Stations



Taking vertical profile with Hydrolab Surveyor III

Deploying Hydrolab Datasondes and Ryan Tempmentors every ten minutes for 30 days, and are located at a depth of 0.9 m (3 ft) in the vertical water column, primarily to prevent loss of data from tampering and vandalism. Each year, the temperature recorders are rotated among the sampling stations to reduce the possibility of biased data. Temperature data are presented in both Fahrenheit and Celsius in this report.

Chemical Analyses

Studies concerned with assessment of water quality conditions can be undertaken by two basic methods: chemical and biological. Chemical analyses furnish the description of a body of water in terms of concentrations present of, for instance, dissolved gases, nutrients, solids, and minerals.

Concentrations of chemicals in free-flowing streams are characteristically homogeneous from surface to bottom and are continuously subject to change because of fluctuations in stream flows. By contrast, the chemical characteristics of quiescent bodies of water, such as ponds and lakes, are not as much subject to the same stream flow fluctuations, and may be homogeneous or heterogeneous, depending primarily upon prevailing conditions of water temperature and wind velocity.

The spectrum of chemical parameters is vast. Thus, the chemist must rely on suggestions concerning pertinent chemical analyses when determining which analyses should be performed. In addition, chemical analyses performed on a single sample indicate only those chemical and physical characteristics present at the exact time the sample was obtained, thus creating the necessity of collecting many samples over a relatively long period before any definite conclusions can be reached.

Routine Surface Water Chemistry. Composite surface water samples are collected twice during each study period from 16 sampling stations. The chemical parameters measured are limited to basic chemical properties known to significantly influence the quality and quantity of aquatic life and are as follows: temperature (°C); dissolved oxygen (mg/l); percent dissolved oxygen saturation (%); pH (su); and conductivity (mhos/cm) were taken with a Hydrolab Surveyor 3 or YSI Datasonde Water Quality Logging System. Samples are also collected for the following laboratory analyses: chlorides (mg/l); turbidity (nephelometric units); total organic carbon (mg/l); total Kjeldahl nitrogen (mg/l); total suspended solids (mg/l); sulfate (mg/l); total phosphorus (mg/l); hardness, as $CaCO_3$ (mg/l); and alkalinity, as $CaCO_3$ (mg/l). All samples are placed on ice, in coolers upon collection and shipped under chain of custody to Savannah Laboratories of Mobile, Alabama, for analysis.

Trace Metal Analyses of Surface Waters. Composite water samples are collected once during each summer low-flow sampling season in polyethylene containers and preserved with nitric acid prior to analysis. ISCO portable water samplers are used to collect 24-hr. composite samples simultaneously (100 ml every 15 min.) from three locations. The sampling points include Plant Scholz Discharge Canal station PSDC #1, which is located just upstream from the ash pond discharge; Plant Scholz Ash Pond discharge station PSAP, which is located just downstream from station PSDC #1; and Plant Scholz Discharge Canal station PSDC #2, which is located below station PSAP and just upstream from confluence with the Apalachicola River. Additionally, spatial composite samples are collected from the remaining stations (up to 16) by combining three samples collected from each location. Samples are then shipped under chain of custody to Savannah Laboratories in Mobile, AL and analyzed for the following trace metals: boron, aluminum, arsenic, cadmium, chromium, copper, iron, mercury, potassium, magnesium, sodium, nickel, lead, selenium, zinc, and vanadium. Analytical procedures utilized are as follows:

- Metals, Total (U.S. EPA Method 6010). A measured volume of a well-mixed water sample is digested with nitric acid, hydrochloric acid, and deionized water. A "soft" digestion technique is used in place of the "hard" digestion as recommended by EPA Method Study 27. The resulting solutions are analyzed for (1) aluminum, boron, calcium, chromium, copper, iron, magnesium, nickel, potassium, sodium, vanadium, and zinc by ICP-AES, and (2) arsenic, lead, and selenium by hydride generation AES.

- Mercury (U.S. EPA Method 7470). A measured volume of a well-mixed water sample is digested at 95°C with potassium permanganate and potassium persulfate in an acid solution. The mercuric ions are then reduced to the elemental state with stannous chloride and are measured by the cold vapor technique. The ICP and hydride generator are utilized for the cold vapor measurement of mercury.

Trace Metal Analyses of Stream Bottom Sediments. Stream bottom sediment samples are collected once from up to 16 stations during each summer low-flow sampling period. Samples are taken from three locations within each sampling area, composited, refrigerated, and shipped under chain of custody to Savannah Laboratories in Mobile for analysis. Sediments are analyzed for aluminum, arsenic, boron, cadmium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, sodium, vanadium, zinc, and percent moisture content. Analytical procedures utilized are as follows:

- Metals, Total (U. S. EPA Method 6010). A sediment sample is first air-dried, ground, and homogenized after which it is digested in nitric acid and hydrogen peroxide on a hot plate at 95°C. Dilute hydrochloric acid is used as the final reflux acid for (1) the ICP analysis of aluminum, boron, calcium, chromium, copper, iron, magnesium, nickel, potassium, sodium, vanadium, and zinc, and (2) the ICP analysis, using the hydride generator, of arsenic, lead, and selenium.

- Mercury (U. S. EPA Method 7470). A sediment sample is air-dried, ground, and homogenized. The sample is then digested in aqua regia followed by oxidation with potassium permanganate. Mercury (organic and inorganic) in the digested sample is then measured by the cold vapor technique utilizing an ICP and hydride generator.

- Moisture (U. S. EPA - CE - 81-1). Moisture is determined gravimetrically on an air-dried sample by heating in an oven at 105°C.

Trace Metal Analyses of Fish Tissues. In 1999, eight fish tissue samples were collected adjacent to the Plant Scholz cooling water intake screens and from the cooling water discharge canal. Samples were collected from each location using standard bait and tackle. Sunfish, bream and similar species were selected primarily because they represent a popular sport fish and are therefore more likely to be consumed by humans. Tissues samples (muscle) were extracted from each fish and placed on ice, in coolers, and shipped under chain of custody to Savannah Laboratories of Mobile, Alabama for analysis. The tissue samples were analyzed for aluminum, arsenic, boron, cadmium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, sodium, vanadium, zinc, and percent moisture content. Analytical procedures utilized are as follows:

- Metals, Total (U. S. EPA Method 6010). A tissue sample is first air-dried, ground, and homogenized after which it is digested in nitric acid and hydrogen peroxide on a hot plate at 95°C. Dilute hydrochloric acid is used as the final reflux acid for (1) the ICP analysis of aluminum, boron, calcium, chromium, copper, iron, magnesium, nickel, potassium, sodium, vanadium, and zinc, and (2) the ICP analysis, using the hydride generator, of arsenic, lead, and selenium.

- Mercury (U. S. EPA Method 7471). A tissue sample is air-dried, ground, and homogenized. The sample is then digested in aqua regia followed by oxidation with potassium permanganate. Mercury (organic and inorganic) in the digested sample is then measured by the cold vapor technique utilizing an ICP and hydride generator.

Moisture (U. S. EPA - CE - 81-1). Moisture is determined gravimetrically on an air-dried sample by heating in an oven at 105°C.

Vertical Mid-Channel Profiles

Vertical profiles of the water column are made on an as needed basis. The profiles include measurements of dissolved oxygen (mg/l), temperature (C°), and conductivity (mhos/cm). The measurements are made from boat at each of the sampling stations within the study area using a Hydrolab Surveyor 3 or YSI water quality logging system. Parameters are recorded in 2 ft intervals from surface to bottom, and the results are printed out by computer program.

DataSonde Water Quality Monitoring

At the beginning of each study period, Hydrolab or YSI DataSonde water quality monitors are installed at sampling stations located on the Apalachicola River above the cooling water intake screens and below the confluence of the cooling water discharge canal. One monitor is positioned at each station at a depth of 0.9 m (3 ft.) from electrical conduit pipe driven in the stream bed. The DataSondes are programmed to analyze temperature (°C), conductivity (mhos/cm), pH (su), and dissolved oxygen (mg/l) at 15-minute intervals for 30 days. Data are then transferred to a laptop computer in the field.

Biological

Permanent bodies of water, such as streams and lakes, normally support a relatively wide variety of aquatic plants and animals, including fish, suspended macroscopic and microscopic animals and plants (zooplankton and phytoplankton), benthic (bottom-dwelling) macroscopic and microscopic invertebrates, attached algae (periphyton), and submerged and emergent aquatic vegetation. Populations of truly aquatic forms, which depend completely upon water for sustenance, are indicative of the prevailing physical and chemical characteristics of their environment (APHA, 1989).

Water quality degradation is essentially a process whereby the biological character of one type of water body is altered to resemble that of another. For example, the biota of a free-flowing stream receiving excessive organic enrichment is altered relative to that found in the stagnating lower depths of lakes during summer stratification. Consequently, "pollution (or degradation) is essentially a biological phenomenon, in that its primary effect is on living things" (Hynes, 1966).

Macroscopic Benthic Invertebrates

Gulf Power Company is in the process of conducting two separate environmental programs. The first program is in conformance with the State Industrial Wastewater Permit issued to Plant Scholz by the FDEP, which requires (in addition to effluent toxicity testing) conducting of an annual Biological Integrity Test on the Apalachicola River. Biological Integrity Testing emphasizes studying the species diversity of bottom-dwelling invertebrate fishfood populations, such as snails, worms, shrimp, and immature insects, which can be seen with the unaided eye. The second program, though similar to the Biological Integrity Test in that macroscopic benthic invertebrate populations are studied, is much more extensive in both size and scope. This effort represents a long-standing corporate commitment of providing environmental protection through an extensive program of in-house monitoring. The following methodology, at a minimum, conforms to protocols outlined in the Florida Administrative Code Rule (FARC) 62-302.530 (Appendix D), and is utilized in conducting both the Biological Integrity Test and the benthos portion of the Plant Scholz Environmental Monitoring Program.

Benthic macroscopic invertebrate animal populations are the tools used in biologically assessing water quality conditions. Benthic macroscopic invertebrate animals are those forms retained by a U.S. Standard #30 mesh sieve (APHA, 1989). These organisms include shrimp, snails, clams, and aquatic insects, and form the important intermediate link between fish at the top of the food chain and microscopic forms such as bacteria, algae, and zooplankton at the bottom of the food chain. These fishfood organisms are restricted to relatively small areas of the streambed during at least a portion of their life cycle and, unlike fish, are not capable of moving quickly from one area to another to avoid adverse conditions. No two species of benthic organisms have the same tolerance to adverse water quality conditions. It is primarily for these reasons that benthic animal populations were chosen as the primary tool to biologically assess water quality conditions. The desirability of studying this biological parameter, in preference to others, is well documented in relevant literature (Gaufin and Tarzwell, 1952; Ingram and Mackenthun, 1966; Klemm, et al., 1990).

Benthic animals, being truly aquatic, are totally dependent upon the chemical and physical characteristics of their environment for survival and propagation. The characteristics of benthic populations, such as the variety and number of animals and species composition within a unit area, are reflective of prevailing, as well as past, water quality conditions. Any significant change in water quality conditions results in a corresponding change in benthic populations.

It is a general rule in water pollution ecology that a relatively healthy body of water supports a wide variety of organisms in which each kind of organism is represented by an equal number. In other words, no particular animal is predominant over any other in a biologically stable community. Although this rule of thumb, in the strictest sense, is seldom found in nature, it is nevertheless a valid guideline (Ellis, 1967).

Benthic sampling of large streams, lakes, and estuaries is especially difficult because of the variety of natural substrates encountered. Stable submerged objects such as logs, rocks, and weed beds attract a wide variety and number of organisms. It is obvious that any effort to collect quantitative samples of benthic animal populations from a unit area of logs or weed beds for comparative purposes between areas would be quite impossible. Stream bottoms consisting of mud, clay, or sand might possibly support a relatively large number, but only a small variety of organisms (Arthur and Horning, 1969). Therefore, artificial substrate samplers (Modified Hester-Dendy multiplate samplers) are used to collect representative samples of benthic invertebrate populations from the study area (Cairns, et al., 1971). These samplers are constructed of 0.125-in. (0.3-cm) tempered hardboard material with 3-in. (7.6-cm) round plates and 1-in. (2.5-cm) round spacers that have 5/8-in. holes drilled in the center (Fullner, 1971). Spacers separate the plates on a 0.25-in. (0.63-cm) diameter eyebolt, held in place by a nut at the top and bottom. A total of 14 large plates and 24 spacers are used in each sampler. The top nine plates are each separated by a single spacer. Two spacers separate plates 9 and 10, three spacers separate plates 11 and 12, and four spacers separate plates 13 and 14. The hardboard sampler is about 5.5-in. (14-cm) long, 3 in. (7.6 cm) in diameter, and weighs about 1.0 lb. (0.45 kg). The Hester-Dendy sampler exposes approximately 1160 cm^2 (.116 m^2) of surface area for the attachment of organisms (Klemm, et al., 1990).

Three modified Hester-Dendy multiplate samplers are suspended from galvanized electrical conduit pipe driven into the streambed, or attached to heavy-gage metal eyebolts screwed into submerged logs or wooden pilings at each station for one 28-day period. The samplers are situated approximately 15.2 cm (6 in.) above the streambed at a depth of approximately 0.9-m (3-ft.). To ensure quick location and retrieval of samplers, a nylon rope is connected to a shoreline tree or stake driven in the bank.

The location of the artificial substrate samplers in the vertical water column, instead of using surface floating platforms, is primarily to reduce the likelihood of tampering and vandalism without significantly sacrificing relevance toward measuring surface water characteristics. Following the submersion period, samplers are retrieved in wide-mouth plastic containers, preserved in a 10-percent formalin solution and transported to TAI Environmental Sciences, Mobile, Alabama for processing.

Prior to examination, benthic invertebrate samplers are rinsed of preservative through a #30 mesh sieve, sorted from debris in a white enamel tray with the aid of a desk model illuminated magnifier, and placed in tagged sample vials. Following identification and counting, samples are placed on blotting paper and weighed.

The samples are collected and examined for total number of species (kinds), total number of animals per unit area, total number of each species of animal per unit area (species composition), and total wet weight of organisms per unit area. Percent composition, by number and weight, of major taxonomic groups is also presented. The data are also calculated into species diversity numbers (Shannon-Weaver Index) (Appendix E). This measurement takes into account the total number of different species present and the proportion of each species within each aquatic community.

The average values of biological parameters, established for each sampling station, are derived from the three replicate samples collected. Values are considered acceptable and representative by SCS if the variance about their mean does not exceed 25-percent the coefficient of variance (Cairns, et al., 1971). In "natural" areas, differences in the distribution of benthic invertebrates and other forms of life can vary greatly. Therefore, in assessing the effect of human-induced alterations, the point at which observed changes can be termed 'significant' must be determined. To accomplish this objective, the average value and coefficient of variance (Appendix E) are determined for each parameter at each station. In accordance with FDEP protocol, it has been determined that a significant change in parameter values occurs when the natural range of variance is exceeded by more than plus or minus 25 percent (Appendix D). The accuracy of this data evaluation technique is limited only by the degree of sampling accuracy attained through replicate sampling.

Environmental Monitoring Program. Sixteen sampling stations have been established on the Apalachicola River. Eight of these stations (AR1R, AR1L, AR2R, AR2L, AR3R, AR3L, AR4R, and AR4L) are control stations, and eight of these stations are considered "test" stations. Several of these "test" stations are clearly out of any possible influence of Plant Scholz (AR5R, AR9R, and, AR9L).

Biological Integrity Test. To conduct the annual tests, three sampling stations (one more than permit required) have been established in the Apalachicola River (AR4R, AR4L, and AR5R). Two of these stations (AR4R and AR4L) are control stations, and one (AR5R) is a "test" station. The two control stations are located just upstream from the confluence of the Plant Scholz cooling water discharge canal, and the one test station is located immediately downstream.

Parameter values and data printouts were obtained by using an IBM compatible computer program. The purposes of the Benthic Applications Program are as follows:

- Produce a table of macroscopic benthic invertebrates collected from artificial substrates. Input consists of orders, species, wet weights per order, and number per species by samples per station. Output is the same as input plus total number of animals, sum number of animals, percent coefficient of variation for number of animals, total number of species, sum number of species, percent coefficient of variation for number of species, species diversity, sum species diversity, percent coefficient of variation for species diversity, total wet weight, sum wet weight, percent coefficient of variation for wet weight, percent by number per order, percent by weight per order, sum percent by number per order, sum percent by weight per order, percent by number per species, and percent by weight per species.

- Summary table for macroscopic benthic invertebrates collected from artificial substrates. Output consists of sum total number, sum total wet weight, and sum species diversity by sampling station, and dates.

Laboratory Effluent Toxicity Testing

Aquatic bioassays are used to establish the character and strength of an effluent by measuring its effect upon laboratory test organisms. There are two basic types of tests:

- Acute toxicity test, which measures short-term exposure effects but is normally not sensitive to lower concentration exposures, and

- Chronic toxicity test, which measures long-term exposure effects and is sensitive to relatively low concentration exposures.

Acute toxicity tests are used to determine the effluent concentration, expressed as percent volume, which is lethal to 50 percent of organisms within a prescribed period of time (LC50). Chronic tests measure more subtle parameters such as growth and reproduction over a relatively longer exposure period at lower effluent concentrations.

Beginning in 1993, in compliance with the State Industrial Wastewater Permit issued to Gulf Power Company's Plant Scholz, a series of 96-hour static, acute, screening toxicity tests were conducted annually on samples of cooling water effluent. The sampling and test procedures utilized conform to FDEP protocols.

Four grab samples of cooling water effluent, one taken every six hours during a 24-hour period, are delivered from Gulf Power Company's Plant Scholz to TRAC Laboratories in Pensacola, Florida. Each sample is contained in a 3.8-liter plastic jug. The samples are brought to room temperature, then immediately characterized for temperature, pH, dissolved oxygen concentration, conductivity, hardness, and alkalinity. Two test organisms, Ceriodaphnia dubia and the bannerfin shiner are used during the toxicity tests.

The dilution/control water used in the Ceriodaphnia dubia test is Dilute Mineral Water (DMW), and the dilution/control water used in the bannerfin shiner test is Reconstituted Freshwater (RCF). Test concentrations for all tests are 100% samples and an RCF control or DMW control. Bannerfin shiners are obtained from a commercial supplier. Test animals are seven days old at the initiation of the tests. The bannerfin shiners are fed brine shrimp nauplii daily until the day of the tests. Daphnids, Ceriodaphnia dubia, are obtained from TRAC culture facilities. The test animals (neonates) are less than 24 hours old at the initiation of the tests. The neonates are released from adults previously acclimated to the dilution/control water.

Methods for the static tests are based on "Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms" (EPA/600/4-90/027) and TRAC's Generic Quality Assurance Plan. All tests are conducted in an environmental chamber in which the temperature is maintained at 24.0-26.0°C. Test aquaria for the bannerfin shiners are 0.6L glass beakers. The test aquaria for the daphnids are 30-ml plastic cups. The effluent volume used is 0.5L for the bannerfin shiner and 20 ml for the Ceriodaphnia dubia. Test treatments for all tests are duplicated with 10 animals per container, resulting in 20 animals per treatment. The test duration is 96 hours, with a renewal at 48 hours. Daily observations are made in all tests for survival. Daily measurements are taken in the bannerfin shiner tests for DO, pH, and temperature. Reference toxicant tests using Sodium Dodecyl Sulfate (SDS) are conducted with each test species from the respective population (Tackett, et al., 1993).

Laboratory Sediment Toxicity Testing

In 1999, in an attempt to further define the impacts of river sediment within the study area, acute sediment toxicity testing was added to the Plant Scholz Environmental Monitoring Program. Two Apalachicola river sediment samples were collected from stations AR4R and AR5R to assess possible acute effects to Hyalella azteca. The Samples were then delivered, under chain of custody, to TRAC Laboratories in Pensacola, FL. Each sediment sample was contained in a 3.8-liter plastic jug. Control and overlying water consisted of reconstituted freshwater (RCF) with a hardness of approximately 100 mg/L $CaCO_3$. Test animals (Hyalella azteca) were obtained from a local supplier and were 14 days old at test initiation.

Methods for the static tests are based on "Guide for Conducting 10-day Static Sediment Toxicity Tests with Freshwater Invertebrates" (ASTM E 1383-93) and TRAC's Generic Quality Assurance Plan. All tests are conducted in an environmental chamber in which the temperature is maintained at 24.0-26.0° C. Sediment tests were conducted in 0.5 liter glass jars containing 100ml of sediment and 175 ml of overlying water. Each exposure concentration consisted of five replicates of ten organisms each, giving a total of 50 organisms per sediment exposure. The test duration was ten days. Daily observations were made in all tests for pH, DO and temperature with survival measured at the end of the test period.

4. RESULTS AND DISCUSSION

Physical and Chemical Data

Stream Bottom Profiles and Daily Stream Flow Records

On July 22, 1993, eight cross-sectional stream bottom profiles were made in various areas of the Apalachicola River, with a portable recording Raytheon Model DE-719 Fathometer Depth Sounder. Stream bottom profiles were taken to aid in updating the physical description of the study area.

Stream bottom profile charts for each of eight locations are shown in Appendix C. Stream bottom gradients from shoreline to mid-channel were found to be relatively gradual in the Apalachicola River. Mid-channel depths and widths within the study area were found to range from 9-21 feet, and 180-260 yards, respectively.

Daily stream flow records for the Apalachicola River near Chattahoochee, Florida, were obtained from the Water Resources Division of the U. S. Geological Survey office in Tallahassee, Florida. From these records, the average monthly stream discharge data were calculated and presented in Table 4-1. Flow data are also illustrated in Figure 4-1. More detailed flow data for individual study years is also illustrated in Appendix F.

Continuous Water Temperature Recordings

Since 1993, surface water temperatures have been recorded annually at ten to fifteen minute intervals for 30 consecutive days during each summer sampling period through the use of Ryan TempMentors or Onset temperature logging devices. The results are detailed in Table 4-3. A brief examination of the temperature data presented on Table 4-3 shows that, in general, relatively uniform water temperatures exist in the study area. A general summary of temperature conditions, in degrees Celsius, found in the study area is as follows:

Table 4-2 Summary of Continuous Water Temperature Measurements

Year	Average Temperature (Range)
1993	29.80°C (27.44°C-30.95°C)
1994	26.17°C (24.00°C-26.86°C)
1995	29.20°C (26.81°C-30.70°C)
1996	28.54°C (26.86°C-30.22°C)
1997	28.65°C (25.53°C-29.44°C)
1998	29.46°C (28.95°C-30.70°C)
1999	27.93°C (27.34°C-28.70°C)
2000	29.21°C (28.75°C-29.65°C)
2001	28.95°C (28.67°C-30.03°C)
2002	28.92°C (28.48°C-29.70°C)
2003	27.74°C (27.56°C-28.00°C)

TABLE 4-1

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

AVERAGE MONTHLY STREAM DISCHARGE (ft^3/s) IN THE APALACHICOLA RIVER

FROM 1992

Readings From USGS Stream Gaging Station 02358000 Located at Chattahoochee, Florida

DATE	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT
1992-1993	13500	31790	43530	47710	33640	52050	39770	21100	12390	11810	11050	9566
1993-1994	9720	13270	15220	17920	33200	34750	27340	15860	14630	87700	31950	25440
1994-1995	29670	21480	33110	27270	56760	44130	20390	15120	14250	11670	11470	10060
1995-1996	15680	22250	21460	27740	51290	55170	30970	20810	14375 (1)	13860 (1)	11860	12100
1996-1997(2)	14263	12270	16787	28878	42560	34190	18098	24996	47767	17662	14060	10704
1997-1998	11480	19660	51660	49810	67310	90330	44750	28840	13010	13200	12450	14560
1998-1999(2)	18641	15897	11511	15884	22679	17281	10885	8807	11040	12035	10874	6548
1999-2000(2)	5727	6248	7582	11546	16648	14544	17330	8413	4826	5117	5806	5889
2000-2001(2)	5719	6432	10655	15258	12505	54019	29803	11795	18374	11619	10431	7540
2001-2002	6130	5975	7337	9036	13771	14771	13892	8326	6578	6084	5735	6991
2002-2003	8206	17304	20129	15858	23761	48703	32947	43039	37117	35358	25697	13971

(1) Data for June and July of 1996 was missing for five days of each month.
Average stream discharge figures are an estimate using remaining 25 days of the months.

(2) Provisional data used.
Overall averages for the days of the months available were calculated.

FIGURE 4-1
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM
From 1993 Average Daily Stream Flows (CFS) in the Apalachacola River (From USGS Stream Gauging Station 02358000 near Chattahoochee, Florida)

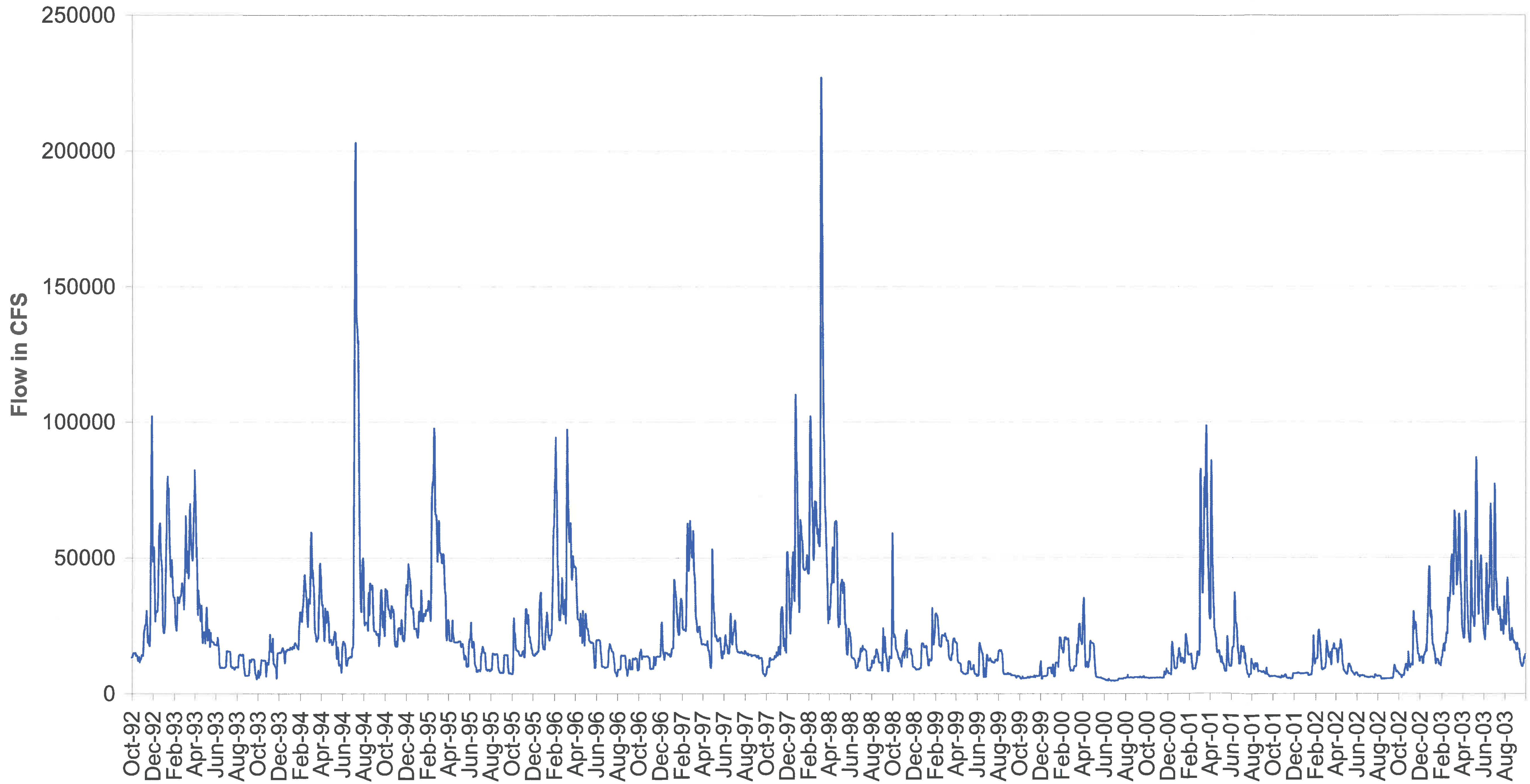


TABLE 4-3
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

SUMMARY OF CONTINUOUS WATER TEMPERATURE MEASUREMENTS IN THE APALACHICOLA RIVER

FROM 1993
Average Water Temperature, °C & °F

YEAR(2)	AR1L		AR1R		AR2L		AR2R		AR3L		AR3R		AR4L		AR4R	
	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
1993	30.07	86.12	29.96	85.93	29.54	85.17	29.88	85.79	29.74	85.53	29.90	85.82	27.44	81.39	30.01	86.02
1994	26.33	79.40	26.39	79.50	26.22	79.20	23.94	75.10	26.72	80.10	26.39	79.50	26.44	79.60	26.86	80.35
1995	29.36	84.85	29.05	84.29	28.77	83.79	26.81	80.26	29.38	84.88	29.21	84.58	29.29	84.72	29.45	85.01
1996	29.39	84.90	28.49	83.28	28.14	82.65	26.81	80.26	29.22	84.60	29.22	84.60	Lost	Lost	29.26	84.67
1997	28.97	84.15	28.67	83.61	28.83	83.89	28.65	83.57	28.74	83.73	29.01	84.22	29.08	84.34	28.96	84.13
1998	29.48	85.06	29.41	84.94	29.14	84.45	29.30	84.74	Lost	Lost	29.28	84.70	29.33	84.79	29.50	85.10
1999	28.00	82.40	27.98	82.36	27.53	81.55	27.88	82.18	27.84	82.11	27.87	82.17	27.81	82.06	28.02	82.44
2000	29.29	84.73	29.22	84.60	28.75	83.75	29.38	84.88	29.04	84.27	29.13	84.43	29.10	84.38	28.87	83.97
2001	29.09	84.36	28.72	83.70	28.78	83.81	28.79	83.82	28.67	83.60	28.85	83.93	29.05	84.29	28.89	84.00
2002	29.08	84.34	28.71	83.67	28.60	83.48	28.81	83.86	28.57	83.43	28.89	84.00	28.97	84.15	28.89	84.01
2003	27.65	81.77	27.77	81.99	27.79	82.02	27.65	81.77	27.85	82.13	Lost	Lost	27.81	82.06	27.60	81.68

YEAR(2)	AR5L		AR5R		AR6L		AR6R		AR7L		AR7R		AR8L		AR8R	
	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
1993	29.82	85.68	30.95	87.71	29.68	85.43	Lost	Lost	29.99	85.98	30.27	86.49	29.85	85.73	29.91	85.83
1994	26.39	79.50	26.12	79.02	26.61	79.90	26.61	79.90	26.61	79.90	26.61	79.90	26.61	79.90	23.94	75.10
1995	28.82	83.88	30.70	87.26	29.32	84.78	29.79	85.62	Lost	Lost	29.62	85.32	29.05	84.29	29.42	84.96
1996	Lost	Lost	30.22	86.40	Lost	Lost	Lost	Lost	29.44	85.00	29.24	84.63	29.15	84.47	Lost	Lost
1997	28.85	83.93	29.44	84.99	28.57	83.43	28.92	84.06	28.74	83.73	28.65	83.57	28.32	82.98	29.06	84.31
1998	29.22	84.60	30.70	87.26	29.31	84.76	29.49	85.08	29.53	85.15	29.58	85.24	28.95	84.11	29.67	85.41
1999	27.74	81.93	28.70	83.66	27.82	82.08	28.22	82.80	28.04	82.47	28.01	82.42	27.34	81.21	28.18	82.72
2000	29.00	84.20	29.50	85.10	29.23	84.61	29.52	85.14	29.37	84.87	29.44	84.99	28.92	84.06	29.65	85.37
2001	28.95	84.11	30.03	86.06	28.77	83.79	29.23	84.62	28.84	83.91	28.98	84.17	28.33	83.00	28.96	84.13
2002	28.85	83.93	29.70	85.46	28.83	83.89	29.31	84.75	28.84	83.92	29.09	84.36	28.48	83.26	29.06	84.30
2003	27.72	81.90	28.00	82.40	27.69	81.84	Lost	Lost	27.75	81.95	27.78	82.00	27.56	81.61	27.75	81.95

As would be expected, water temperatures remain relatively constant throughout the study area; from Highway 90 bridge, near Jim Woodruff Dam, downstream past I-10 bridge. Plant Scholz has been on-line throughout much of the study periods. Only slight increases in water temperatures has been observed just downstream of the confluence of the Plant Scholz cooling water discharge canal at station AR5R (Figure 4-2). Temperature differentials, just upstream (AR4R) and downstream (AR5R) from the Plant Scholz cooling water canal, appear to be negligible, and are as follows:

Table 4-4 Upstream and Downstream Water Temperatures and Differentials

Year	AR4R	AR5R	Temperature Differential
1993	30.01°C	30.95°C	+0.94°C
1994	26.86°C	26.12°C	-0.74°C
1995	29.45°C	30.70°C	+1.25°C
1996	29.26°C	30.22°C	+0.96°C
1997	28.96°C	29.44°C	+0.48°C
1998	29.50°C	30.70°C	+1.20°C
1999	28.02°C	28.70°C	+0.68°C
2000	28.87°C	29.50°C	+0.63°C
2001	28.89°C	28.95°C	+0.06°C
2002	28.89°C	29.70°C	+0.81°C
2003	27.60°C	28.00°C	+0.40°C

Chemical Analysis

Routine Surface Water Chemistry

Composite surface water grab samples are collected annually from a 100 square foot sampling area during each four-week sampling period per year. When the annual environmental monitoring program began in 1993, 16 stations were established on the Apalachicola River.

Samples collected from each of the stations were analyzed for 14 basic parameters: temperature, dissolved oxygen, percent dissolved oxygen saturation, pH, alkalinity (as $CaCO_3$), hardness (as $CaCO_3$), sulfate, turbidity, chloride, conductivity, total nitrogen, total phosphorus, total organic carbon, and total suspended solids. The results of these analyses are summarized in Table 4-5. It should be noted that the data in these tables are representative only for that point in time when the samples were collected. Copies of the laboratory datasheets are presented in Appendix G. Data quality is dependent upon both human impacts and natural variables such as season, sunlight, and stream flow. Temperature, dissolved oxygen, and pH values naturally fluctuate to some extent from hour to hour and from day to day in natural waters (Neel, Nicholson, and Hirsch, 1963).

An examination of the Summary of Routine Surface Water Analysis on Table 4-5 shows the following range of parameter values found in the study area since 1993:

Figure 4-2
Gulf Power Company - Plant Scholz Environmental Monitoring Program
High/Low/Average Water Temperature Measurements
1998

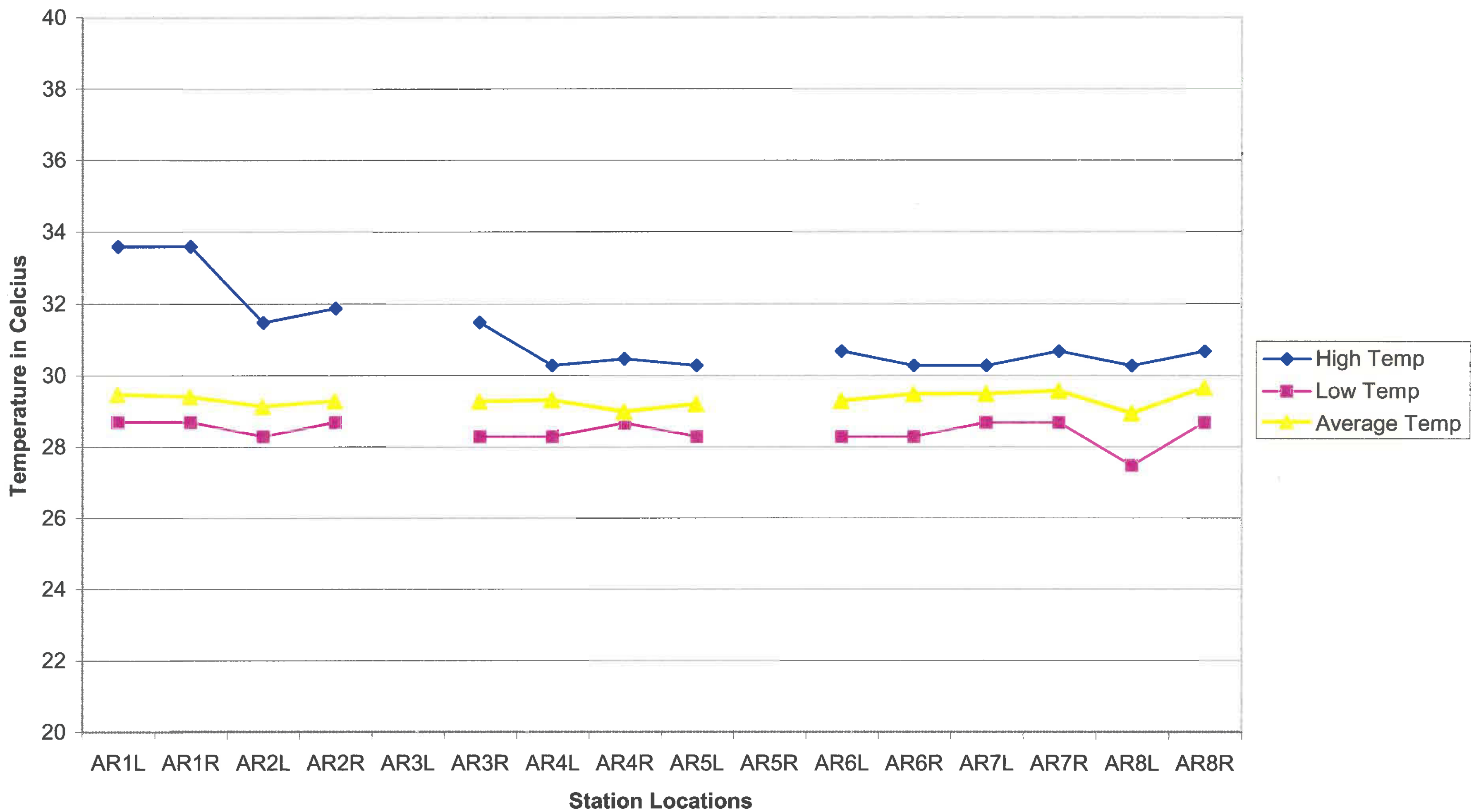


Figure 4-2
Gulf Power Company - Plant Scholz Environmental Monitoring Program
High/Low/Average Water Temperature Measurements
1999

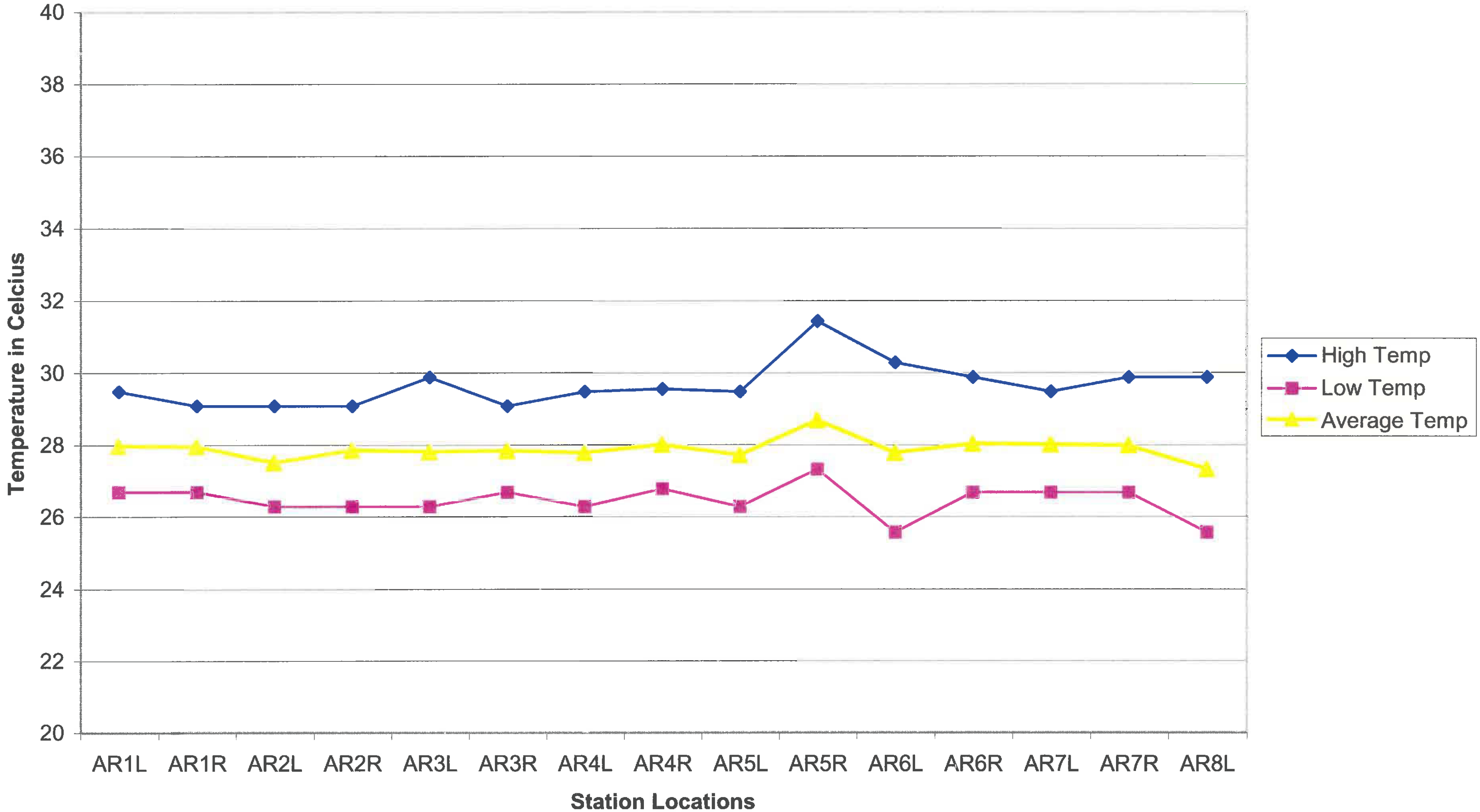


Figure 4-2
Gulf Power Company - Plant Scholz Environmental Monitoring Program
High/Low/Average Water Temperature Measurements
2000

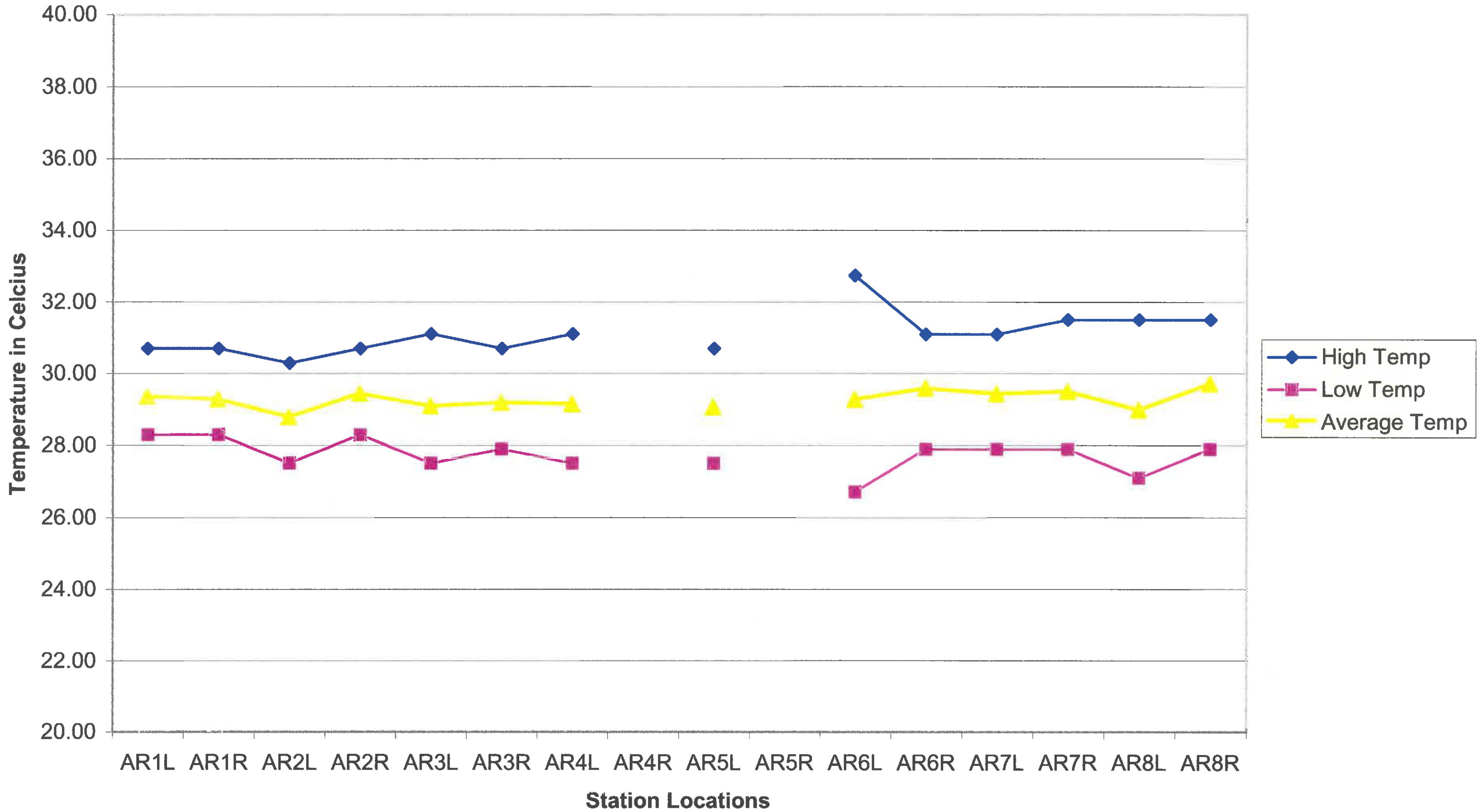


Figure 4-2
Gulf Power Company - Plant Scholz Environmental Monitoring Program
High/Low/Average Water Temperature Measurements
2001

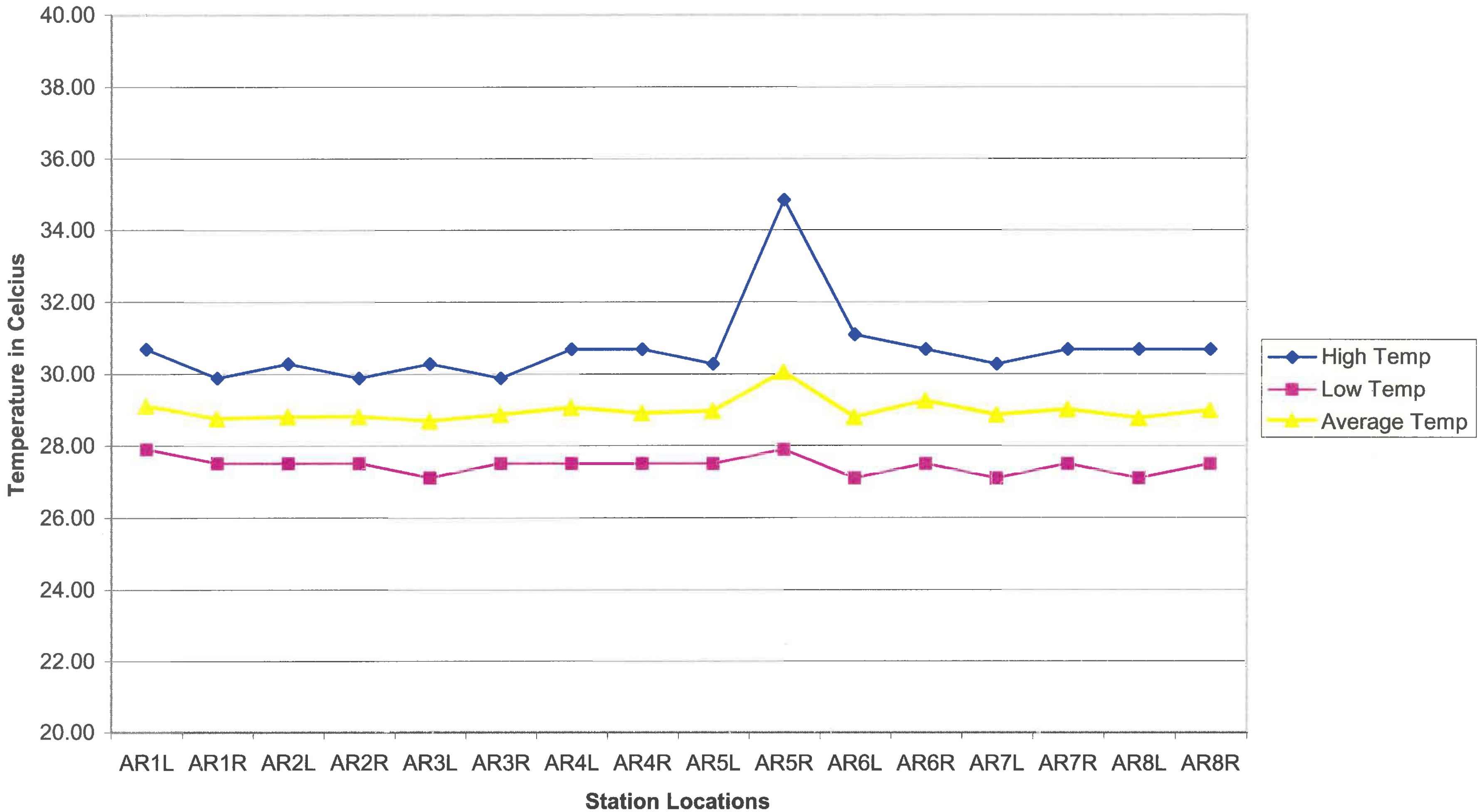


Figure 4-2
Gulf Power Company - Plant Scholz Environmental Monitoring Program
High/Low/Average Water Temperature Measurements
2002

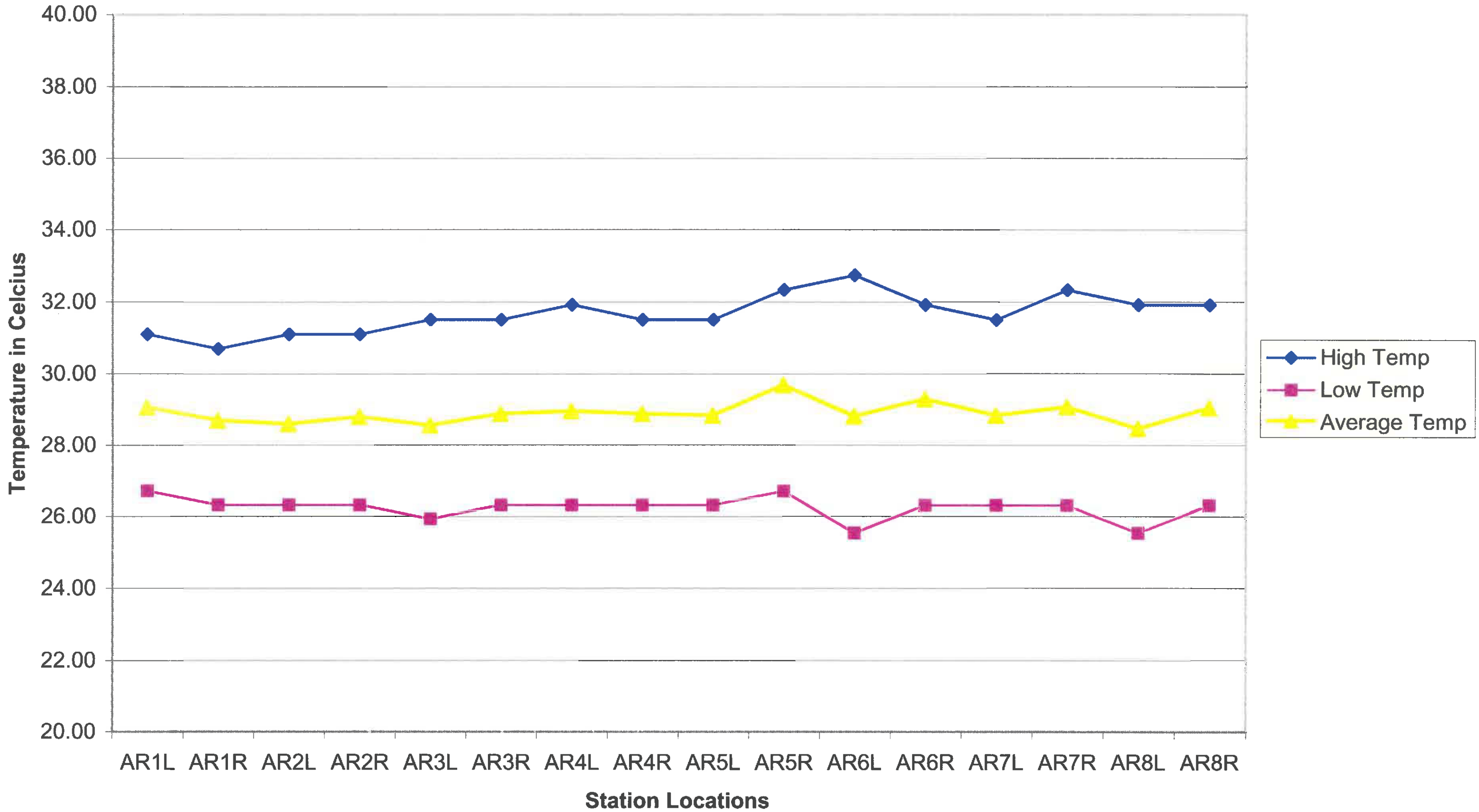


Figure 4-2
Gulf Power Company - Plant Scholz Environmental Monitoring Program
High/Low/Average Water Temperature Measurements
2003

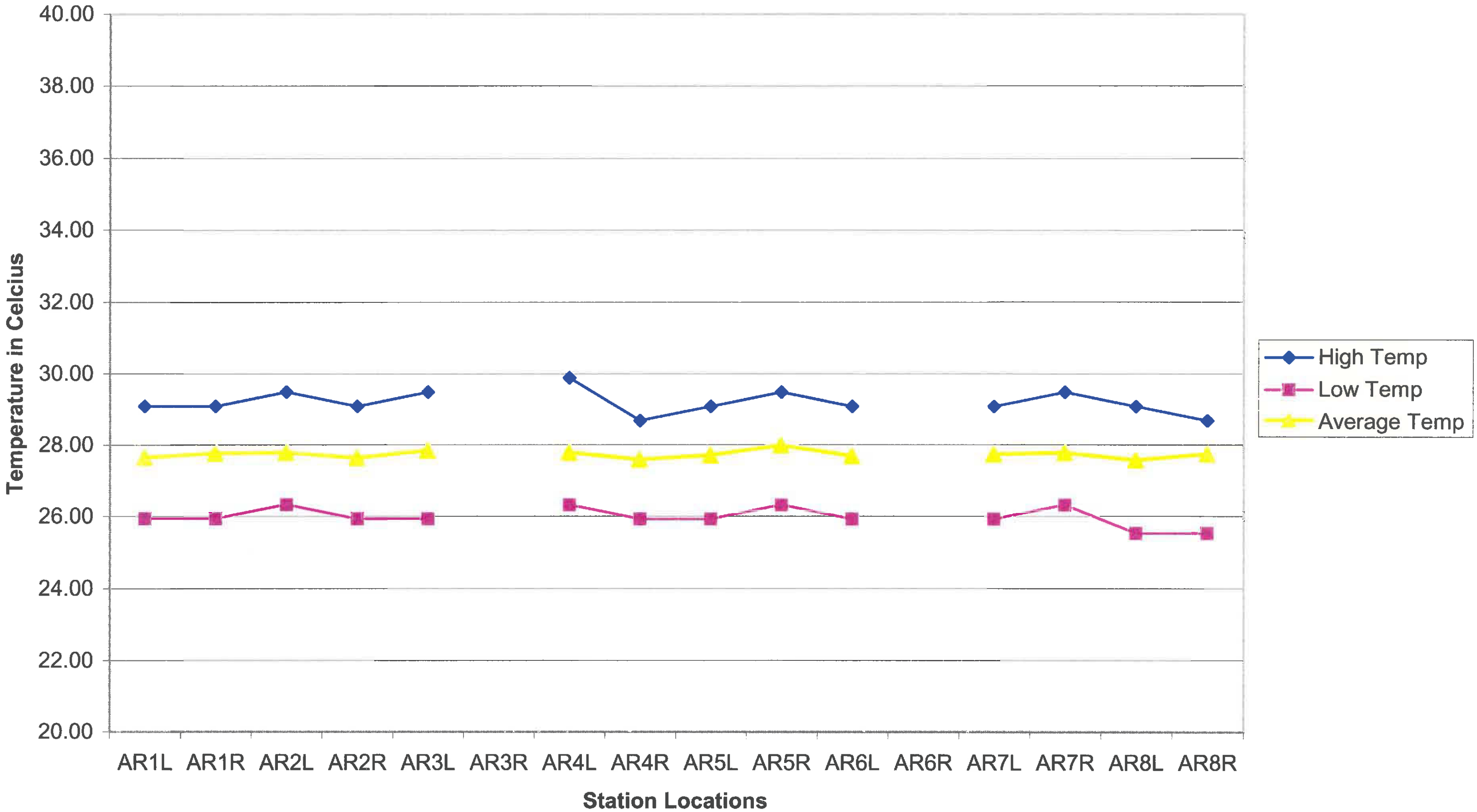


TABLE 4-5

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

ROUTINE SURFACE WATER ANALYSES

FROM 1993

Average Annual Values; Sampling event 1 - sampling event 2 (1993 to present)

Parameters	Year	Date	AR1L		AR1R		AR2L		AR2R		AR3L		AR3R		AR4L		AR4R		AR5L		AR5R		AR6L		AR6R		AR7L		AR7R		AR8L		AR8R	
	1993	7/22 -8/21	9:20	12:55	9:25	12:59	10:07	12:17	10:12	12:20	10:43	12:36	10:48	12:33	11:11	12:51	11:16	12:48	11:35	13:02	11:40	13:06	12:15	13:23	12:20	13:20	13:10	13:38	13:15	13:35	13:37	13:48	13:45	13:45
	1994	7/28-8/28	8:43	9:05	8:47	10:01	9:00	9:35	9:04	10:20	9:15	10:25	9:24	10:40	9:30	11:20	9:35	11:00	9:40	11:45	9:45	11:30	9:53	12:10	10:00	12:00	10:05	12:51	10:08	12:45	10:15	13:05	10:25	13:20
Time of	1995	7/14-8/16	11:00	11:30	11:05	11:15	11:10	12:05	11:15	11:45	11:20	12:40	11:25	12:25	11:30	13:15	11:35	12:55	11:45	13:35	11:40	13:55	11:50	14:35	11:55	14:15	12:00	13:15	12:05	14:50	12:10	13:55	12:15	13:35
Collection	1996	7/15-8/18	10:50	11:20	10:55	11:05	11:00	11:55	11:05	11:35	11:10	12:30	11:15	12:15	11:20	13:15	11:25	12:45	11:30	13:45	11:35	13:25	11:40	14:25	11:45	14:05	11:50	13:05	11:55	14:40	12:00	13:45	12:05	13:25
	1997	7/23-8/24	9:09	9:40	9:06	9:24	9:22	10:23	9:18	10:15	9:40	10:45	9:31	10:34	9:55	11:35	9:50	11:20	10:13	11:40	10:06	11:50	10:23	12:04	10:22	11:57	10:42	12:30	10:40	12:15	10:59	12:48	10:52	12:36
	1998	7/21-8/21	10:16	10:25	10:04	10:00	10:41	10:55	10:33	10:40	11:03	11:15	10:54	10:59	11:32	11:46	11:22	11:33	12:01	12:10	11:44	11:55	13:46	13:45	12:33	12:25	13:31	13:49	13:23	13:34	13:09	-	13:03	-
	1999	6/24-7/20	10:08	9:18	9:45	9:28	10:40	9:42	10:26	9:47	11:45	10:03	11:00	10:07	12:09	10:27	11:55	10:34	14:13	10:52	13:30	10:45	14:45	11:39	14:38	11:45	15:02	12:04	14:50	12:10	15:22	13:07	15:10	13:15
	2000	6/24-7/26	10:05	8:45	9:50	8:34	11:15	8:55	10:20	8:50	11:40	9:05	11:25	9:00	12:10	9:13	12:00	9:10	12:35	9:26	12:25	9:18	13:30	9:34	13:00	9:29	15:00	9:46	14:45	9:41	14:00	9:56	13:45	9:49
	2001	6/29-7/27	12:45	9:04	12:55	8:53	12:20	9:27	12:30	9:22	11:58	9:56	12:07	9:42	11:21	10:36	11:33	10:08	10:57	10:35	11:07	11:09	10:31	11:31	10:42	11:18	10:06	12:52	10:16	12:46	8:40	13:22	9:53	13:50
	2002	6/26-7/24	9:01	10:26	8:46	10:20	9:21	10:37	9:12	10:33	9:36	10:47	9:28	10:44	9:54	10:56	9:50	10:53	10:15	11:03	10:01	10:58	10:36	11:20	10:27	11:11	11:01	11:31	10:52	11:27	11:15	11:40	11:07	11:37
	2003	6/25-7/20	8:22	9:07	8:05	9:02	8:56	9:22	8:37	9:16	9:21	9:28	9:05	9:25	10:02	9:35	9:32	9:32	10:56	9:44	10:11	9:40	10:51	9:56	10:38	9:51	11:16	10:06	11:03	10:02	11:38	10:15	11:24	10:12
	1993	7/22 -8/21	29.98	30.92	29.47	30.26	29.92	30.53	29.84	30.4	29.96	30.71	29.78	30.53	30.00	30.69	29.78	30.37	30.07	30.65	31.63	31.85	30.17	30.44	30.53	30.80	30.29	30.69	30.34	30.72	30.29	30.70	30.47	30.92
	1994	7/28-8/28	26.25	27.56	26.23	27.60	26.23	27.43	26.25	27.45	26.15	27.41	26.23	27.45	26.26	27.43	26.26	27.48	26.28	27.43	26.30	27.50	26.30	27.41	26.43	27.50	26.36	27.43	26.45	27.50	26.38	27.45	26.42	27.47
Temperature	1995	7/14-8/16	30.19	30.37	30.05	30.09	29.96	30.27	30.13	30.15	30.15	30.51	30.00	30.21	30.30	30.31	30.41	30.47	30.21	30.31	30.54	31.58	30.44	30.47	30.28	30.76	30.29	30.34	30.47	30.52	30.07	30.42	30.54	30.71
(°C)	1996	7/15-8/18	29.05	29.78	29.09	29.84	28.81	29.72	29.07	29.84	28.29	29.71	29.13	29.80	28.91	29.72	29.28	29.82	29.07	29.72	30.29	33.27	28.89	29.74	29.34	29.86	29.03	29.78	29.32	29.94	29.68	29.78	29.09	29.92
	1997	7/23-8/24	28.69	28.83	28.55	28.79	28.57	28.61	28.87	28.91	28.40	28.55	28.65	28.89	28.63	28.79	28.87	30.25	28.57	28.81	31.67	34.71	28.59	28.63	28.97	29.05	28.65	28.89	28.87	29.01	28.10	28.36	28.89	29.09
	1998	7/21-8/21	29.97	29.29	29.69	29.19	29.69	29.15	29.89	29.25	29.95	29.21	29.89	29.21	29.91	29.19	30.01	29.25	29.91	29.23	34.17	36.32	29.75	29.29	30.23	29.55	29.91	29.39	29.91	29.45	29.77	-	30.07	-
	1999	6/24-7/20	27.82	29.38	27.80	29.13	27.70	28.98	27.87	29.22	27.92	29.10	27.87	29.3	27.97	29.19	28.03	29.48	28.03	29.28	31.40	34.60	28.53	29.53	28.45	29.97	28.08	29.57	28.42	29.98	27.84	29.8	28.31	30.1
	2000	6/24-7/26	28.96	29.31	28.78	29.11	28.59	28.80	28.93	29.22	29.23	28.75	29.23	29.13	29.09	28.82	29.15	29.06	29.04	28.88	34.25	30.37	31.09	28.92	29.79	29.32	29.88	28.96	30.15	29.18	29.27	28.51	29.73	29.16
	2001	6/29-7/27	28.62	29.20	28.44	29.00	28.71	28.85	28.49	29.08	28.65	28.94	28.35	29.08	28.38	28.92	28.38	29.08	28.65	30.93	29.59	29.07	27.87	29.41	28.37	29.46	27.99	29.29	28.21	29.53	27.64	28.93	28.23	29.35
	2002	6/26-7/24	26.9	30.60	26.68	30.34	26.57	30.18	26.85	30.47	26.48	30.21	26.70	30.55	26.68	30.13	26.71	30.41	26.41	30.18	27.84	36.61	26.53	30.38	26.88	30.78	26.63	30.39	26.73	30.72	26.08	30.00	26.61	30.61
	2003	6/25-7/20	28.23	28.10	28.54	28.06	28.24	28.05	28.54	28.12	28.20	27.86	28.26	28.10	28.30	28.05	28.30	28.12	28.33	28.07	34.45	31.11	28.36	28.08	28.49	28.21	28.38	28.13	28.42	28.19	28.03	28.02	28.49	28.23
	1993	7/22 -8/21	6.08	6.61	5.92	6.32	5.48	6.07	5.45	6.01	5.40	6.02	5.42	6.06	5.13	5.90	5.05	5.71	4.98	5.96	4.83	5.74	4.85	5.51	4.92	5.85	4.72	5.35	5.57	5.81	4.44	5.61	4.37	5.27
	1994	7/28-8/28	7.12	7.56	8.79	9.08	7.06	7.59	8.89	9.05	6.49	7.73	8.37	8.52	7.13	8.28	8.32	8.52	7.03	8.04	8.33	8.46	6.96	7.81	8.24	8.27	7.24	7.92	8.19	8.29	7.16	7.75	7.66	7.95
Dissolved	1995	7/14-8/16	7.37	7.60	6.91	7.02	7.08	7.08	6.55	6.75	6.66	6.75	6.67	6.75	6.43	6.50	6.09	6.40	6.29	6.57	6.14	6.50	6.21	6.51	6.24	6.50	6.07	6.43	5.93	6.26	6.01	6.50	5.88	6.02
Oxygen	1996	7/15-8/18	6.13	7.24	7.13	7.50	6.51	6.98	6.66	6.55	6.50	6.65	6.44	6.71	6.30	7.09	6.32	6.46	6.37	6.71	6.51	6.74	6.22	7.03	6.44	6.44	6.21	6.33	6.06	6.19	6.04	6.32	6.08	6.38
(mg/l)	1997	7/23-8/24	6.10	6.90	6.18	6.58	5.99	6.20	5.92	6.61	5.57	6.01	6.07	6.43	5.38	6.01	5.47	5.95	5.45	5.68	5.84	6.18	5.33	5.86	5.90	6.28	5.50	5.84	5.47	5.92	5.63	5.91	5.39	5.92
	1998	7/21-8/21	6.19	6.75	6.51	6.36	6.42	6.63	6.37	6.15	6.22	6.20	6.39	6.1	6.08	6.04	6.11	5.76	6.28	6.09	5.74	5.80	5.92	5.87	5.63	5.74	5.92	5.57	6.03	5.84	6.26	-	6.23	-
	1999	6/24-7/20	9.65	10.35	9.60	9.40	8.82	8.76	9.08	8.77	8.70	8.04	8.85	8.81	8.39	7.59	8.65	8.42	8.76	8.35	8.34	7.77	8.72	6.84	8.77	7.96	8.51	6.97	8.48	7.91	8.21	8.53	8.41	8.47
	2000	6/24-7/26	7.98	10.25	7.77	9.86	7.87	9.65	7.49	9.77	7.05	10.05	7.37	9.67	6.31	10.88	7.04	10.78	7.42	10.48	7.10	10.73	7.90	10.37	6.94	11.02	7.59	10.51	7.42	10.18	7.30	10.23	6.94	10.14
	2001	6/29-7/27	6.35	7.02	6.07	6.75	5.95	5.87	6.30	5.87	5.89	5.15	6.24	5.24	5.88	4.74	5.97	5.14	5.84	4.03	5.71	4.92	5.88	5.06	5.53	4.97	5.22	5.24	5.47	5.26	5.26	5.64	5.82	5.23
	2002	6/26-7/24	6.44	5.77	6.79	6.56	6.29	5.49	6.36	6.10	6.55	4.95	6.24	5.72	6.15	5.00	5.92	5.23	5.59	5.00	6.18	5.86	5.71	5.21	5.97	5.38	5.77	5.22	5.92	5.44	6.37	5.09	6.11	5.46
	2003	6/25-7/20	8.75	6.90	9.56	8.94	7.61	6.48	9.00	8.52	7.21	6.48	8.72	7.94	7.65	6.69	8.56	7.87	7.89	6.74	7.65	7.43	7.8	6.58	8.39	7.71	8.07	6.98	8.34	7.53	7.33	6.71	8.23	7.43
	1993	7/22 -8/21	82.9	90.3	78.5	86.6	73.7	82.9	71.6	80.9	72.8	82.0	73.7	83.5	68.7	80.3	66.6	77.6	66.9	80.2	65.4	78.2	65.1	75.0	67.3	79.6	63.6	73.0	64.8	75.8	60.2	76.3	59.5	72.2
Percent	1994	7/28-8/28	88.9	96.3	114.2	116.8	87.7	95.5	110.8	113.7	81.6	97.0	104.6	106.0	87.4	103.3	102.5	107.8	86.9	92.4	102.7	108.6	85.8	98.1	101.8	107.1	88.9	99.8	102.2	108.6	91.5	97.6	99.2	101.2
Dissolved	1995	7/14-8/16	96.8	101.3	91.8	92.8	93.0	94.1	87.1	89.1	88.8	88.9	88.5	88.8	85.4	85.9	81.0	85.2	83.7	86.3	82.1	87.8	82.7	86.0	83.0	86.8	80.9	84.8	79.1	83.1	80.1	84.7	78.4	79.8
Oxygen	1996	7/15-8/18	75.7	95.8	92.4	95.3	83.7	91.5	85.4	85.7	83.0	87.3	83.8	87.0	83.5	91.5	80.9	84.4	83.9	86.1	85.1	93.8	81.7	89.8	83.4	83.5	80.4	80.7	79.3	79.6	77.9	81.8	78.5	78.8
Saturation	1997	7/23-8/24	78.7	89.0	79.6	84.0	77.4	79.9	76.7	85.1	71.9	77.2	77.4	83.6	69.6	76.9	74.9	75.9	70.2	73.3	77.6	83.7	67.9	75.7	76.6	81.8	71.6	75.6	71.4	79.5	72.3	75.6	70.6	76.5
	1998	7/21-8/21	82.7	88.0	85.5	83.1	84.4	86.0	84.5	80.0	81.8	80.9	84.4	79.0	81.1	78.7	79.2	75.4	83.0	79.5	79.0	84.0	77.8	77.0	74.4	75.0	77.7	75.0	79.9	76.7	82.4	-	82.2	-
	1999	6/24-7/20	122.8	135.8	122.1	123.1	112.2	114.0	115.9	114.5	111.1	104.7	112.9	115.2	107.2	99.1	110.7	110.3	112.1	109.1	113.2	113.7	112.4	89.6	112.8	105.1	108.9	91.4	109.2	104.6	104.7	112.8	107.9	112.4
	2000	6/24-7/26	103.4	130.8	100.7	127.4	101.0	129.1	76.6	127.3	91.5	124.3	95.5	127.2	88.8	143.6	91.6	136.7	95.4	143.8	98.9	143.3	106.3	138.2	91.2	150.4	98.9	140.0	96.9	137.6	95.0	133.4	91.0	126.1
	2001	6/29-7/27	82.1	91.6	78.1	87.7	77.0	75.8	80.1	76.4	75.7	66.6	80.2	68.3	75.5	61.5	75.3	66.7	75.5	65.1	75.1	64.1	75.0	66.8	74.1	65.2	66.5	68.5	70.1	68.9	66.6	73.2	78.4	68.4
	2002	6/26-7/24	81.9	77.2	84.5	87.4	77.0	75.0	79.4	83.7	77.6	75.8	77.6	78.1	79.6	66.3	74.0	69.9	70.0	66.4	78.1	88.6	71.2	70.4	74.1	72.7	73.5	70.5	75.1	74.3	78.6	67.8	76.9	75.0
	2003	6/25-7/20	112.4	87.9	123.2	114.6	97.6	83.2	116.1	109.2	111.9	80.1	92.4	102.6	98.2	86.0	110.0	100.8	101.3	85.9	106.6	100.2	100.2	84.6	108.1	98.8	103.8	89.4	107.3	96.7	93.9	85.9	106.1	95.6

TABLE 4-5

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

ROUTINE SURFACE WATER ANALYSES

FROM 1993

Average Annual Values; Sampling event 1 - sampling event 2 (1993 to present)

Parameters	Year	Date	AR1L		AR1R		AR2L		AR2R		AR3L		AR3R		AR4L		AR4R		AR5L		AR5R		AR6L		AR6R		AR7L		AR7R		AR8L		AR8R	
	1993	7/22 -8/21	7.61	7.70	7.46	7.67	7.50	7.59	7.37	7.48	7.48	7.54	7.53	7.57	7.35	7.52	7.38	7.54	7.39	7.49	7.30	7.42	7.27	7.45	7.31	7.49	7.24	7.48	7.33	7.51	7.28	7.51	7.28	7.53
	1994	7/28-8/28	7.70	8.66	7.58	8.44	7.66	8.44	7.59	8.37	7.66	8.44	7.70	8.33	7.64	8.39	7.60	8.31	7.64	8.24	7.60	8.26	7.68	8.31	7.64	8.28	7.67	8.31	7.68	8.28	7.69	8.30	7.67	8.25
	1995	7/14-8/16	8.08	8.71	7.96	8.45	7.97	8.47	7.91	8.40	7.83	8.37	7.86	8.37	7.79	8.36	7.74	8.27	7.86	8.30	7.78	8.29	7.77	8.25	7.78	8.29	7.76	8.25	7.74	8.22	7.79	8.22	7.75	8.20
pH (Units)	1996	7/15-8/18	8.26	8.91	8.32	8.82	7.91	8.77	8.18	8.61	8.03	8.70	8.10	8.68	8.06	8.60	8.02	8.54	8.08	8.58	8.07	8.57	8.14	8.52	8.02	8.53	8.03	8.57	8.06	8.53	8.09	8.54	8.13	8.54
	1997	7/23-8/24	7.66	7.83	7.60	7.79	7.66	7.75	7.67	7.70	7.69	7.81	7.55	7.72	7.59	7.70	7.59	7.81	7.55	7.74	7.59	7.72	7.52	7.67	7.50	7.65	7.49	7.66	7.50	7.60	7.52	7.76	7.47	7.62
	1998	7/21-8/21	7.80	7.73	7.86	7.75	7.57	7.66	7.71	7.78	7.46	7.59	7.61	7.60	8.11	7.52	7.92	7.63	7.41	7.57	7.44	7.54	7.43	7.58	7.45	7.59	7.36	7.60	7.40	7.54	7.47	-	7.47	-
	1999	6/24-7/20	7.95	7.52	7.96	7.48	7.78	7.47	7.87	7.41	7.65	7.39	7.84	7.38	7.63	7.45	7.67	7.37	7.61	7.41	7.72	7.47	7.59	7.32	7.65	7.38	7.57	7.39	7.57	7.38	7.52	7.45	7.57	7.35
	2000	6/24-7/26	7.47	7.38	7.42	7.57	7.47	7.40	7.44	7.37	7.51	7.29	7.47	7.47	7.45	7.34	7.48	7.36	7.37	7.28	7.59	7.39	7.62	7.37	7.41	7.39	7.41	7.32	7.39	7.49	7.35	7.32	7.45	7.36
	2001	6/29-7/27	7.56	7.59	7.48	7.56	7.45	7.64	7.59	7.55	7.49	7.52	7.66	7.54	7.58	7.57	7.39	7.59	7.58	7.59	7.58	7.59	7.65	7.62	7.53	7.59	7.35	7.57	7.55	7.58	7.27	7.58	7.53	7.62
	2002	6/26-7/24	7.47	7.51	7.37	7.56	7.78	7.49	7.47	7.45	7.51	7.43	7.58	7.41	7.59	7.43	7.62	7.44	7.70	7.42	7.70	7.64	7.75	7.43	7.71	7.41	7.82	7.43	7.81	7.45	7.92	7.44	7.94	7.44
	2003	6/25-7/20	7.63	7.18	7.59	7.32	7.60	7.03	7.88	7.05	7.58	7.05	7.49	7.09	7.51	7.07	7.48	7.06	7.49	7.03	7.40	7.07	7.48	7.06	7.47	7.06	7.47	7.08	7.47	7.04	7.33	7.08	7.44	7.05
	1993	7/22 -8/21	2.5	3.1	2.6	2.7	2.0	2.3	2.7	3.2	2.2	2.6	2.5	8.6	1.9	2.6	2.7	3.6	1.3	2.4	1.9	2.9	2.5	3.0	1.9	2.1	1.9	3.2	2.1	4.0	2.3	2.5	2.0	2.2
	1994	7/28-8/28	9.0	17.0	9.5	18.0	9.3	17.0	10.0	22.0	9.7	15.0	10.0	21.0	9.8	16.0	10.0	20.0	9.4	18.0	9.9	21.0	10.0	16.0	11	18	9.8	17.0	9.7	18.0	10.0	18.0	10.0	17.0
	1995	7/14-8/16	2.6	4.2	3.0	4.1	2.3	2.8	3.5	5.6	3.1	3.6	2.9	6.2	2.8	3.0	3.8	3.9	3.5	4.5	3.3	5.7	2.8	4.0	2.8	4.4	3.5	3.9	3.5	6.5	4.0	5.1	3.5	4.2
Turbidity	1996	7/15-8/18	3.4	4.7	4.4	5.4	3.6	6.7	5.5	6.6	4.1	5.4	4.7	6.7	4.8	6.0	4.5	5.5	4.1	8.4	5.2	6.4	3.9	4.6	4.7	5.7	4.2	6.5	4.3	6.2	4.5	9.0	4.5	4.9
(Formazine	1997	7/23-8/24	6.1	6.4	6.0	6.3	5.9	7.1	5.7	10.0	5.5	7.4	9.9	18.0	5.5	6.1	6.2	7.5	5.5	6.4	6.1	8.0	5.5	6.1	5.9	6.6	5.7	6.6	6.0	6.3	6.5	10.0	6.0	6.1
Units)	1998	21-Jul	4.4	-	5.8	-	4.2	-	5.2	-	4.1	-	8.8	-	4.0	-	5.7	-	4.3	-	5.4	-	4.2	-	5.5	-	4.4	-	5.2	-	5.4	-	4.8	-
	1999	24-Jun	2.0	-	2.0	-	2.0	-	1.5	-	2.5	-	2.1	-	3.5	-	2.0	-	2.0	-	2.7	-	2.0	-	2.0	-	2.0	-	2.0	-	2.5	-	2.5	-
	2000	24-Jun	5.8	-	6.1	-	5.4	-	10.1	-	5.3	-	8.8	-	6.5	-	6.7	-	7.6	-	6.1	-	6.3	-	6.8	-	5.6	-	5.7	-	12.5	-	11.0	-
	2001	29-Jun	3.5	-	3.9	-	3.4	-	4.1	-	3.2	-	3.8	-	3.5	-	3.7	-	3.4	-	3.4	-	2.9	-	3.6	-	3.3	-	3.3	-	4.4	-	3.7	-
	2002	26-Jun	3.8	-	4.0	-	3.9	-	4.5	-	5.6	-	8.9	-	4.3	-	3.5	-	4.0	-	6.7	-	3.3	-	4.4	-	4.1	-	6.5	-	8.5	-	4.9	-
	2003	25-Jun	3.7	-	3.8	-	4.3	-	5.5	-	5.5	-	4.2	-	4.2	-	4.5	-	5.8	-	4.0	-	5.0	-	5.0	-	4.7	-	3.8	-	5.6	-	5.4	-
	1993	7/22 -8/21	5.5	10.0	5.2	5.8	4.9	5.6	5.0	5.6	4.9	5.6	5.1	5.7	5.2	5.5	4.7	5.6	5.7	6.1	5.1	5.5	5.1	5.7	5.0	5.6	5.0	5.7	5.0	5.6	5.1	5.5	5.0	5.6
	1994	7/28-8/28	3.9	26.0	3.3	3.8	3.9	5.4	3.1	4.0	3.8	3.9	3.6	3.9	3.8	5.0	3.8	6.8	3.9	4.5	3.7	3.7	3.1	3.7	3.3	3.7	3.8	4.4	3.7	7.2	3.2	3.8	3.4	4.0
Chlorides	1995	7/14-8/16	5.0	5.1	5	5.2	4.1	4.6	4.0	8.6	4.1	5.4	4.1	4.9	4.1	5.0	4.2	4.9	4.1	5.0	4.1	5.0	4.1	5.0	4.0	5.0	4.2	5.0	4.3	4.4	4.2	4.5	4.1	4.7
(mg/l)	1996	7/15-8/18	5.6	6.2	5.8	5.9	5.2	5.8	5.4	5.6	5.7	28.0	5.9	6.3	5.3	6.1	5.5	6.3	5.7	6.2	5.4	5.5	5.3	6.1	5.5	5.9	5.5	6.2	5.4	6.5	5.4	5.9	5.4	5.7
	1997	7/23-8/24	4.7	5.2	4.8	5.3	5.0	5.6	5.2	6.0	5.0	5.2	4.8	5	4.8	5.9	4.9	5.1	4.7	5.3	4.7	6.0	4.8	5.1	4.8	5.1	4.5	6.0	4.5	5.6	4.8	5.0	4.4	4.8
	1998	21-Jul	4.7	-	4.5	-	4.9	-	4.8	-	5.1	-	5	-	4.7	-	4.7	-	4.8	-	4.8	-	4.8	-	4.8	-	5.4	-	4.6	-	4.7	-	4.7	-
	1999	24-Jun	6.1	-	5.3	-	5.7	-	5.5	-	5.9	-	5.4	-	6.1	-	5.7	-	4.7	-	6.2	-	5.8	-	5.5	-	5.6	-	5.5	-	5.7	-	5.8	-
	2000	24-Jun	7.5	-	8.2	-	8.1	-	7.7	-	7.7	-	7.6	-	7.7	-	8.0	-	6.8	-	8.1	-	9.0	-	8.6	-	7.5	-	8.9	-	6.9	-	8.0	-
	2001	29-Jun	4.6	-	4.7	-	4.8	-	4.6	-	4.6	-	4.7	-	4.8	-	4.7	-	5.5	-	5.2	-	4.9	-	4.6	-	4.7	-	5.0	-	4.8	-	5.5	-
	2002	26-Jun	7.0	-	7.6	-	7.0	-	7.4	-	7.1	-	7.3	-	7.2	-	7.3	-	7.2	-	7.3	-	8.1	-	7.2	-	7.1	-	7.1	-	6.7	-	7.0	-
	2003	25-Jun	3.5	-	3.5	-	3.6	-	3.4	-	3.7	-	3.8	-	3.7	-	3.7	-	3.8	-	3.7	-	3.7	-	3.8	-	6.2	-	3.5	-	3.5	-	3.6	-
	1993	7/22 -8/21	0.114	0.169	0.053	0.118	0.147	0.170	0.078	0.098	0.168	0.177	0.168	0.173	0.047	0.178	0.147	0.175	0.095	0.177	0.157	0.188	0.056	0.172	0.076	0.183	0.046	0.173	0.046	0.177	0.045	0.179	0.171	0.186
	1994	7/28-8/28	0.083	0.097	0.083	0.096	0.083	0.097	0.084	0.098	0.086	0.096	0.09	0.098	0.101	0.111	0.091	0.101	0.101	0.112	0.100	0.102	0.097	0.112	0.097	0.100	0.100	0.110	0.098	0.099	0.099	0.107	0.096	0.097
Conductivity	1995	7/14-8/16	0.120	0.138	0.117	0.140	0.121	0.141	0.120	0.142	0.118	0.145	0.122	0.142	0.122	0.146	0.122	0.146	0.123	0.145	0.120	0.146	0.120	0.145	0.122	0.144	0.121	0.145	0.117	0.146	0.122	0.146	0.116	0.145
(mhos/cm)	1996	7/15-8/18	0.117	0.129	0.116	0.128	0.114	0.131	0.115	0.125	0.112	0.129	0.116	0.127	0.122	0.127	0.126	0.126	0.120	0.130	0.131	0.148	0.128	0.139	0.115	0.130	0.121	0.127	0.132	0.134	0.124	0.137	0.123	0.130
	1997	7/23-8/24	0.125	0.128	0.121	0.127	0.119	0.131	0.120	0.126	0.123	0.113	0.122	0.127	0.125	0.130	0.123	0.128	0.123	0.131	0.133	0.143	0.127	0.131	0.122	0.128	0.219	0.130	0.129	0.135	0.127	0.128	0.119	0.130
	1998	7/21-8/21	0.155	0.153	0.026	0.152	0.158	0.152	0.149	0.151	0.157	0.150	0.146	0.143	0.160	0.150	0.152	0.151	0.128	0.151	0.156	0.157	0.149	0.150	0.150	0.150	0.152	0.149	0.157	0.148	0.154	-	0.149	-
	1999	6/24-7/20	0.131	0.113	0.131	0.113	0.134	0.115	0.131	0.113	0.132	0.116	0.131	0.115	0.133	0.115	0.132	0.113	0.130	0.115	0.138	0.115	0.133	0.116	0.132	0.116	0.132	0.115	0.132	0.117	0.126	0.116	0.132	0.116
	2000	6/24-7/26	0.146	0.148	0.149	0.151	0.152	0.153	0.150	0.151	0.158	0.154	0.152	0.154	0.156	0.156	0.153	0.154	0.154	0.155	0.158	0.157	0.165	0.156	0.153	0.154	0.154	0.155	0.157	0.156	0.136	0.149	0.154	0.155
	2001	6/29-7/27	0.104	0.127	0.106	0.132	0.106	0.136	0.109	0.133	0.107	0.135	0.109	0.133	0.107	0.136	0.107	0.135	0.107	0.137	0.109	0.134	0.110	0.140	0.106	0.135	0.105	0.133	0.112	0.135	0.105	0.130	0.109	0.132
	2002	6/26-7/24	0.142	0.141	0.146	0.145	0.147	0.148	0.146	0.145	0.148	0.148	0.145	0.145	0.160	0.148	0.148	0.148	0.161	0.147	0.151	0.149	0.151	0.149	0.150	0.148	0.147	0.148	0.151	0.149	0.140	0.145	0.151	0.149
	2003	6/25-7/20	0.102	0.093	0.049	0.074	0.102	0.097	0.096	0.075	0.102	0.102	0.099	0.080	0.102	0.096	0.100	0.081	0.102	0.095	0.103	0.093	0.101	0.097	0.099	0.083	0.100	0.091	0.100	0.086	0.099	0.095	0.101	0.088

TABLE 4-5

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

ROUTINE SURFACE WATER ANALYSES

FROM 1993

Average Annual Values; Sampling event 1 - sampling event 2 (1993 to present)

Parameters	Year	Date	AR1L		AR1R		AR2L		AR2R		AR3L		AR3R		AR4L		AR4R	
	1993	7/22 -8/21	41	47	41	48	44	48	41	47	44	48	44	48	44	48	44	45
	1994	7/28-8/28	32	40	28	30	32	37	29	32	35	40	30	32	32	32	33	40
Hardness	1995	7/14-8/16	33	41	31	41	36	44	31	44	36	44	31	44	32	44	34	47
(mg/l as	1996	7/15-8/18	30	39	31	33	31	36	31	34	31	36	29	34	31	34	32	34
CaCO3)	1997	7/23-8/24	36	46	34	38	36	46	34	41	36	38	34	42	36	46	34	41
	1998	21-Jul	46	-	44	-	52	-	41	-	49	-	44	-	49	-	44	-
	1999	24-Jun	-	-	44	-	-	-	44	-	-	-	44	-	-	-	44	-
	2000	24-Jun	-	-	40	-	-	-	42	-	-	-	43	-	-	-	43	-
	2001	29-Jun	-	-	36	-	-	-	34	-	-	-	34	-	-	-	34	-
	2002	26-Jun	-	-	42	-	-	-	39	-	-	-	42	-	-	-	42	-
	2003	25-Jun	-	-	38	-	-	-	38	-	-	-	42	-	-	-	41	-
	1993	7/22 -8/21	44	44	45	45	44	47	45	45	46	47	44	46	44	47	45	46
	1994	7/28-8/28	29	37	24	28	29	36	27	30	30	37	27	29	30	34	28	30
Alkalinity	1995	7/14-8/16	36	45	37	46	39	46	35	47	38	50	35	47	36	48	38	48
(mg/l as	1996	7/15-8/18	37	41	33	39	33	39	33	37	33	39	33	38	32	38	33	37
CaCO3)	1997	7/23-8/24	34	38	38	39	38	39	38	39	39	40	38	38	38	39	38	39
	1998	7/21-8/21	53	-	46	-	54	-	44	-	48	-	46	-	49	-	43	-
	1999	6/24-7/20	45	-	49	-	48	-	46	-	48	-	47	-	48	-	48	-
	2000	6/24-7/26	39	-	51	-	54	-	52	-	55	-	53	-	57	-	54	-
	2001	6/29-7/27	35	-	34	-	36	-	34	-	35	-	29	-	40	-	35	-
	2002	6/26-7/24	48	-	47	-	50	-	48	-	50	-	49	-	51	-	51	-
	2003	25-Jun	35.0	-	35.0	-	39.0	-	35.0	-	39.0	-	37.0	-	39.0	-	37.0	-
	1993	22-Jul	5.6	-	6.4	-	7.2	-	4.3	-	3.7	-	6.6	-	7.6	-	5.8	-
	1994	7/28-8/28	3.7	14.0	8.4	17.0	13.0	13.0	5.3	12.0	3.5	11.0	4.5	12.0	4.3	9.7	5.3	9.9
Sulfate	1995	7/14-8/16	4.9	7.2	7.2	7.8	8.0	8.2	7.8	8.0	5.6	7.6	6.6	6.8	7.2	7.4	5.4	6.8
(mg/l)	1996	7/15-8/18	6.8	9.0	9.5	10.0	5.6	9.9	9.9	11.0	7.8	10.0	8.2	9.7	8.4	8.8	8.8	9.2
	1997	7/23-8/24	6.2	9.3	6.8	8.0	<5.0	8.2	6.8	10.0	<5.0	5.1	6.4	8.8	6.4	6.8	6.2	6.8
	1998	21-Jul	6.0	-	7.4	-	6.4	-	8.0	-	6.6	-	8.6	-	7.2	-	7.6	-
	1999	24-Jun	5.8	-	5.8	-	5.8	-	6.4	-	<5.0	-	7.0	-	<5.0	-	<5.0	-
	2000	24-Jun	29.0	-	17.0	-	12.0	-	8.2	-	15.0	-	8.2	-	29.0	-	11.0	-
	2001	29-Jun	7.2	-	7.8	-	8.6	-	9.7	-	6.8	-	8.6	-	8.0	-	9.5	-
	2002	26-Jun	14.0	-	16.0	-	14.0	-	15.0	-	14.0	-	15.0	-	10.0	-	16.0	-
	2003	25-Jun	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-
	1993	7/22 -8/21	<2.0	2.2	<2.0	<2.0	<2.0	2.2	2.0	2.8	2.1	2.4	<2.0	2.1	<2.0	2.2	2.3	2.5
	1994	7/28-8/28	3.2	7.7	2.3	7.5	<2.0	7.0	<2.0	6.7	5.3	8.3	3.5	8.5	6.2	7.9	3.9	7.5
Total	1995	7/14-8/16	3.0	13.0	3.4	13.0	3.5	11.0	3.4	12.0	3.2	11.0	3.3	12.0	3.3	12.0	2.8	11.0
Organic	1996	7/15-8/18	1.9	2.0	2.4	2.5	2.1	2.2	2.0	2.2	1.8	2.1	2.0	2.3	2.0	2.1	2.2	2.2
Carbon	1997	7/23-8/24	2.2	2.8	2.4	2.5	2.4	2.4	2.2	2.5	2.4	2.6	2.6	2.6	2.3	2.4	2.5	2.7
(mg/l)	1998	21-Jul	2.4	-	2.9	-	2.4	-	1.4	-	2.3	-	2.4	-	2.4	-	2.3	-
	1999	24-Jun	3.2	-	3.2	-	2.8	-	2.7	-	3.0	-	2.7	-	3.2	-	2.4	-
	2000	24-Jun	3.0	-	3.5	-	2.8	-	3.4	-	3.2	-	3.2	-	3.8	-	3.1	-
	2001	29-Jun	3.8	-	7.0	-	2.3	-	2.5	-	2.9	-	2.7	-	2.5	-	2.5	-
	2002	26-Jun	4.6	-	2.0	-	5.3	-	3.4	-	1.9	-	2.4	-	6.4	-	2.5	-
	2003	25-Jun	3.2	-	3.6	-	3.2	-	3.3	-	3.4	-	4.4	-	8.9	-	4.0	-

Parameters	Year	Date	AR5L		AR5R		AR6L		AR6R		AR7L		AR7R		AR8L		AR8R	
	1993	7/22 -8/21	44	49	44	48	46	47	42	49	45	46	45	46	44	46	42	46
	1994	7/28-8/28	32	40	32	35	32	40	32	34	32	37	32	37	32	37	32	37
Hardness	1995	7/14-8/16	36	46	36	49	39	52	36	46	36	46	39	44	36	44	36	44
(mg/l as	1996	7/15-8/18	32	36	34	35	31	34	32	36	31	36	34	34	31	34	34	34
CaCO3)	1997	7/23-8/24	36	41	43	44	36	38	37	39	36	38	35	39	36	37	34	41
	1998	21-Jul	46	-	48	-	47	-	44	-	46	-	45	-	46	-	28	-
	1999	24-Jun	-	-	47	-	-	-	44	-	-	-	44	-	-	-	44	-
	2000	24-Jun	-	-	43	-	-	-	43	-	-	-	44	-	-	-	43	-
	2001	29-Jun	-	-	37	-	-	-	36	-	-	-	34	-	-	-	37	-
	2002	26-Jun	-	-	43	-	-	-	42	-	-	-	43	-	-	-	43	-
	2003	25-Jun	-	-	39	-	-	-	39	-	-	-	41	-	-	-	41	-
	1993	7/22 -8/21	45	47	44	47	44	47	43	47	42	49	43	47	42	48	43	47
	1994	7/28-8/28	29	34	28	29	30	33	29	30	30	31	30	30	31	31	30	30
Alkalinity	1995	7/14-8/16	37	47	38	47	37	48	35	48	37	50	37	48	36	48	35	48
(mg/l as	1996	7/15-8/18	33	39	33	37	33	36	33	38	33	38	33	38	33	38	33	37
CaCO3)	1997	7/23-8/24	39	40	38	39	39	39	38	39	37	39	38	40	37	38	38	40
	1998	7/21-8/21	46	-	49	-	46	-	44	-	46	-	46	-	46	-	46	-
	1999	6/24-7/20	45	-	46	-	47	-	44	-	46	-	49	-	47	-	43	-
	2000	6/24-7/26	55	-	54	-	60	-	54	-	54	-	56	-	47	-	56	-
	2001	6/29-7/27	37	-	35	-	35	-	50	-	34	-	35	-	34	-	35	-
	2002	6/26-7/24	50	-	51	-	52	-	51	-	50	-	52	-	47	-	51	-
	2003	25-Jun	39.0	-	38.0	-	39.0	-	36.0	-	37.0	-	38.0	-	38.0	-	37.0	-
	1993	22-Jul	6.2	-	7.6	-	7.4	-	5.3	-	4.9	-	2.7	-	5.6	-	5.3	-
	1994	7/28-8/28	3.1	9.7	4.5	8.6	4.3	4.3	3.9	3.9	3.3	3.7	4.5	5.3	4.5	4.7	3.5	4.9
Sulfate	1995	7/14-8/16	7.2	7.4	6.0	6.8	7.4	8.4	5.6	7.0	7.2	8.6	6.2	7.8	7.2	7.8	6.8	7.2
(mg/l)	1996	7/15-8/18	8.6	9.7	9.7	11.0	8.6	9.0	7.6	12.0	6.6	8.0	8.8	10.0	7.6	8.0	5.8	9.2
	1997	7/23-8/24	6.4	7.8	11.0	12.0	6.4	8.2	6.0	8.8	6.2	8.8	7.0	8.4	6.6	8.4	6.8	7.2
	1998	21-Jul	8.2	-	11.0	-	7.2	-	7.6	-	7.4	-	6.4	-	7.6	-	7.6	-
	1999	24-Jun	6.4	-	5.4	-	6.0	-	<5.0	-	<5.0	-	5.6	-	<5.0	-	5.1	-
	2000	24-Jun	17.0	-	11.0	-	11.0	-	5.8	-	5.8	-	18.0	-	12.0	-	20.0	-
	2001	29-Jun	9.1	-	11.0	-	6.6	-	9.1	-	9.3	-	9.7	-	9.3	-	9.7	-
	2002	26-Jun	14.0	-	14.0	-	12.0	-	12.0	-	13.0	-	13.0	-	12.0	-	12.0	-
	2003	25-Jun	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-
	1993	7/22 -8/21	<2.0	2.5	<2.0	2.4	<2.0	2.0	2.2	3.1	2.6	2.7	<2.0	2.8	<2.0	2.5	<2.0	2.0
	1994	7/28-8/28	6.6	8.1	2.3	7.3	<2.0	7.5	7.2	9.8	4.2	5.6	5.7	6.8	7.1	7.2	6.3	6.5
Total	1995	7/14-8/16	2.9	11.0	3.2	11.0	2.7	12.0	2.8	5.6	3.0	6.8	3.5	12.0	3.4	12.0	3.3	13.0
Organic	1996	7/15-8/18	1.7	2.3	2.0	2.4	2.0	2.2	1.7	2.0	2.0	2.5	2.2	2.5	2.0	2.3	1.9	2.4
Carbon	1997	7/23-8/24	2.5	3.0	2.3	2.6	2.7	3.0	2.5	2.6	2.6	2.7	2.4	2.5	2.5	2.7	2.6	2.8
(mg/l)	1998	21-Jul	2.1	-	2.2	-	2.1	-	2.3	-	2.1	-	2.1	-	2.0	-	2.4	-
	1999	24-Jun	3.7	-	3.1	-	2.8	-	2.8	-	2.6	-	2.8	-	2.9	-	3.2	-
	2000	24-Jun	2.8	-	3.0	-	3.0	-	2.8	-	2.6	-	3.7	-	3.2	-	2.9	-
	2001	29-Jun	2.6	-	2.5	-	2.7	-	3.6	-	3.1	-	3.3	-	3.0	-	2.8	-
	2002	26-Jun	3.4	-	2.2	-	15.0	-	1.9	-	4.3	-	2.0	-	1.8	-	2.5	-
	2003	25-Jun	3.8	-	4.3	-	3.9	-	3.6	-	5.7	-	3.3	-	3.9	-	3.2	-

Table 4-6 Summary of Routine Surface Water Analyses

Parameter	Apalachicola River*
Dissolved oxygen (mg/l)	4.03 to 11.02
pH (su)	7.24 to 8.91
Turbidity (NTU)	1.3 to 22.0
Conductivity (mmhos/cm)	0.026 to 0.219
Hardness (mg/l)	28 to 52
Alkalinity (mg/l)	24 to 60
Total Kjeldahl nitrogen (mg/l)	<0.20 to 2.9
Total phosphorus (mg/l)	<0.020 to 0.880
Total organic carbon (mg/l)	1.4 to 15.0
Chloride (mg/l)	3.1 to 28.0
Total suspended solids (mg/l)	**2.0** to 61.0
Sulfate (mg/l)	2.7 to 29.0

***Bold** text denotes changes made this year (2003).

Trace Metal Analyses of Surface Waters

Beginning in 1993, composite surface water samples are collected during each annual study period from up to 19 sampling stations (16 river stations, and three along the discharge canal and ash pond). The samples are analyzed for 16 trace metals: aluminum, arsenic, boron, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, sodium, sulfate, zinc, and vanadium.

The results of these analyses are summarized in Table 4-7. The concentrations found are, to a great extent, dependent upon stream flow conditions prevalent at the time samples were collected. (See Appendix F, Detailed Daily Stream Flows in the Apalachicola River)

ISCO portable water samplers are used to collect 24-hr. composite samples simultaneously from three locations along the discharge canal: stations PSDC #1, PSAP, and PSIC. The ranges of values for river stations, since 1993, are presented as follows:

TABLE 4-5

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

ROUTINE SURFACE WATER ANALYSES

FROM 1993

Average Annual Values; Sampling event 1 - sampling event 2 (1993 to present)

Parameters	Year	Date	AR1L		AR1R		AR2L		AR2R		AR3L		AR3R		AR4L		AR4R	
	1993	7/22 -8/21	4.2	5.6	4.8	5.0	3.8	5.0	4.2	10.0	4.2	4.6	6.2	13	4.4	5.0	5.4	6.6
	1994	7/28-8/28	5.8	10.0	8.0	15.0	7.0	11.0	6.2	11.0	6.8	9.2	6	11	6.8	10.0	5.8	10.0
Total	1995	7/14-8/16	4.2	6.0	3.7	5.8	4.2	6.2	6.2	6.4	3.5	8.0	4.5	11	4.2	18.0	9.2	9.4
Suspended	1996	7/15-8/18	4.6	6.8	5.6	11.0	4.2	8.6	7.0	11.0	4.4	6.4	5.6	16	5.4	9.2	7.0	7.6
Solids	1997	7/23-8/24	4.0	6.8	6.0	6.4	3.0	8.0	7.0	20.0	3.0	6.8	13	61.0	5.0	6.0	7.2	10.0
(mg/l)	1998	21-Jul	3.6	-	6.0	-	4.4	-	5.2	-	4.0	-	24.0	-	2.8	-	6.8	-
	1999	24-Jun	14.0	-	6.7	-	53.0	-	16.0	-	14.0	-	11	-	28.0	-	57.0	-
	2000	24-Jun	3.7	-	5.3	-	5.7	-	38.0	-	4.3	-	12.0	-	4.3	-	7.3	-
	2001	29-Jun	3.5	-	6.0	-	4.0	-	8.0	-	3.0	-	7.0	-	6.5	-	4.0	-
	2002	26-Jun	16.0	-	11.0	-	10.0	-	4.0	-	14.0	-	24.0	-	16.0	-	16.0	-
	2003	25-Jun	4.0	-	9.0	-	6.0	-	16.0	-	3.0	-	14.0	-	8.0	-	14.0	-
	1993	7/22 -8/21	0.30	0.34	0.36	0.42	0.27	0.46	0.34	0.44	0.30	0.40	0.32	0.38	0.34	0.36	0.41	0.55
	1994	7/28-8/28	0.39	0.52	0.39	0.46	0.38	0.49	0.35	0.39	0.35	0.64	0.37	0.46	0.35	0.58	0.33	0.50
Total	1995	7/14-8/16	0.47	0.78	0.46	0.53	0.45	0.49	0.45	0.48	0.49	0.52	0.47	0.53	0.47	0.51	0.39	0.42
Nitrogen	1996	7/15-8/18	0.49	0.59	0.45	0.46	0.46	0.52	0.48	0.64	0.45	0.50	0.40	0.49	0.40	0.50	0.57	0.72
(mg/l)	1997	7/23-8/24	0.54	0.70	0.34	0.37	0.36	0.39	0.36	0.44	0.30	0.37	0.29	0.50	0.24	0.34	0.26	0.36
	1998	21-Jul	0.41	-	0.54	-	0.51	-	0.51	-	0.35	-	0.46	-	0.40	-	0.46	-
	1999	24-Jun	0.60	-	0.71	-	0.36	-	0.48	-	0.62	-	0.43	-	0.37	-	0.39	-
	2000	24-Jun	0.62	-	0.84	-	0.87	-	0.52	-	0.28	-	0.50	-	0.65	-	0.44	-
	2001	29-Jun	0.42	-	0.33	-	0.36	-	0.48	-	0.40	-	0.46	-	0.65	-	0.33	-
	2002	26-Jun	0.56	-	0.62	-	1.10	-	0.74	-	0.62	-	0.66	-	0.75	-	0.58	-
	2003	25-Jun	0.60	-	0.70	-	0.59	-	0.73	-	0.54	-	0.45	-	0.51	-	0.55	-
	1993	7/22 -8/21	<0.02	0.026	<0.02	0.026	<0.02	0.028	<0.02	0.034	<0.02	0.03	<0.02	0.029	<0.02	0.026	<0.02	0.028
	1994	7/28-8/28	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.14	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total	1995	7/14-8/16	<0.050	0.051	<0.050	<0.050	<0.050	0.058	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Phosphorus	1996	7/15-8/18	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.063	<0.050	<0.050	<0.050	<0.050	<0.050	0.055
(mg/l)	1997	7/23-8/24	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	1998	21-Jul	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
	1999	24-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
	2000	24-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
	2001	29-Jun	0.14	-	0.22	-	0.18	-	0.15	-	0.11	-	0.18	-	0.12	-	0.18	-
	2002	26-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	0.110	-	0.052	-	<0.050	-	<0.050	-
	2003	25-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
Current	1993	22-Jul	0.8	-	0.8	-	<0.5	-	1.0	-	1.0	-	0.8	-	<0.5	-	0.8	-
Velocity	1994	7/28-8/28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(ft/s)	1995	7/14-8/16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Parameters	Year	Date	AR5L		AR5R		AR6L		AR6R		AR7L		AR7R		AR8L		AR8R	
	1993	7/22 -8/21	4.0	6.0	4.6	5.4	3.8	4.0	5.2	5.6	3.0	4.8	4.8	6.0	3.6	6.0	4.4	5.6
	1994	7/28-8/28	7.6	11.0	6.4	10.0	7.4	11.0	5.8	11.0	7.0	12.0	5.2	11.0	5.8	11.0	5.4	10.0
Total	1995	7/14-8/16	5.5	8.6	5.0	9.0	4.5	5.7	4.5	8.6	4.2	5.4	5.2	7.0	5.8	6.0	5.0	6.8
Suspended	1996	7/15-8/18	5.2	20.0	7.2	10.0	4.4	5.2	7.6	11.0	5.2	8.4	5.2	9.6	5.8	26.0	5.6	6.0
Solids	1997	7/23-8/24	3.0	6.4	5.0	10.0	3.0	5.2	6.0	8.0	4.0	6.0	3.0	8.4	3.0	12.0	5.0	5.2
(mg/l)	1998	21-Jul	3.2	-	4.8	-	3.6	-	6.8	-	3.2	-	6.0	-	10.0	-	5.6	-
	1999	24-Jun	26.0	-	32.0	-	8.0	-	6.7	-	43.0	-	19.0	-	57.0	-	60.0	-
	2000	24-Jun	4.3	-	5.0	-	3.0	-	5.7	-	5.3	-	4.3	-	21.0	-	19.0	-
	2001	29-Jun	3.5	-	5.0	-	2.5	-	3.5	-	4.0	-	5.0	-	5.5	-	5.0	-
	2002	26-Jun	5.0	-	16.0	-	<2.0	-	3.0	-	3.0	-	11.0	-	27.0	-	7.0	-
	2003	25-Jun	2.0	-	3.0	-	8.0	-	11.0	-	3.0	-	4.0	-	7.0	-	13.0	-
	1993	7/22 -8/21	0.37	0.52	0.35	0.41	0.36	0.44	0.34	0.42	0.33	0.36	0.39	0.41	0.30	0.34	0.36	0.37
	1994	7/28-8/28	0.37	0.45	0.34	0.66	0.35	0.48	0.32	0.53	0.33	0.43	0.37	0.50	0.36	0.44	0.33	0.42
Total	1995	7/14-8/16	0.47	0.53	0.49	0.59	0.47	0.54	0.45	0.58	0.52	0.56	0.51	0.53	0.46	0.46	0.54	0.55
Nitrogen	1996	7/15-8/18	0.43	0.57	0.53	0.58	0.46	0.50	0.50	0.55	0.43	0.51	0.46	0.46	0.49	0.53	0.47	0.56
(mg/l)	1997	7/23-8/24	0.26	0.37	0.6	2.9	0.44	0.60	0.44	0.47	0.39	0.78	0.37	0.52	0.49	0.55	0.35	0.46
	1998	21-Jul	0.52	-	0.67	-	0.55	-	0.66	-	0.39	-	0.53	-	0.42	-	0.63	-
	1999	24-Jun	0.41	-	0.77	-	0.53	-	0.41	-	0.40	-	0.40	-	0.33	-	0.50	-
	2000	24-Jun	0.35	-	0.62	-	0.40	-	0.61	-	<0.20	-	1.00	-	0.73	-	0.48	-
	2001	29-Jun	0.29	-	0.38	-	0.44	-	0.35	-	0.29	-	0.58	-	0.47	-	0.43	-
	2002	26-Jun	0.58	-	0.57	-	0.59	-	0.72	-	0.56	-	0.66	-	0.81	-	0.56	-
	2003	25-Jun	0.61	-	0.38	-	0.68	-	0.55	-	0.54	-	0.57	-	0.72	-	0.47	-
	1993	7/22 -8/21	<0.02	0.032	<0.02	0.034	<0.02	0.03	<0.02	0.032	<0.02	0.027	<0.02	0.45	<0.02	0.028	<0.02	0.03
	1994	7/28-8/28	<0.050	<0.050	<0.050	0.083	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.087	<0.050	0.077	<0.050	<0.050
Total	1995	7/14-8/16	<0.050	0.054	<0.050	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Phosphorus	1996	7/15-8/18	<0.050	<0.050	<0.050	0.053	<0.050	0.062	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
(mg/l)	1997	7/23-8/24	<0.050	0.055	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	1998	21-Jul	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
	1999	24-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
	2000	24-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
	2001	29-Jun	0.20	-	0.15	-	0.11	-	0.17	-	0.16	-	0.23	-	0.22	-	0.28	-
	2002	26-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	0.880	-	<0.050	-
	2003	25-Jun	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-
Current	1993	22-Jul	0.6	-	0.7	-	0.8	-	0.8	-	0.8	-	0.6	-	0.8	-	0.7	-
Velocity	1994	7/28-8/28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(ft/s)	1995	7/14-8/16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE 4-7
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

SURFACE WATER TRACE METAL ANALYSES

FROM 1993

Station Locations

Parameters	Year[a]	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R	PSDC1	PSAPD	PSDC2	PSIC
Aluminum (mg/l)	1993	0.14	0.14	0.14	0.1	0.2	0.36	0.22	0.25	0.23	0.22	0.12	0.27	0.13	0.24	0.15	0.12	0.08	0.1	0.09	-
	1994	0.78	1.1	1.1	1.1	1.1	1.2	1.1	1.1	1.1	1.6	1.0	1.4	1.1	1.2	1.3	0.92	0.77	<0.10	0.66	-
	1995	0.2	0.22	0.21	0.24	0.27	0.33	0.27	0.44	0.29	0.38	0.41	0.27	0.26	0.33	0.27	0.21	0.14	<0.10	0.15	-
	1996	0.33	0.55	0.5	0.59	0.38	0.57	0.4	0.48	1.4	0.42	0.33	0.48	0.44	0.51	0.93	0.36	0.2	<0.10	0.2	-
	1997	0.4	0.28	0.3	0.75	0.29	0.45	0.52	0.28	0.29	0.33	0.27	0.29	0.29	0.24	0.4	0.2	0.22	<0.10	0.26	-
	1998	0.28	0.32	0.66	0.31	0.25	0.87	0.32	0.27	0.32	0.4	0.3	0.42	0.28	0.36	0.34	0.43	0.29	<0.20	1.3	-
	1999	-	0.22	-	0.21	-	0.29	-	0.27	-	2.0	-	0.20	-	0.23	-	0.22	<0.20	-	-	-
	2000	-	<0.20	-	0.31	-	0.57	-	<0.20	-	<0.20	-	0.22	-	0.21	-	0.52	<0.20	-	-	<0.20
	2001	-	<0.20	-	0.24	-	0.24	-	0.22	-	0.30	-	0.24	-	0.25	-	0.23	0.42	<0.20	-	0.21
	2002	-	0.22	-	0.22	-	0.69	-	0.22	-	0.27	-	0.27	-	0.44	-	0.25	0.20	-	-	<0.20
	2003	-	0.22	-	0.33	-	0.25	-	0.25	-	0.32	-	0.31	-	0.31	-	0.3	<0.20	-	-	0.24
Arsenic (mg/l)	1993	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.07	0.003	-
	1994	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.01	<0.002	-
	1995	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.1	<0.002	-
	1996	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0024	0.092	<0.002	-
	1997	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.087	<0.002	-
	1998	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	0.14	<0.010	-
	1999	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	-
	2000	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2001	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	0.038	-	<0.010
	2002	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2003	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
Boron (mg/l)	1993	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	3.1	0.15	-
	1994	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.088	3.3	0.058	-
	1995	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.067	2.6	<0.050	-
	1996	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	3.1	<0.050	-
	1997	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	1.8	<0.050	-
	1998	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	1.4	<0.050	-
	1999	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	<0.050	-	-	-
	2000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	2001	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	<0.050	6.6	-	<0.050
	2002	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	<0.050	-	-	<0.050
	2003	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	-	<0.050	<0.050	-	-	<0.050
Calcium (mg/l)	1993	14	14	15	14	15	15	15	15	15	15	16	14	16	15	15	14	17	76	19	-
	1994	14	9.3	13	9.7	14	10	11	14	14	12	14	12	13	13	13	13	14	100	13	-
	1995	11	10	12	10	12	10	10	11	12	12	13	12	12	13	12	12	13	85	12	-
	1996	10	10	10	10	10	9.4	10	10	10	11	10	10	10	11	10	11	12	110	12	-
	1997	16	13	16	14	13	14	15	14	14	15	13	13	13	13	12	14	13	79	13	-
	1998	16	15	15	14	17	15	17	15	16	16	16	15	16	15	16	9.6	16	59	17	-
	1999	-	15	-	15	-	15	-	15	-	16	-	15	-	15	-	15	16	-	-	-
	2000	-	13	-	14	-	14	-	14	-	14	-	14	-	14	-	14	15	-	-	15
	2001	-	12	-	11	-	11	-	11	-	12	-	12	-	11	-	12	12	210	-	12
	2002	-	14	-	13	-	14	-	14	-	14	-	14	-	14	-	14	14	-	-	11
	2003	-	13	-	13	-	14	-	14	-	13	-	13	-	14	-	14	10	-	-	12

TABLE 4-7
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

SURFACE WATER TRACE METAL ANALYSES

FROM 1993

Station Locations

Parameters	Year[a]	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R	PSDC1	PSAPD	PSDC2	PSIC
	1993	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.059	<0.010	<0.010	<0.010	<0.010	-
	1994	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
Chromium	1995	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
(mg/l)	1996	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1997	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1998	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.023	0.022	-
	1999	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	-
	2000	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2001	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	<0.010	-	<0.010
	2002	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2003	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	1993	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1994	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
Copper	1995	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
(mg/l)	1996	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1997	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1998	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.025	<0.025	<0.025	-
	1999	-	<0.002	-	<0.002	-	<0.002	-	<0.002	-	<0.002	-	<0.002	-	<0.002	-	<0.002	<0.002	-	-	-
	2000	-	<0.002	-	<0.002	-	<0.002	-	<0.002	-	0.005	-	<0.002	-	0.0028	-	<0.002	0.0027	-	-	0.0069
	2001	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	0.01	-	<0.005	-	<0.005	-	<0.005	<0.005	<0.005	-	<0.005
	2002	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	<0.005	-	-	<0.005
	2003	-	<0.0020	-	<0.0020	-	<0.0020	-	<0.0020	-	0.0027	-	<0.0020	-	<0.0020	-	<0.0020	<0.0020	-	-	0.0047
	1993	0.27	0.34	0.30	0.28	0.35	0.53	0.37	0.41	0.43	0.38	0.46	0.60	0.26	0.36	0.52	0.25	0.18	0.17	0.21	-
	1994	1.5	1.8	1.7	1.7	1.6	1.6	1.7	1.7	1.8	1.9	1.7	1.8	1.8	1.7	1.8	1.6	1.3	0.083	1.3	-
Iron	1995	0.26	0.35	0.30	0.36	0.35	0.47	0.38	0.64	0.44	0.51	0.59	0.43	0.39	0.47	0.41	0.35	0.23	0.11	0.25	-
(mg/l)	1996	0.46	0.7	0.50	0.66	0.46	0.56	0.51	0.51	1.7	0.52	0.42	0.58	0.57	0.58	0.94	0.43	0.25	0.076	0.24	-
	1997	0.61	0.54	0.60	0.99	0.52	0.70	1.0	0.48	0.53	0.59	0.45	0.57	0.52	0.50	0.75	0.38	0.43	0.073	0.38	-
	1998	0.25	0.34	0.34	0.30	0.24	0.85	0.30	0.27	0.28	0.38	0.29	0.40	0.25	0.33	0.35	0.16	0.30	0.24	1.8	-
	1999	-	0.24	-	0.28	-	0.33	-	0.59	-	0.41	-	0.27	-	0.30	-	0.31	0.26	-	-	-
	2000	-	0.33	-	0.36	-	0.53	-	0.20	-	0.13	-	0.23	-	0.21	-	0.52	0.11	-	-	0.17
	2001	-	0.46	-	0.53	-	0.52	-	0.48	-	0.59	-	0.47	-	0.42	-	0.42	0.45	0.14	-	0.38
	2002	-	0.35	-	0.33	-	0.82	-	0.32	-	0.42	-	0.38	-	0.61	-	0.35	0.28	-	-	0.21
	2003	-	0.69	-	0.90	-	0.81	-	0.80	-	0.88	-	0.88	-	0.86	-	0.82	0.50	-	-	0.61
	1993	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
	1994	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
Lead	1995	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
(mg/l)	1996	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	2.9	<0.005	-
	1997	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
	1998	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-
	1999	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	0.0071	-	<0.005	-	<0.005	-	<0.005	<0.005	-	-	-
	2000	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	0.0071	-	<0.005	-	<0.005	-	<0.005	<0.005	-	-	<0.005
	2001	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	0.0071	-	<0.005	-	<0.005	-	<0.005	<0.005	<0.005	-	<0.005
	2002	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	<0.005	-	-	<0.005
	2003	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	-	<0.005	<0.005	-	-	<0.005

TABLE 4-7
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

SURFACE WATER TRACE METAL ANALYSES

FROM 1993

Station Locations

Parameters	Year[a]	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R	PSDC1	PSAPD	PSDC2	PSIC
	1993	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
	1994	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
Selenium	1995	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-
(mg/l)	1996	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0022	<0.002	-
	1997	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0031	<0.002	-
	1998	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1999	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	-
	2000	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2001	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	<0.010	-	<0.010
	2002	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2003	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	1993	6.0	6.2	6.2	6.3	6.2	6.4	6.2	6.0	6.0	6.2	6.4	6.1	6.1	6.0	5.9	5.4	36	12	11	-
	1994	3.6	4.3	3.9	4.0	3.7	3.9	3.7	3.7	3.8	4.1	3.5	3.6	3.6	3.6	3.8	3.5	9.6	10	24	-
Sodium	1995	6.8	6.8	6.5	6.5	6.5	6.4	6.6	6.6	6.6	6.9	6.8	6.7	6.8	6.7	6.4	6.9	51	15	27	-
(mg/l)	1996	6.4	6.8	6.4	6.1	5.8	5.6	6.1	6.6	6.4	6.9	6.6	6.8	6.6	6.8	6.6	6.8	20	12	38	-
	1997	6.0	6.1	6.0	6.3	5.0	6.2	5.4	5.8	5.8	6.1	5.6	5.8	5.7	5.7	4.7	5.9	14	12	6.2	-
	1998	5.4	5.6	5.6	5.9	5.9	5.9	5.9	6.1	6.1	6.3	6.0	5.9	6.1	5.9	5.7	5.9	6.9	13	7.0	-
	1999	-	7.7	-	7.8	-	7.6	-	7.6	-	7.3	-	7.2	-	7.3	-	7.6	13	-	-	-
	2000	-	11	-	12	-	12	-	12	-	11	-	11	-	12	-	11	16	-	-	41
	2001	-	6.6	-	6.5	-	6.7	-	6.5	-	6.6	-	6.8	-	6.4	-	6.8	7.1	410	-	6.8
	2002	-	11	-	11	-	11	-	11	-	11	-	11	-	10	-	10	9.4	-	-	11
	2003	-	4.6	-	4.3	-	4.5	-	4.3	-	4.20	-	4.3	-	4.2	-	4.1	13.00	-	-	40
	1993	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1994	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
Vanadium	1995	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
(mg/l)	1996	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1997	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1998	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-
	1999	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	-
	2000	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2001	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	0.022	-	<0.010
	2002	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	2003	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	-	<0.010	<0.010	-	-	<0.010
	1993	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.028	<0.020	0.023	-
	1994	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
Zinc	1995	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
(mg/l)	1996	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
	1997	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.031	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
	1998	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
	1999	-	<0.020	-	0.032	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	<0.020	-	-	-
	2000	-	<0.020	-	0.032	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	<0.020	-	-	<0.020
	2001	-	<0.020	-	0.032	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	<0.020	<0.020	-	<0.020
	2002	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	<0.020	-	-	<0.020
	2003	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	<0.020	-	-	<0.020

[a] Sampling dates same as pre-submersion period dates given on Table 4-3.

TABLE 4-7
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

SURFACE WATER TRACE METAL ANALYSES

FROM 1993

Station Locations

Parameters	Year[a]	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R	PSDC1	PSAPD	PSDC2	PSIC
	1993	1.4	1.5	1.6	1.5	1.6	1.7	1.6	1.6	1.5	1.7	1.7	1.6	1.6	1.8	1.6	1.6	5.8	4.6	2.7	-
	1994	1.1	1.2	1.2	1.1	1.2	1.1	1.1	1.2	1.2	1.2	1.1	1.1	1.2	1.2	1.2	1.2	2.2	5.6	3.7	-
Magnesium	1995	1.4	1.4	1.6	1.4	1.6	1.4	1.6	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.5	1.6	7.2	6.6	4.2	-
(mg/l)	1996	1.3	1.5	1.5	1.4	1.5	1.3	1.5	1.6	1.6	1.6	1.5	1.6	1.5	1.6	1.5	1.6	3.1	4.6	5.4	-
	1997	1.4	1.4	1.6	1.5	1.4	1.6	2.1	1.5	1.5	1.7	1.4	1.5	1.4	1.5	1.4	1.5	2.5	5.8	1.6	-
	1998	1.4	1.6	1.6	1.5	1.7	1.6	1.6	1.6	1.6	1.9	1.7	1.7	1.6	1.8	1.6	1.0	2.0	6.2	2.3	-
	1999	-	1.5	-	1.5	-	1.6	-	1.7	-	1.8	-	1.6	-	1.7	-	1.6	2.6	-	-	-
	2000	-	1.7	-	1.8	-	1.9	-	1.9	-	1.9	-	1.9	-	2.1	-	2.0	3.0	-	-	5.4
	2001	-	1.4	-	1.5	-	1.6	-	1.6	-	1.8	-	1.6	-	1.7	-	1.7	2.0	30	-	1.7
	2002	-	1.7	-	1.7	-	1.8	-	1.8	-	1.9	-	1.8	-	2.0	-	1.9	2.3	-	-	1.7
	2003	-	1.4	-	1.4	-	1.6	-	1.5	-	1.60	-	1.5	-	1.5	-	1.5	2.60	-	-	6.1
	1993	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.002	<0.002	-
	1994	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-
Mercury	1995	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-
(mg/l)	1996	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-
	1997	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	-	-	-
	1998	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-
	1999	-	<0.0002	-	<0.0002	-	<0.0002	-	0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	<0.0002	-	-	-
	2000	-	<0.0002	-	<0.0002	-	<0.0002	-	0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	<0.0002	-	-	<0.0002
	2001	-	<0.0002	-	<0.0002	-	<0.0002	-	0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	<0.0002	<0.0002	-	<0.0002
	2002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	<0.0002	-	-	<0.0002
	2003	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	-	<0.0002	<0.0002	-	-	<0.0002
	1993	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
	1994	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.02	<0.020	<0.020	<0.020	<0.020	-
Nickel	1995	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
(mg/l)	1996	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
	1997	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
	1998	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.040	<0.040	<0.040	-
	1999	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	<0.040	-	-	-
	2000	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	<0.040	-	-	<0.040
	2001	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	<0.040	<0.040	-	<0.040
	2002	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	<0.040	-	-	<0.040
	2003	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	-	<0.040	<0.040	-	-	<0.040
	1993	1.8	2.0	2.2	1.5	1.7	1.7	1.7	2.0	1.5	1.6	1.6	1.7	1.9	1.8	1.7	1.7	2.9	5.5	1.9	-
	1994	1.6	1.5	1.3	1.7	1.6	1.6	1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.3	1.4	1.4	1.7	7.6	2.0	-
Potassium	1995	1.3	1.4	1.4	1.6	1.4	1.4	1.4	1.2	1.9	1.7	1.7	1.7	1.3	1.8	1.6	1.8	3.4	4.9	2.4	-
(mg/l)	1996	1.8	1.6	1.8	1.9	2.0	1.6	1.7	1.8	2.0	1.7	1.8	1.7	1.6	1.6	2.0	1.4	2.3	10	2.9	-
	1997	1.6	1.4	1.8	0.8	1.3	1.3	1.4	1.2	1.4	1.8	1.2	1.4	1.1	1.3	1.0	1.7	1.8	7.6	1.7	-
	1998	1.3	1.3	1.3	1.3	1.2	1.4	1.2	1.2	1.2	1.5	1.2	1.3	1.2	1.2	1.1	<1.0	1.3	8.1	1.4	-
	1999	-	1.4	-	1.4	-	1.5	-	1.5	-	1.5	-	1.4	-	1.4	-	1.4	1.6	-	-	-
	2000	-	2.3	-	2.4	-	2.3	-	2.3	-	2.2	-	2.2	-	2.5	-	2.2	2.5	-	-	3.6
	2001	-	1.5	-	1.5	-	1.5	-	1.5	-	1.6	-	1.5	-	1.5	-	1.5	1.5	42	-	1.5
	2002	-	2.0	-	2.0	-	2.1	-	2.0	-	2.1	-	2.1	-	2.0	-	2.0	1.7	-	-	2.0
	2003	-	1.8	-	1.8	-	1.9	-	1.9	-	1.90	-	1.8	-	1.8	-	1.8	2.40	-	-	3.9

Table 4-8 Summary of Trace Metal Analyses

Trace Metals	Water (mg/l)*
Aluminum	0.10 to 2.00
Arsenic	<0.002 to 0.0021
Boron	<0.050 to <0.050
Calcium	9.3 to 17
Chromium	<0.010 to 0.059
Copper	<0.002 to 0.010
Iron	0.13 to 1.90
Lead	<0.005 to 0.0071
Magnesium	1.0 to 2.1
Mercury	<0.0002 to 0.0002
Nickel	<0.02 to <0.04
Potassium	0.8 to 2.5
Selenium	<0.002 to <0.010
Sodium	3.5 to 12
Vanadium	<0.010
Zinc	<0.020 to 0.032

*__Bold__ text denotes changes made this year (2003).

Trace Metal Analyses of Stream Bottom Sediments

Beginning in 1993, composite stream bottom sediment samples were collected during each annual study period from up to 16 sampling stations and analyzed for 16 trace metals: aluminum, arsenic, boron, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, sodium, zinc, and vanadium.

The results of these analyses are summarized in Table 4-9. In general, during low flow periods, higher trace metal concentrations are found in the upper part of the study area (AR1-AR4), nearest Jim Woodruff Dam. Evidently, Lake Seminole acts as a natural sink in which various species of trace metals flocculate and precipitate out, then are redistributed downriver through periodic releases from Jim Woodruff Dam.

An examination of stream bottom profiles given in Appendix C and vertical mid-channel profiles presented in Appendix H indicate that topography and stream flow characteristics contribute significantly to this buildup of trace metals in the bottom mud within the study area. As the Plant Scholz database is added to from year to year, the deposition patterns of metals will become better defined, as well as better understood, regarding possible adverse effects, if any, on the surrounding environment. The range of values for river stations, since 1993, are presented as follows:

TABLE 4-9
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

STREAM BOTTOM SEDIMENT TRACE METAL ANALYSES (DRY WEIGHT BASIS)

FROM 1993

Station Locations

Parameters	Year[a]	Date	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
	1993	22-Jul	9800	2000	1200	3900	3000	9500	4800	5800	4300	2000	680	2300	1200	9800	6100	5600
	1994	28-Jul	4600	1900	2000	13000	5600	16000	950	9900	2100	4900	18000	4500	590	3400	9900	880
Aluminum	1995	14-Jul	4500	2200	8200	5600	1900	9300	9200	8700	8700	10000	3100	1800	820	8900	3500	7100
(mg/kg)	1996	15-Jul	2500	630	2300	9800	9400	10000	3800	5300	3900	25000	1500	4500	2200	7200	1300	1900
	1997	23-Jul	20000	640	15000	7800	6700	7300	1700	15000	3500	5800	8100	860	340	3400	8400	5600
	1998	21-Jul	3100	590	530	6000	2300	5900	710	6200	1800	6000	420	430	310	10000	4600	1700
	1999	24-Jun	-	26000	-	2800	-	18000	-	2800	-	4400	-	1800	-	15000	-	1900
	2000	24-Jun	-	520	-	3300	-	1900	-	2500	-	4300	-	840	-	6300	-	1200
	2001	29-Jun	-	570	-	3400	-	5300	-	6000	-	7200	-	810	-	3300	-	960
	2002	26-Jun	-	7600	-	6400	-	7100	-	5200	-	4100	-	2000	-	18000	-	2000
	2003	25-Jun	-	550	-	NA	-	5700	-	1700	-	15000	-	460	-	2300	-	10000
	1993	22-Jul	1.2	0.39	1.7	0.34	0.32	0.86	0.9	0.78	0.72	0.47	0.32	0.71	0.38	1.2	2.0	0.96
	1994	28-Jul	1.1	0.27	0.41	1.2	0.64	2.2	0.43	1.4	0.3	0.71	0.7	0.096	0.48	0.54	1.3	0.24
Arsenic	1995	14-Jul	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.1	1.4	<1.0	<2.0	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0
(mg/kg)	1996	15-Jul	0.44	0.23	0.91	1.1	0.79	0.99	0.58	0.77	0.72	3.1	0.83	0.42	0.4	0.57	0.42	0.35
	1997	23-Jul	1.4	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	1.1	<1.0	1.2	1.1	<1.0	<1.0	<1.0	1.1	1.4
	1998	21-Jul	<1.0	<1.0	1.3	1.3	<1.0	1.3	<1.0	1.6	<1.0	1.8	<1.0	<1.0	<1.0	2	1.2	<1.0
	1999	24-Jun	-	2.5	-	<1.0	-	2.1	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0
	2000	24-Jun	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	2.6	-	<1.0
	2001	29-Jun	-	<1.0	-	<1.0	-	<1.0	-	1.2	-	1.8	-	<1.0	-	1.6	-	<1.0
	2002	26-Jun	-	1.7	-	2.3	-	1.6	-	1.6	-	1.6	-	<1.0	-	3.3	-	<1.0
	2003	25-Jun	-	<1.0	-	NA	-	<1.0	-	<1.0	-	2.8	-	1.6	-	<1.0	-	2.2
	1993	22-Jul	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	1994	28-Jul	22	6.0	5.9	24	12	32	3.9	20	6.8	12	18	11	4.0	9.3	18	4.4
Boron	1995	14-Jul	<8.6	<7.2	<8.1	<7.5	<7.1	<7.6	<7.4	<7.9	<6.6	<7.8	<6.7	<6.8	<6.4	<7.2	<7.5	<7.9
(mg/kg)	1996	15-Jul	<6.3	<5.4	<6.2	<6.8	<7.8	<6.4	<6.6	<7.0	<7.1	<8.6	<5.5	<7.4	<5.3	<6.9	<5.5	<8.0
	1997	23-Jul	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	1998	21-Jul	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	1999	24-Jun	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0
	2000	24-Jun	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	5.3	-	<5.0
	2001	29-Jun	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0
	2002	26-Jun	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0	-	<5.0
	2003	25-Jun	-	<5.0	-	NA	-	<5.0	-	<5.0	-	5.1	-	<5.0	-	<5.0	-	<5.0
	1993	22-Jul	890	220	910	380	370	1100	1200	880	630	750	68	900	150	1800	530	1100
	1994	28-Jul	1300	470	450	1000	970	1100	660	1200	830	1000	2600	9600	100	780	1300	260
Calcium	1995	14-Jul	1300	320	1200	510	330	990	930	910	1100	1200	450	330	160	980	880	940
(mg/kg)	1996	15-Jul	470	100	420	850	1300	970	670	610	880	2000	180	620	330	810	190	4000
	1997	23-Jul	1800	2100	3700	690	760	600	8000	1100	780	780	840	230	62	410	840	32000
	1998	21-Jul	2300	1300	160	1100	340	820	1000	900	840	1000	78	990	95	1600	1100	9300
	1999	24-Jun	-	1400	-	370	-	1600	-	470	-	520	-	340	-	3000	-	39000
	2000	24-Jun	-	110	-	480	-	350	-	600	-	860	-	250	-	43000	-	320
	2001	29-Jun	-	230	-	480	-	630	-	1200	-	2100	-	180	-	43000	-	300
	2002	26-Jun	-	670	-	930	-	970	-	940	-	850	-	460	-	1200	-	650
	2003	25-Jun	-	190	-	NA	-	570	-	580	-	1800	-	130	-	7000	-	2000

TABLE 4-9
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

STREAM BOTTOM SEDIMENT TRACE METAL ANALYSES (DRY WEIGHT BASIS)

FROM 1993

Station Locations

Parameters	Year[a]	Date	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
	1993	22-Jul	18	5.5	5.3	8.8	6.6	16	9.4	13	9.8	5.4	3.4	6.6	4.2	18	12	11
	1994	28-Jul	16	5.0	5.4	22	11	26	3.8	18	6.0	11	34	10	2.8	8.6	16	3.9
Chromium	1995	14-Jul	9.9	5.8	11	12	4.7	16	15	20	3.0	19	6.8	4.6	2.9	13	8.5	12
(mg/kg)	1996	15-Jul	5.8	3.0	5.5	15	15	16	7.6	13	8.0	36	4.0	8.4	5.4	12	4.1	5.0
	1997	23-Jul	24	3.3	4.8	15	13	13	4.4	24	7.4	12	15	3.0	1.7	8.6	12	8.4
	1998	21-Jul	7.4	2.9	4.9	14	6.1	13	4.0	14	5.5	12	2.5	2.9	1.8	19	10	5.0
	1999	24-Jun	-	23	-	6.0	-	19	-	5.7	-	7.6	-	3.2	-	14	-	3.6
	2000	24-Jun	-	2.8	-	8.3	-	5.8	-	6.8	-	10	-	2.7	-	16	-	6.1
	2001	29-Jun	-	4.2	-	8.6	-	11	-	12	-	14	-	2.6	-	9.1	-	3.0
	2002	26-Jun	-	14	-	16.0	-	15	-	11	-	9.7	-	4.5	-	28	-	4.8
	2003	25-Jun	-	2.6	-	NA	-	12	-	5.1	-	26	-	2.1	-	5.7	-	18
	1993	22-Jul	2.8	1.0	2.7	1.1	0.83	2.7	2.1	2.0	1.6	1.0	<0.50	0.96	0.5	3.5	2.7	1.8
	1994	28-Jul	3.4	0.86	0.87	4.8	2.8	6.1	0.62	4.4	1.0	2.1	8.1	2.1	<0.50	1.4	3.7	0.8
Copper	1995	14-Jul	4.2	1.2	4.2	2.1	1.2	4.0	3.0	4.7	<0.50	4.0	1.6	0.93	0.73	3.0	1.8	3.1
(mg/kg)	1996	15-Jul	2.1	<0.05	2.7	3.6	3.7	4.0	1.4	2.8	1.9	8.3	<0.05	1.8	0.85	2.3	0.78	0.85
	1997	23-Jul	5.8	0.61	2.0	2.5	2.0	1.9	0.68	4.3	1.6	2.2	2.1	<0.50	<0.50	1.1	2.6	2.4
	1998	21-Jul	3.1	2.2	5.5	3.7	2.8	5.2	1.9	3.6	2.4	5.7	1.2	<1.0	1.4	7.6	5.0	1.5
	1999	24-Jun	-	11	-	1.9	-	8.1	-	1.5	-	2.6	-	1.2	-	5.3	-	2.0
	2000	24-Jun	-	<2.0	-	2.6	-	<2.0	-	<2.0	-	3.6	-	<2.0	-	24	-	<2.0
	2001	29-Jun	-	3.0	-	5.0	-	6.5	-	8.0	-	9.4	-	2.7	-	20	-	2.9
	2002	26-Jun	-	7.6	-	6.6	-	7.2	-	11.0	-	6.7	-	3.8	-	15	-	8.0
	2003	25-Jun	-	4.6	-	NA	-	9.4	-	4.7	-	13	-	3.7	-	4.7	-	12
	1993	22-Jul	12000	3600	18000	4600	3900	9500	6800	7800	6200	3700	1800	4900	3000	12000	8400	7300
	1994	28-Jul	6900	3300	3400	15000	6600	21000	2000	12000	3700	6600	9800	6500	2600	4800	12000	2800
Iron	1995	14-Jul	8600	3600	10000	7600	3000	13000	1000	14000	1700	12000	6200	3100	2200	9800	6400	8600
(mg/kg)	1996	15-Jul	3300	1500	6900	12000	10000	12000	5400	8300	6700	25000	7500	5300	3400	8200	2400	3000
	1997	23-Jul	20000	2400	8800	9600	8500	8700	2400	1400	5600	7700	10000	1900	960	4700	8900	5900
	1998	21-Jul	4600	1800	16000	7000	3600	8300	2000	8300	3700	8800	1500	1300	1000	9700	8200	3200
	1999	24-Jun	-	32000	-	4500	-	20000	-	4500	-	5800	-	3000	-	17000	-	3900
	2000	24-Jun	-	1900	-	6800	-	3700	-	4400	-	7200	-	1800	-	11000	-	3800
	2001	29-Jun	-	3200	-	5400	-	6700	-	8800	-	10000	-	1600	-	7800	-	2100
	2002	26-Jun	-	9500	-	11000	-	9400	-	8000	-	6800	-	3300	-	29000	-	3500
	2003	25-Jun	-	1600	-	NA	-	6600	-	3800	-	18000	-	1400	-	4300	-	14000
	1993	22-Jul	8.4	2.3	6.5	3.3	2.6	5.1	4.2	4.0	3.8	2.1	2.0	2.7	2.4	6.1	4.3	4.2
	1994	28-Jul	6.9	1.8	2.2	7.9	5.3	9.0	1.0	6.4	2.2	4.2	9.4	3.9	1.8	3.0	6.9	1.4
Lead	1995	14-Jul	10	2.8	7.4	3.9	2.8	6.2	4.6	10	0.66	5.6	2.8	2.0	1.7	5.2	5.3	5.5
(mg/kg)	1996	15-Jul	7.1	1.7	13	7.2	5.7	6.8	3.8	6.4	4.3	13	2.4	3.8	2.9	5.4	1.7	2.9
	1997	23-Jul	13	0.58	10	6.0	5.1	4.0	2.6	8.0	4.3	5.3	7.0	1.9	0.73	4.4	6.9	5.5
	1998	21-Jul	4.1	0.67	9.3	5.9	3.4	5.8	1.4	6	3.3	6.1	1.1	0.82	1.0	7.4	5.8	1.3
	1999	24-Jun	-	9.3	-	3.2	-	7.5	-	2.7	-	3.6	-	1.6	-	6.3	-	1.4
	2000	24-Jun	-	1.0	-	4.6	-	2.6	-	3.3	-	4.8	-	1.4	-	6.1	-	1.7
	2001	29-Jun	-	1.0	-	3.4	-	4.1	-	5.1	-	5.8	-	1.2	-	3.0	-	1.4
	2002	26-Jun	-	6.2	-	6.5	-	5.2	-	5.0	-	3.8	-	2.0	-	8.7	-	1.7
	2003	25-Jun	-	0.83	-	NA	-	4.9	-	2.0	-	8.0	-	0.80	-	2.8	-	7.7

TABLE 4-9

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

STREAM BOTTOM SEDIMENT TRACE METAL ANALYSES (DRY WEIGHT BASIS)

FROM 1993

Station Locations

Parameters	Year[(a)]	Date	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
	1993	22-Jul	1100	230	140	520	370	1300	760	1000	680	390	60	580	130	1500	430	890
	1994	28-Jul	920	380	330	1600	570	1800	350	1500	480	880	1700	840	52	660	920	140
Magnesium	1995	14-Jul	510	390	680	830	240	1400	960	1100	540	1700	350	310	110	1100	570	930
(mg/kg)	1996	15-Jul	230	61	190	1200	1000	1400	480	820	620	2800	170	600	260	950	140	2200
	1997	23-Jul	1200	590	100	1100	910	1000	3400	1700	580	1000	1000	150	<25	550	720	17000
	1998	21-Jul	370	540	<50	1000	380	1000	540	1100	400	970	<50	<50	<50	1600	750	230
	1999	24-Jun	-	1700	-	430	-	1700	-	540	-	590	-	270	-	1900	-	300
	2000	24-Jun	-	58	-	580	-	380	-	530	-	850	-	170	-	25000	-	200
	2001	29-Jun	-	110	-	560	-	830	-	1000	-	1200	-	120	-	23000	-	150
	2002	26-Jun	-	870.0	-	1100	-	1200	-	880	-	810	-	330	-	1800	-	360
	2003	25-Jun	-	52	-	NA	-	830	-	390	-	2100	-	<50	-	2600	-	1600
	1993	22-Jul	0.022	0.0065	0.0078	0.0087	<0.0050	0.018	0.0099	0.011	0.0066	0.0075	<0.0050	0.0076	<0.0050	0.016	0.024	0.011
	1994	28-Jul	0.015	<0.0050	0.0058	0.019	0.018	0.022	<0.0050	0.026	0.006	0.011	0.022	0.0097	<0.0050	0.0091	0.022	<0.0050
Mercury	1995	14-Jul	0.018	0.0054	0.024	0.019	0.01	0.019	0.02	0.046	<0.0050	0.016	0.0099	0.0062	<0.0050	0.014	0.019	0.017
(mg/kg)	1996	15-Jul	0.0057	<0.0050	0.014	0.014	0.019	0.018	0.014	0.028	0.016	0.031	<0.0050	0.0063	0.011	0.0079	<0.0050	0.0054
	1997	23-Jul	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	1998	21-Jul	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	1999	24-Jun	-	0.037	-	<0.03	-	<0.03	-	<0.03	-	<0.03	-	<0.03	-	<0.03	-	<0.03
	2000	24-Jun	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020
	2001	29-Jun	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020
	2002	26-Jun	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020
	2003	25-Jun	-	<0.020	-	NA	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	<0.020	-	0.020
	1993	22-Jul	4.4	1.5	2.3	2.1	1.9	4.2	3.1	3.8	2.7	1.5	0.75	1.6	1.2	5.1	3.1	3.1
	1994	28-Jul	4.7	5.0	<1.0	7.5	3.4	8.1	<1.0	5.4	1.6	2.9	11	3.7	1.1	2.4	4.8	1.5
Nickel	1995	14-Jul	3.6	1.7	2.9	2.9	1.4	5.1	4.5	5.0	<1.0	5.3	2.4	1.5	1.2	4.2	2.4	4.1
(mg/kg)	1996	15-Jul	2.2	1.1	2.0	4.8	4.7	5.4	3.1	3.3	2.5	10	1.9	3.0	1.9	3.2	1.2	2.0
	1997	23-Jul	8.1	2.0	1.9	4.0	3.4	2.8	1.1	7.5	2.4	3.3	4.3	<1.0	<1.0	2.1	3.1	3.2
	1998	21-Jul	<2.0	<2.0	<2.0	3.9	<2.0	3.6	<2.0	3.6	<2.0	3.5	<2.0	<2.0	<2.0	5.7	2.8	<2.0
	1999	24-Jun	-	9.4	-	<4.0	-	7.7	-	<4.0	-	<4.0	-	<4.0	-	4.6	-	<4.0
	2000	24-Jun	-	<4.0	-	<4.0	-	<4.0	-	<4.0	-	<4.0	-	<4.0	-	4.9	-	<4.0
	2001	29-Jun	-	<4.0	-	<4.0	-	<4.0	-	<4.0	-	<4.0	-	<4.0	-	10	-	<4.0
	2002	26-Jun	-	4.8	-	<4.0	-	4.4	-	<4.0	-	<4.0	-	<4.0	-	8.1	-	1.6
	2003	25-Jun	-	<4.0	-	NA	-	6.6	-	<4.0	-	8.0	-	<4.0	-	<4.0	-	5.6
	1993	22-Jul	660	160	68	400	280	830	300	750	540	160	55	340	89	620	330	470
	1994	28-Jul	600	220	240	960	310	1100	91	880	220	520	1200	510	<50	380	570	90
Potassium	1995	14-Jul	370	350	480	680	210	1000	590	800	62	1300	280	250	98	760	370	670
(mg/kg)	1996	15-Jul	160	62	160	840	770	990	240	580	350	1800	140	460	220	600	140	250
	1997	23-Jul	900	65	100	900	790	880	150	1300	350	810	780	84	<50	480	520	470
	1998	21-Jul	240	<100	<100	720	300	740	<100	750	230	600	<100	<100	<100	940	390	100
	1999	24-Jun	-	1200	-	340	-	1200	-	370	-	470	-	120	-	480	-	170
	2000	24-Jun	-	<100	-	460	-	400	-	430	-	690	-	<100	-	820	-	<100
	2001	29-Jun	-	40	-	460	-	660	-	660	-	820	-	79	-	460	-	71
	2002	26-Jun	-	570	-	800	-	880	-	600	-	550	-	170	-	1100	-	130
	2003	25-Jun	-	<100	-	NA	-	720	-	230	-	1500	-	<100	-	380	-	840

TABLE 4-9
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

STREAM BOTTOM SEDIMENT TRACE METAL ANALYSES (DRY WEIGHT BASIS)

FROM 1993

Station Locations

Parameters	Year[a]	Date	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
	1993	22-Jul	0.072	<0.050	<0.050	<0.050	<0.050	0.065	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.062	<0.050
	1994	28-Jul	0.13	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.10	<0.100	<0.100	0.22	<0.100	<0.100	<0.100	0.10	<0.100
Selenium	1995	14-Jul	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
(mg/kg)	1996	15-Jul	<0.010	<0.010	0.12	0.16	0.19	0.16	<0.100	0.13	0.11	0.67	<0.100	0.11	<0.100	0.11	<0.100	<0.100
	1997	23-Jul	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00
	1998	21-Jul	<1.0	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	1999	24-Jun	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0
	2000	24-Jun	-	<10	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0
	2001	29-Jun	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0
	2002	26-Jun	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0
	2003	25-Jun	-	<1.0	-	NA	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0	-	<1.0
	1993	22-Jul	63	15	49	18	19	30	23	26	21	16	12	18	11	32	26	27
	1994	28-Jul	<50	<50	<50	<50	<50	75	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Sodium	1995	14-Jul	34	23	35	32	19	44	40	32	19	50	22	19	24	37	27	36
(mg/kg)	1996	15-Jul	<50	<50	<50	<50	<50	<50	<50	<50	<50	73	<50	<50	<50	<50	<50	<50
	1997	23-Jul	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	150
	1998	21-Jul	<250	<250	<250	<250	<250	<250	<250	<250	<250	<5250	<250	<250	<250	<250	<250	<250
	1999	24-Jun	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250
	2000	24-Jun	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250	-	340	-	<250
	2001	29-Jun	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250	-	440	-	<250
	2002	26-Jun	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250
	2003	25-Jun	-	<250	-	NA	-	<250	-	<250	-	<250	-	<250	-	<250	-	<250
	1993	22-Jul	25	7.2	4.0	10	7.4	19	12	15	12	5.9	3.4	7.8	5.5	24	14	13
	1994	28-Jul	22	6.4	6.4	30	14	36	4.4	23	7.8	14	38	14	3.5	11	23	4.7
Vanadium	1995	14-Jul	14	7.6	18	15	6.2	22	21	22	3.6	24	10	6.2	3.5	20	12	17
(mg/kg)	1996	15-Jul	6.8	2.7	7.0	22	21	22	11	14	11	47	8.6	10	6.8	17	4.6	6.8
	1997	23-Jul	35	3.1	3.7	18	16	16	4.9	29	8.8	16	18	3.4	1.3	10	15	12
	1998	21-Jul	8.8	2.5	3.0	16	6.9	17	3.4	17	6.3	17	1.8	2.0	1.5	24	15	5.4
	1999	24-Jun	-	41	-	7.3	-	27	-	7.0	-	10	-	4.1	-	24	-	5.0
	2000	24-Jun	-	2.7	-	11	-	6.7	-	8.0	-	13	-	3.2	-	18	-	7.8
	2001	29-Jun	-	3.9	-	11	-	14	-	16	-	19	-	3.3	-	11	-	3.5
	2002	26-Jun	-	20	-	21	-	19	-	14	-	12	-	5.8	-	50	-	5.6
	2003	25-Jun	-	2.3	-	NA	-	15	-	5.6	-	35	-	2.2	-	7.6	-	2.6
	1993	22-Jul	22	5.5	6.8	8.2	7.8	17	14	15	10	7.2	3.9	8.4	5.0	19	14	14
	1994	28-Jul	28	8.7	9.3	30	19	36	4.8	24	8.9	16	52	15	6.1	11	25	6.4
Zinc	1995	14-Jul	24	7.9	21	14	7.4	25	21	25	4.8	25	7.4	7.4	6.1	19	13	22
(mg/kg)	1996	15-Jul	13	3.3	11	20	20	21	9.3	15	13	41	8.8	9.8	6.7	14	5.6	5.9
	1997	23-Jul	38	4.7	6.6	26	15	14	4.8	28	13	14	17	4.3	3.0	8.4	16	12
	1998	21-Jul	11	4.5	16	19	7.7	18	4.4	18	8.6	18	4.1	3.2	3.4	27	16	8.2
	1999	24-Jun	-	44	-	8.4	-	37	-	8.6	-	14	-	7.0	-	22	-	10
	2000	24-Jun	-	5.3	-	10	-	6.5	-	9	-	14	-	4.4	-	15	-	7.8
	2001	29-Jun	-	5.6	-	9.9	-	15	-	20	-	24	-	4.4	-	9.9	-	5.8
	2002	26-Jun	-	18	-	18	-	21	-	20	-	16	-	7.7	-	33	-	8.9
	2003	25-Jun	-	5.6	-	NA	-	18	-	6.7	-	32	-	3.8	-	10	-	31

Table 4-10 Summary of Stream Bottom Trace Metal Analyses

Trace Metals	Sediment (mg/kg)*
Aluminum	310 to 26000
Arsenic	0.096 to 3.3
Boron	3.9 to 22.0
Calcium	62 to 43000
Chromium	1.7 to 36.0
Copper	<0.50 to 24
Iron	960 to 32000
Lead	0.58 to 13.0
Magnesium	52 to 25000
Mercury	<0.005 to .046
Nickel	0.75 to 11.0
Potassium	40 to 1800
Selenium	<0.050 to 1.1
Sodium	11 to 340
Vanadium	1.3 to 50.0
Zinc	3.0 to 52.0

***Bold** text denotes changes made this year (2003).

Trace Metal Analyses of Fish Tissues

In 1999, eight fish tissue samples were collected from the area of the cooling water intake screens (6 samples) and the cooling water discharge canal (2 samples) and analyzed for 16 trace metals: aluminum, arsenic, boron, calcium, chromium, copper, iron, lead, magnesium, mercury, nickel, potassium, selenium, sodium, zinc, and vanadium. Fish tissue sampling was initiated in order to investigate whether elevated heavy metal levels (possibly originating from river bottom sediment) were present in the area fish populations.

The results of these analyses are summarized in Table 4-11. The ranges of values for the intake and discharge canals are presented as follows:

TABLE 4-11
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

FISH TISSUE TRACE METAL ANALYSES (DRY WEIGHT BASIS)

FROM 1993

Station Locations

Parameters	Year	SH1	SH2	SH3	SH4	SH5	SH6	SH7	SH8
Aluminum (mg/kg)	1999	<20	<20	<20	<20	24	<20	<20	<20
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic (mg/kg)	1999	1.6	1.0	<1.0	<1.0	<1.0	1.4	3.2	1.3
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Boron (mg/kg)	1999	<5.0	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Calcium (mg/kg)	1999	1600	5800	2500	980	1200	1800	11000	3200
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chromium (mg/kg)	1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.7	<1.0
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Copper (mg/kg)	1999	2.8	2.2	7.6	1.2	2.9	1.2	2.4	2.0
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Iron (mg/kg)	1999	38	22	21	29	26	11	16	20
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Lead (mg/kg)	1999	0.081	0.85	0.69	<0.50	0.72	<0.50	<0.50	0.81
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Magnesium (mg/kg)	1999	1300	1400	1200	1200	1300	1300	1600	1500
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 4-11
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

FISH TISSUE TRACE METAL ANALYSES (DRY WEIGHT BASIS)

FROM 1993

Station Locations

Parameters	Year	SH1	SH2	SH3	SH4	SH5	SH6	SH7	SH8
Mercury (mg/kg)	1999	0.10	0.050	0.10	0.058	0.057	0.046	0.033	0.032
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Nickel (mg/kg)	1999	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Potassium (mg/kg)	1999	19000	16000	18000	9700	14000	16000	20000	16000
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Selenium (mg/kg)	1999	3.3	2.7	2.5	2.2	1.7	2.1	3.0	2.4
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sodium (mg/kg)	1999	2300	2100	2300	4500	2700	2200	3000	3200
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vanadium (mg/kg)	1999	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Zinc (mg/kg)	1999	52	63	77	38	56	33	63	59
	2000	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2002	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2003	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 4-12 Summary of Fish Tissue Trace Metal Analyses

Trace Metals	Fish Tissue (mg/kg)
Aluminum	<20 to 24
Arsenic	<1.0 to 3.2
Boron	<5.0
Calcium	980 to 11000
Chromium	<1.0
Copper	1.2 to 7.6
Iron	11 to 38
Lead	<0.50 to 0.85
Magnesium	1300 to 16000
Mercury	0.033 to 0.10
Nickel	<4.0
Potassium	9700 to 20000
Selenium	1.7 to 3.3
Sodium	2100 to 4500
Vanadium	<1.0
Zinc	33 to 77

DataSonde Water Quality Monitoring

Beginning in 1993, Hydrolab or YSI DataSonde water quality dataloggers were installed annually in the Apalachicola River for one four-week period, just upstream and downstream from the confluence of the Plant Scholz cooling water discharge canal. The sampling locations are as follows: station AR4R, which is located approximately 0.16 mile upstream from the cooling water discharge canal; and station AR5R, which is located just downstream from the discharge canal. The DataSondes are programmed to measure temperature (°C), dissolved oxygen (mg/l), pH (su), and conductivity (mhos/cm) at 15-minute intervals for 30 days. The resulting data are summarized on Tables 4-14 through 4-17. A brief summary of data collected thus far is presented below:

Table 4-13 Summary of Datasonde Water Monitoring Data

Year	Avg. Temp.(°C)		Avg. pH (Units)		Avg. Cond. (mhos/cm)		Avg. D.O. (mg/l)	
	AR4R	AR5R	AR4R	AR5R	AR4R	AR5R	AR4R	AR5R
1993	30.01	30.95	6.90	6.99	0.155	0.270	*	*
1994	26.86	26.12	7.34	7.00	0.122	0.171	*	*
1995	29.45	30.70	7.96	7.87	0.145	0.165	5.19	4.55
1996	29.26	30.22	7.59	7.35	0.145	0.158	5.33	5.19
1997	28.96	29.44	7.30	7.32	0.062	0.159	6.06	*
1998	29.50	30.70	*	7.23	0.135	0.134	5.67	5.31
1999	28.02	28.70	7.34	6.90	0.122	0.147	6.57	6.60
2000	28.87	29.50	7.15	7.10	0.147	0.150	4.86	5.24
2001	29.11	30.18	6.68	6.60	0.116	0.106	5.25	5.65
2002	29.10	29.78	7.21	7.17	0.149	0.155	5.92	5.52
2003	27.60	27.96	6.86	7.07	0.090	0.100	8.22	9.93

* No data available.

TABLE 4-14

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
DATASONDE WATER MONITORING DATA

Average Daily Values For Temperature, °C (°F)

Submersion Period	Station Location	Average Temperature, °C (°F)
07/21/93 - 08/20/93	AR4R[1]	30.01(86.02)
	AR5R[1]	30.95(87.71)
07/28/94 - 08/28/94	AR4R	26.86(80.35)
	AR5R	26.12(79.02)
07/14/95 - 08/15/95	AR4R	29.45(85.01)
	AR5R	30.70(87.26)
07/15/96 - 08/17/96	AR4R	29.26(84.67)
	AR5R	30.22(86.40)
07/22/97 - 08/23/97	AR4R	28.96(84.13)
	AR5R	29.44(84.99)
07/20/98 – 08/20/98	AR4R	29.50(85.10)
	AR5R	30.70(87.26)
06/23/99 – 07/19/99	AR4R	28.02(82.44)
	AR5R	28.70(83.66)
06/23/00 – 07/25/00	AR4R	28.87(83.97)
	AR5R	29.50(85.10)
06/28/01 – 07/26/01	AR4R	29.11(84.40)
	AR5R	30.18(86.32)
06/25/02 – 07/23/02	AR4R	29.10(84.38)
	AR5R	29.78(85.60)
06/24/03 – 07/21/03	AR4R	27.60(81.68)
	AR5R	27.96(82.33)

(1) Instruments shut off prematurely due to data overload.

TABLE 4-15

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
DATASONDE WATER MONITORING DATA

Average Daily Values for pH

Submersion Period	Station Location	Average pH (Units)
07/21/93 - 08/20/93	AR4R[1]	6.90
	AR5R[1]	6.99
07/28/94 - 08/28/94	AR4R	7.34
	AR5R	7.00
07/14/95 - 08/15/95	AR4R	7.96
	AR5R	7.87
07/15/96 - 08/17/96	AR4R	7.59
	AR5R	7.35
07/22/97 - 08/23/97	AR4R	7.30
	AR5R	7.32
07/20/98 – 08/20/98	AR4R	no data[2]
	AR5R	7.23
06/23/99 – 07/19/99	AR4R	7.34
	AR5R	6.90
06/23/00 – 07/25/00	AR4R	7.15
	AR5R	7.10
06/28/01 – 07/26/01	AR4R	6.68
	AR5R	6.60
06/25/02 – 07/23/02	AR4R	7.21
	AR5R	7.17
06/24/03 – 07/21/03	AR4R	6.86
	AR5R	7.07

(1) Instruments shut off prematurely due to data overload.
(2) The pH electrode was destroyed at beginning of sampling run.

TABLE 4-16

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
DATASONDE WATER MONITORING DATA

Average Daily Values For Conductivity (mhos/cm)

Submersion Period	Station Location	Average Conductivity (mhos/cm)
07/21/93 - 08/20/93	AR4R[1]	0.150
	AR5R[1]	0.270
07/28/94 - 08/28/94	AR4R	0.122
	AR5R	0.170
07/14/95 - 08/15/95	AR4R	0.1449
	AR5R	0.1646
07/15/96 - 08/17/96	AR4R	0.1446
	AR5R	0.1583
07/22/97 - 08/23/97	AR4R	0.0622
	AR5R	0.1593
07/20/98 – 08/20/98	AR4R	0.1347
	AR5R	0.1336
06/23/99 – 07/19/99	AR4R	0.1219
	AR5R	0.1472
06/23/00 – 07/25/00	AR4R	0.1473
	AR5R	0.1502
06/28/01 – 07/26/01	AR4R	0.1160
	AR5R	0.1060
06/25/02 – 07/23/02	AR4R	0.1490
	AR5R	0.1550
06/24/03 – 07/21/03	AR4R	0.090
	AR5R	0.100

(1) Instruments shut off prematurely due to data overload.

TABLE 4-17

GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
DATASONDE WATER MONITORING DATA

Average Daily Values For Dissolved Oxygen (mg/l)

Submersion Period	Station Location	Average Dissolved Oxygen (mg/l)[3]
07/21/93 - 08/20/93	AR4R[1]	No Data
	AR5R[1]	No Data
07/28/94 - 08/28/94	AR4R[2]	No Data
	AR5R[2]	No Data
07/14/95 - 08/15/95	AR4R	5.19
	AR5R	4.55
07/15/96 - 08/17/96	AR4R	5.33
	AR5R	5.19
07/22/97 - 08/23/97	AR4R	6.06
	AR5R[2]	No Data
07/20/98 – 08/20/98	AR4R	5.03
	AR5R	4.48
06/23/99 – 07/19/99	AR4R	6.57
	AR5R	6.60
06/23/00 – 07/25/00	AR4R	4.86
	AR5R	5.24
06/28/01 – 07/26/01	AR4R	5.25
	AR5R	5.65
06/25/02 – 07/23/02	AR4R	5.92
	AR5R	5.52
06/24/03 – 07/21/03	AR4R	8.22
	AR5R	9.93

(1) Instruments shut off prematurely due to data overload.
(2) Data not representative; protective socks on probe head caused interference.
(3) Seven-day average only; significant fouling occurs after seven days.

Vertical Mid-Channel Profiles

Beginning in 1993, vertical profiles for temperature (°C), dissolved oxygen (mg/l), pH (su), and conductivity (mhos/cm) were collected as needed in eight mid-channel areas of the Apalachicola River. The profiles were collected twice per study period to better define water quality conditions occurring in the vertical water column.

These measurements were incorporated into the Plant Scholz monitoring program in order to better document the natural water quality conditions which develop during the study period, from year to year. The resulting data (Appendix H) allow a greater understanding of water quality conditions resulting from water releases from Jim Woodruff Dam.

A cursory examination of vertical profiles indicates that the vertical distribution of temperature, pH, and conductivity values remained relatively constant within the study area throughout the study period. The Apalachicola River in our study area resembles a free-flowing stream exhibiting essentially homogenous water quality conditions from surface to bottom. With respect to dissolved oxygen concentrations, there is a decided influence exerted by water releases from Jim Woodruff Dam. For example, a 50-percent increase in stream flow, according to U. S. Geological Survey records, (from 9590 ft^3/s on 7/22/93 to 14,100 ft^3/s on 8/19/93) resulted in approximately a 50-percent increase in dissolved oxygen along the river bottom (from an average of 3.28 mg/l on 7/22/93 to 5.69 mg/l on 8/19/93).

In a report by state fisheries biologists studying the fisheries ecology and dredging impacts (by the U. S. Army Corps of Engineers) on the Apalachicola River system, similar low dissolved oxygen conditions were noted to occur in a 25-mile stretch of river below Jim Woodruff Dam, which includes our study area. No explanation was offered, except the possibility that a large die-off of the Asiatic clam, Corbicula fluminea, below Jim Woodruff Dam could cause such depressed oxygen conditions (Florida Game and Fresh Water Fish Commission, 1986). While taking river sediment samples for chemical analysis in July 1993, Ron Ammons and Hainey Tackett found it virtually impossible to use a Petite Ponar dredge for this purpose, so profuse were the dead clams at station AR1, just downstream from Jim Woodruff Dam.

Biological Results

The health of an aquatic ecosystem is degraded when the ecosystem's assimilative capacity to absorb a stress has been exceeded. A healthy ecosystem is composed of biotic communities (such as phytoplankton, zooplankton, macroscopic benthic invertebrates, and fish) and abiotic characteristics (such as temperature, salinity, and flow) which form a self-regulating and self-sustaining unit. Although changes within an ecosystem can result from naturally occurring events, anthropogenic activities often impose stresses on these systems. When organisms of an ecosystem are exposed to stress, their resistance to displacement from that ecosystem may be exceeded. Depending upon the magnitude and temporal nature of the stress, the organisms may not be sufficiently resilient to reestablish their pre-stress community structure. The community structure of an aquatic ecosystem is sensitive to, and determined by, the conditions and resources available within a habitat. Conditions include abiotic environmental factors, which vary with time and space (e.g., temperature, salinity, and flow). Resources are all things consumed by an organism (e.g., food, light, and space). Organisms that come to make up an aquatic community are those that can endure, tolerate, compete, reproduce, and persist within a given habitat. If a habitat is characterized by conditions that are within acceptable limits and provides all necessary resources for a given species, that species could potentially occur there (Loeb, et al., 1994; pp. 3-4).

Macroscopic Benthic Invertebrates

Population characteristics of benthos communities were used to biologically monitor water quality conditions existing in the Apalachicola River near the Plant Scholz facility.

Environmental Monitoring Program

Sixteen sampling stations have been established in the study area along approximately 7.3 miles of Apalachicola River. As has been mentioned previously, eight of these stations (AR1R, AR1L, AR2R, AR2L, AR3R, AR3L, AR4R and AR4L) are considered control stations, while the remaining eight stations (AR5R, AR5L, AR6R, AR6L, AR7R, AR7L, AR8R, and AR8L) are designated as "test" stations. The manner in which the biological data is evaluated is perhaps best explained by an examination of sheets one and two of Table 4-18. On sheet one, the average species diversity values (Shannon-Weaver Index) of bottom-dwelling fishfood populations are given; along with a measure of productivity which is expressed as total number fishfood organisms per unit area. After determining the minimum and maximum control station values, the range of natural variance for population diversity and productivity is determined. This is accomplished by subtracting 25 percent of the minimum control station value, from the minimum control station value, and adding 25 percent of the maximum control station value to the maximum control station value. To evaluate study results, any "test" station value which is higher or lower than the natural variance span of control station values is considered by SCS to be a significant deviation from normal. Referring to sheet two of Table 4-18, any average parameter value, which has a coefficient of variation greater than approximately 25 percent, is viewed by SCS as questionable and may not accurately represent actual conditions present at that location. Detailed laboratory data sheets for each study year are presented in Appendix I.

As a general rule, average values (from 2-3 replicate samples) for benthic population diversity and productivity, as expressed in individuals per unit area, are representative, i.e., falling within 25 percent coefficient of variance; while those values for wet weight, in most cases, are not. Therefore, due to the size variability of specimens collected, detailed discussions regarding productivity, as expressed by wet weight will be avoided. Results and conclusions are as follows:

- The biological stability and productivity of bottom-dwelling fishfood populations in the Apalachicola River, since monitoring activities began in 1993, indicate that water quality conditions are essentially unaffected by the discharge of cooling water from Plant Scholz (Table 4-18, Figures 4-3 and 4-4). Neither the population species diversity value, nor the total number (productivity) of benthic animals per unit area at either station AR5R, or any of the other test stations, were less than 25 percent of the minimum control station values for the study area.

TABLE 4-18 (Sheet 1 of 2)
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
ENVIRONMENTAL MONITORING PROGRAM

A SUMMARY OF MACROSCOPIC BENTHIC INVERTEBRATE POPULATIONS COLLECTED FROM ARTIFICIAL SUBSTRATES
IN THE APALACHICOLA RIVER (AR)

Average Species Diversity [d] of Benthic Invertebrate Populations

Submersion Period of Artificial Substrates	AR1L[a]	AR1R[a]	AR2L[a]	AR2R[a]	AR3L[a]	AR3R[a]	AR4L[a]	AR4R[a]	±25 Percent Range of Natural Variance[d]	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
07/21/93 - 08/20/93	2.07[b]	2.32	3.39	2.93	3.21	2.90	2.99	3.53[c]	(1.55 - 4.41)	3.54	3.3	3.01	2.4	3.15	3.05	3.37	3.11
07/28/94 - 08/28/94	3.03	2.36	2.95	3.08	2.95	3.05	3.24[c]	1.92[b]	(1.44 - 4.05)	2.19	2.89	2.42	2.09	3.3	2.69	2.61	2.55
07/14/95 - 08/15/95	2.86	2.26[b]	3.89	2.57	3.61	4.13[c]	3.17	3.43	(1.69 - 5.16)	2.54	3.65	3.95	3.63	LOST	3.64	3.82	3.12
07/15/96 - 08/17/96	2.85	2.68	3.11	3.57	2.89	2.18[b]	LOST	3.81[c]	(1.64 - 4.76)	LOST	3.46	LOST	LOST	4.07	3.78	3.53	2.58
07/21/97 - 08/22/97(e)	0.50[b]	0.58	3.39	2.32	4.66[c]	2.95	3.96	4.59	(0.38 - 5.83)	4.44	4.98	4.88	4.82	4.23	3.25	5.2	5.25
07/19/98 - 08/20/98 (f)	3.12	3.07	2.40	3.15	2.32[b]	3.01	3.22[c]	2.83	(1.74 - 4.03)	2.48	3.01	3.14	3.41	2.18	3.18	3.59	2.53
06/23/99 – 07/19/99	2.48	2.76	2.99	3.07	2.13	3.21	2.73	2.89	(1.59 - 4.01)	2.25	3.1	2.82	3.05	2.16	2.53	2.67	2.15
06/23/00 – 07/25/00	2.04[b]	2.24	3.77	3.49	3.09	3.96	3.18	3.99[c]	(1.53 - 4.99)	2.59	4.12	3.69	3.37	2.96	3.80	2.98	3.10
06/28/01 – 07/26/01	3.12	2.45	2.66	3.36	2.21[b]	3.47	3.90[c]	3.21	(1.66 - 4.88)	2.81	4.19	1.06	3.26	3.24	3.06	3.59	3.55
06/25/02 – 07/23/02	1.13[b]	1.52	3.00	1.96	3.52	2.96	3.28	3.90[c]	(0.85 - 4.54)	3.02	3.39	3.64	3.95	3.65	3.63	3.99	3.39
06/24/03 – 07/21/03	3.61	3.41	3.04	3.53	*2.62[b]	3.75[c]	3.42	3.42	(1.97 - 4.69)	4.33	3.72	3.96	LOST	3.04	2.88	3.11	3.93

Average Number of Benthic Invertebrates Per Unit Area

Submersion Period of Artificial Substrates	AR1L[a]	AR1R[a]	AR2L[a]	AR2R[a]	AR3L[a]	AR3R[a]	AR4L[a]	AR4R[a]	±25 Percent Range of Natural Variance[d]	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
07/21/93 - 08/20/93	873	885	228[b]	478	793	1184[c]	237	249	(171 - 1480)	216	155	795	407	220	299	83	209
07/28/94 - 08/28/94	234	546[c]	205	150	108[b]	143	198	223	(81 - 683)	110	96	564	831	160	152	182	127
07/14/95 - 08/15/95	375	1004[c]	517	341	410	440	331	308[b]	(231 - 1255)	346	366	274	348	LOST	144	206	392
07/15/96 - 08/17/96	1055[c]	799	267	345	485	235[b]	LOST	348	(176 - 1319)	LOST	283	LOST	LOST	221	256	224	200
07/21/97 - 08/22/97(e)	275	833	1197[c]	289	54	52[b]	120	116	(39-1496)	126	88	161	1197	160	162	88	201
07/19/98 - 08/20/98 (f)	504	966[c]	871	598	111[b]	370	260	359	(83 - 1208)	1001	248	148	403	86	134	110	102
06/23/99 – 07/19/99	1629	795	1486	494	468	509	866	812	(351 - 2036)	2283	779	861	239	954	298	388	1007
06/23/00 – 07/25/00	648	1063	4176[c]	861	406[b]	986	553	713	(305 - 5520)	2438	735	615	380	369	435	724	479
06/28/01 – 07/26/01	935[c]	687	459	364	532	173	149	132[b]	(99 - 1169)	1395	191	207	263	163	169	137	375
06/25/02 – 07/23/02	605	652	2563[c]	573	2435	271	385	213[b]	(150 - 3204)	1960	355	221	150	85	73	204	412
06/24/03 – 07/21/03	535	267	1619[c]	147	*964	99[b]	429	429	(74.3 - 2024)	517	67	125	LOST	356	209	371	471

* Replicate Lost
a. Control station.
b. Minimum control station value.
c. Maximum control station value.
d. Values range from minus 25% of the average minimum control station value to plus 25% of the average maximum control station value. Values which occur outside of the ±25% range of natural variance signify significant deviations from normal.
e. Benthic work performed by CK-Associates of Baton Rouge, LA.
All previous benthic work performed by Barry Vittor and Associates of Mobile, AL.
f. Benthic work performed by TAI, Inc. Mobile, AL.

TABLE 4-18 (Sheet 2 of 2)

ENVIRONMENTAL MONITORING PROGRAM
GULF POWER COMPANY - PLANT SCHOLZ - JACKSON COUNTY, FLORIDA
FROM 1993

MACROSCOPIC BENTHIC INVERTEBRATE SAMPLING ACCURACY(a): PERCENT COEFFICIENT OF VARIATION(%)
OF REPLICATE[b] ARTIFICIAL SUBSTRATE SAMPLES COLLECTED FROM THE APALACHICOLA RIVER (AR)

Accurary of Species Diversity [d] Values

Submersion Period of Artificial Substrates	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
07/21/93 - 08/20/93	23.72	13.97	14.91	10.38	13.69	17.62	14.65	3.89	3.52	2.11	7.49	10.67	7.22	9.12	11.06	3.96
07/28/94 - 08/28/94	6.56	13.31	15.93	4.16	6.03	10.34	20.02	13.26	32.3	13.89	9.08	23.75	1.56	9.91	19.72	7.31
07/14/95 - 08/15/95	2.89	10.83	1.76	16.14	12.58	6.26	7.42	3.08	0.74	3.45	6.14	7.70	LOST	1.88	6.5	7.83
07/15/96 - 08/17/96	17.22	13.58	8.10	1.57	18.80	16.12	LOST	3.62	LOST	2.77	LOST	LOST	6.94	5.94	4.73	29.85
07/21/97 - 08/22/97[c]	23.40	67.80	32.4	34.10	33.90	14.90	28.00	0.60	26.60	35.50	83.30	30.90	39.60	48.10	47.2	44.1
07/19/98 - 08/20/98 [d]	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
06/23/99 – 07/19/99	18.87	11.18	10.19	22.91	48.60	20.83	12.39	10.83	16.54	21.92	4.33	13.48	9.36	0.00	18.18	11.17
06/23/00 – 07/25/00	27.40	17.30	3.21	10.10	14.10	11.8	9.61	1.60	5.29	3.80	5.49	6.35	7.49	2.83	8.24	9.08
06/28/01 – 07/26/01	5.19	14.75	17.7	17.55	17.71	2.88	4.69	37.43	4.94	2.88	35.14	11.82	5.14	12.28	9.78	3.82
06/25/02 – 07/23/02	43.31	49.60	16.70	7.02	21.40	7.09	55.80	30.00	25.00	29.70	6.03	17.10	43.70	31.90	18.50	11.70
06/24/03 – 07/21/03	10.79	7.63	8.71	7.87	15.00	6.59	6.5	13.3	10.5	9.95	5.33	LOST	9.37	27.72	20.7	12.75

Accuracy of Total Number of Animals Per Unit Area Values

Submersion Period of Artificial Substrates	AR1L	AR1R	AR2L	AR2R	AR3L	AR3R	AR4L	AR4R	AR5L	AR5R	AR6L	AR6R	AR7L	AR7R	AR8L	AR8R
07/21/93 - 08/20/93	24.14	21.56	28.14	12.73	58.94	44.75	34.97	9.81	10.77	21.09	41.73	40.02	19.42	53.11	21.31	36.69
07/28/94 - 08/28/94	32.44	35.07	25.22	59.38	58.83	65.48	56.34	32.25	32.32	46.57	52.97	51.9	36.03	27.02	18.67	58.27
07/14/95 - 08/15/95	33.85	52.05	31.07	9.86	23.96	28.12	16.11	19.14	37.76	18.34	19.54	19.54	LOST	30.38	38.73	24.82
07/15/96 - 08/17/96	38.96	30.24	15.12	19.00	16.44	18.31	LOST	25.29	LOST	27.93	LOST	LOST	10.19	3.58	27.31	65.64
07/21/97 - 08/22/97[c]	14.70	10.60	32.10	37.00	42.40	40.40	9.30	30.70	6.70	32.50	10.40	61.70	46.50	38.40	40.70	23.50
07/19/98 - 08/20/98 [d]	69.30	43.07	24.04	5.25	71.31	5.87	30.14	13.97	50.51	31.04	27.75	25.44	95.96	27.81	62.36	42.43
06/23/99 – 07/19/99	65.81	40.57	14.78	12.89	98.01	76.26	10.42	13.34	52.92	12.52	54.28	23.73	32.06	32.53	10.94	11.56
06/23/00 – 07/25/00	20.31	30.41	33.61	13.99	13.02	17.22	19.83	17.09	24.25	22.27	15.22	18.79	7.45	6.01	19.54	42.17
06/28/01 – 07/26/01	19.03	10.78	15.36	30.63	42.26	8.17	12.53	15.76	16.72	32.4	12.59	70.74	28.93	17.79	53.42	34.05
06/25/02 – 07/23/02	46.10	10.30	56.90	28.90	35.70	22.50	40.80	9.20	48.30	19.10	49.30	47.20	16.30	20.10	10.20	9.80
06/24/03 – 07/21/03	30.98	58.54	31.97	15.26	*21.71	7.07	27.17	27.17	54.85	84.46	14.85	LOST	31.64	27.76	132.3	24.28

a. Values in excess of 25 percent are questionable.
b. Three replicate samples.
c. Benthic work performed by CK-Associates of Baton Rouge, LA.
All previous benthic work performed by Barry Vittor and Associates of Mobile, AL.
d. Benthic work performed by TAI, Inc. of Mobile, AL.
N/C = not calculated

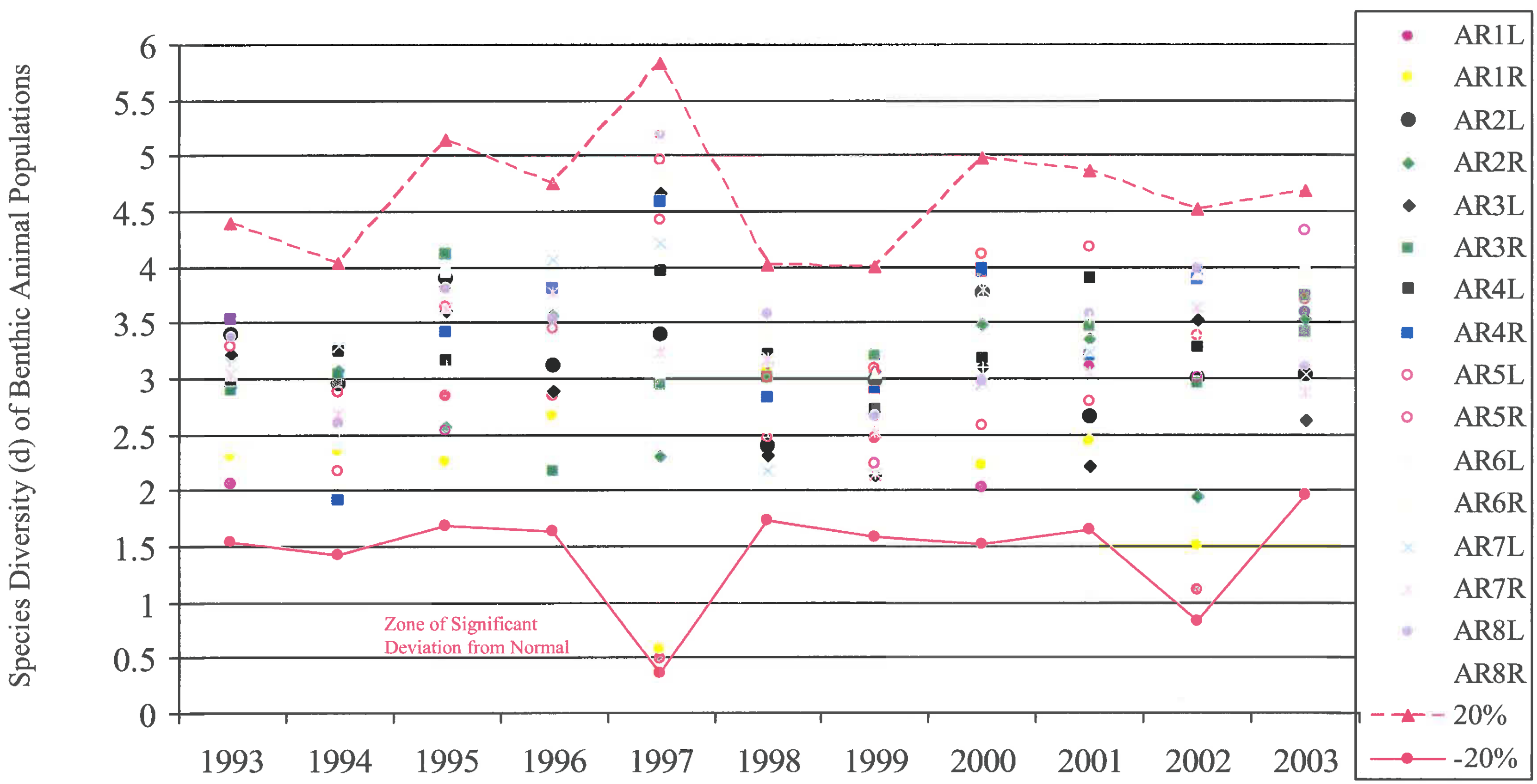
Figure 4-3

Gulf Power Company - Plant Scholz - Sneads, Florida

ENVIRONMENTAL MONITORING PROGRAM

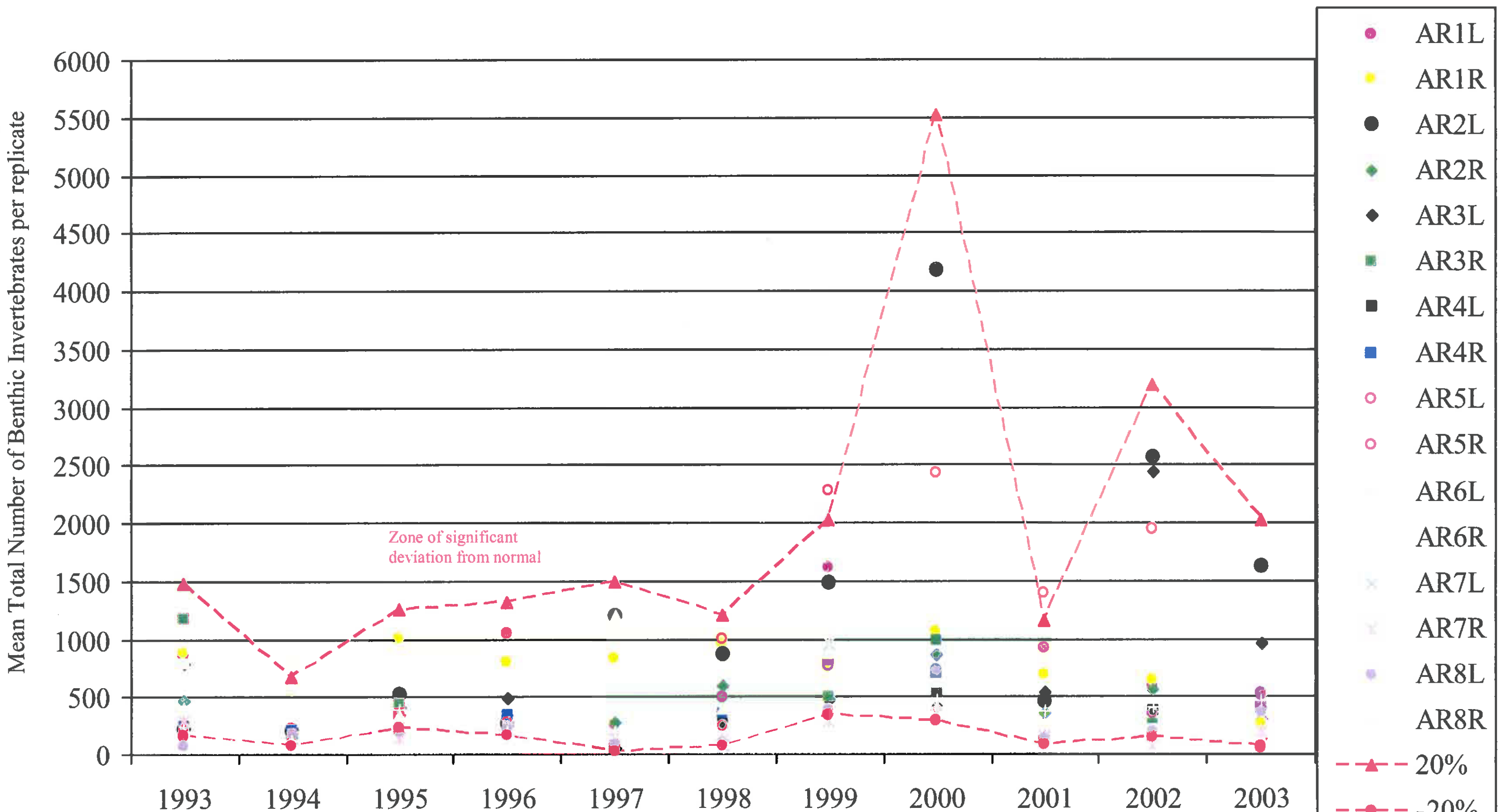
since 1993

<u>Average Species Diversity (d) of Benthic Invertebrates Collected in the Apalachicola River (AR)</u>



Values which occur outside of the plus or minus 20 percent range of natural variance signify deviations from normal.

Figure 4-4
Gulf Power Company - Plant Scholz - Sneads, Florida
ENVIRONMENTAL MONITORING PROGRAM
From 1993
Average Total Number of Benthic Invertebrates Collected per replicate in the Apalachicola River (AR)



Values which occur outside of the plus of minus 20 percent range of natural variance signify significant deviations from normal

- Study results indicate that, since 1993, relatively high water quality conditions have existed throughout the entire study area; from the Apalachicola River, near Jim Woodruff Dam, downstream beyond I-10 bridge. The average and range of species diversity values found since 1993 are as follows:

Table 4-19 Species Diversity Values for Test and Control Stations

Year	Control Stations AR1R-AR4R	"Test" Stations AR5R-AR8R
1993	2.99(2.07-3.54)	3.06(2.40-3.37)
1994	2.82(1.92-3.24)	2.59(2.09-3.30)
1995	3.24(2.26-4.13)	3.48(2.54-3.95)
1996	3.01(2.18-3.81)	3.48(2.58-4.07)
1997	2.87(0.50-4.66)	4.63(3.25-5.25)
1998	2.89(2.32-3.22)	2.94(2.18-3.59)
1999	2.78(2.13-3.21)	2.59(2.15-3.10)
2000	3.22(2.04-3.99)	3.32(2.59-4.12)
2001	3.05(2.21-3.90)	3.10(1.06-4.19)
2002	2.66(1.13-3.90)	3.58(3.02-3.99)
2003	3.44(2.62-3.75)	3.58(2.88-4.33)

Two significant biological changes have been observed in the study area since 1993 and are as follows:

- The incidence in 1993 (a normal low-flow year) of decreased species diversity, and increased productivity in the upstream portion of the study area nearest to the Jim Woodruff Dam. For the most part, this is likely due to fluctuating stream flow velocities resulting from the operation of Jim Woodruff Dam and accelerated phytoplankton productivity which originates from the enriched, quiescent waters of Lake Seminole; and

- The general decrease in biological stability (10%) and productivity (45%) in the study area, which accompanied severe flooding during the 1994 study period.

A total of 261 species of benthic fishfood organisms have been collected in the study area of which at least one fourth were organisms commonly associated with clean water conditions, i.e., mayflies, stoneflies, caddisflies, hellgrammites, scuds, elmid beetles, operculate snails, and mussels (Gaufin, 1973).

Biological Integrity Test

To conduct these annual tests, three sampling stations were established in 1993 in the Apalachicola River immediately upstream and downstream from the confluence of the cooling water discharge canal from Plant Scholz. Two of these stations (one more than required by the FDEP) are control stations (AR4R and AR4L), and one is a "test" station (AR5R). Only benthic species diversity values were required in these tests. The manner in which this data were evaluated was the same as that described previously using FDEP protocol outlined in item 11 of FAC Rule 62-302-530 (Appendix D). Gulf Power Company's Environmental Affairs Department forwards a separate report containing test results to the FDEP annually during the month of December. (Note: The Biological Integrity Test is currently not a requirement of Plant Scholz's wastewater permit). The results of these tests are as follows:

July 21 - August 20, 1993. Plant Scholz passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic bottom-dwelling fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic fishfood populations were collected from modified Hester-Dendy artificial substrates submerged in the river for 30 days. Average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values (Tackett, et al., 1993).

A total of 53 species were collected from the study area (AR4R, AR4L, and AR5R); of which approximately 25 percent are organisms commonly associated with clean water conditions (mayflies, caddisflies, scuds, and operculate snails). No major shifts were observed in population composition, i.e., percent by number, weight, order, or species.

July 28 - August 28, 1994. Plant Scholz passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic bottom-dwelling fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic fishfood populations were collected from modified Hester-Dendy artificial substrates submerged in the river for 30 days. Average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values.

A total of 42 species were collected from the study area (AR4L, AR4R, and AR5R); of which approximately 33 percent are organisms commonly associated with clean water conditions (mayflies, hellgrammites, elmid beetles, caddisflies, scuds, and operculate snails). No major shifts were observed in population composition, i.e., percent by number, weight, order, or species.

July 14, 1995 - August 15, 1995. Plant Scholz passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic bottom-dwelling fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic fishfood populations were collected from modified Hester-Dendy artificial substrates submerged in the river for 30 days. Average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values.

- A total of 66 species were collected from the study area (AR4L, AR4R, and AR5R); of which approximately 32 percent were organisms commonly associated with clean water conditions (mayflies, hellgrammites, elmid beetles, caddisflies, scuds, and operculate snails). No major shifts were observed in population composition, i.e. percent by number, weight, order, or species.

July 15, 1996 - August 17, 1996. Plant Scholz passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic bottom-dwelling fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic fishfood populations were collected from modified Hester-Dendy artificial substrates submerged in the river for 30 days. Average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of the primary (AR4R) control station value. The secondary control station (AR4L) was lost during the testing period for 1996.

- A total of 57 species were collected from the study area (AR4L, AR4R, and AR5R); of which approximately 28 percent were organisms commonly associated with clean water conditions (mayflies, hellgrammites, elmid beetles, caddisflies, scuds, and operculate snails). No major shifts were observed in population composition, i.e. percent by number, weight, order, or species.

July 21, 1997 – August 22, 1997. Plant Scholz passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic benthic fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic macroinvertebrate populations were collected from Hester-Dendy artificial substrates submerged in the river for 30 days. The average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values. The average value for species diversity at station AR5R was found to be greater than 25 percent of the average values of the primary (AR4R) and secondary control station (AR4L).

- A total of 39 species were collected from the study area (AR4L, AR4R, and AR5R); of which approximately 32 percent were organisms commonly associated with clean water conditions (mayflies, hellgrammites, elmid beetles, caddisflies, scuds, and operculate snails). No major shifts were observed in population composition, i.e. percent by number, weight, order, or species.

July 19, 1998 – August 20, 1998. The Plant Scholz discharge sample passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic benthic fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic macroinvertebrate populations were collected from Hester-Dendy artificial substrates submerged in the river for 30 days. The average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values.

- A total of 68 species were collected from the study area (AR4L, AR4R, and AR5R); of which approximately 25 percent were organisms commonly associated with clean water conditions (mayflies, hellgrammites, elmid beetles, caddisflies, scuds, and operculate snails). No major shifts were observed in population composition, i.e. percent by number, weight, order, or species.

June 23, 1999 – July 19, 1999. The Plant Scholz discharge sample passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic benthic fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic macroinvertebrate populations were collected from Hester-Dendy artificial substrates submerged in the river for 30 days. The average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values.

- A total of 25 species and 11 taxa were collected from the study area (AR4L, AR4R, and AR5R). No major shifts were observed in population composition, i.e., percent by number, weight, order or species.

June 23, 2000 – July 25, 2000. The Plant Scholz discharge sample passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic benthic fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic macroinvertebrate populations were collected from Hester-Dendy artificial substrates submerged in the river for 30 days. The average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values.

- A total of 49 species and 15 taxa were collected from the study area (AR4L, AR4R, and AR5R). No major shifts were observed in population composition, i.e., percent by number, weight, order or species.

June 28, 2001 – July 26, 2001. The Plant Scholz discharge sample passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic benthic fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic macroinvertebrate populations were collected from Hester-Dendy artificial substrates submerged in the river for 28 days. The average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values.

- A total of 56 species and 15 taxa were collected from the study area (AR4L, AR4R, and AR5R). No major shifts were observed in population composition, i.e., percent by number, weight, order or species.

June 25, 2002 – July 23, 2002. The Plant Scholz discharge sample passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic benthic fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic macroinvertebrate populations were collected from Hester-Dendy artificial substrates submerged in the river for 28 days. The average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values (refer to Figures 4-3 and 4-4, and Table 4-18).

- A total of 50 species were collected from the study area (AR4L, AR4R, and AR5R). No major shifts were observed in population composition, i.e., percent by number, weight, order or species.

June 24, 2003 – July 21, 2003. The Plant Scholz discharge sample passed the Biological Integrity Test. Relatively good water quality conditions were found to exist in the study area. Populations of macroscopic benthic fishfood organisms were utilized in biologically assessing water quality conditions in the Apalachicola River above and below the cooling water discharge from Gulf Power Company's Plant Scholz. Benthic macroinvertebrate populations were collected from Hester-Dendy artificial substrates submerged in the river for 28 days. The average species diversity values of populations found at station AR5R, just downstream from the cooling water discharge, were not found to be reduced in excess of 25 percent of either the primary (AR4R) or secondary (AR4L) control station values (refer to Figures 4-3 and 4-4, and Table 4-18).

- A total of 61 species were collected from the study area (AR4L, AR4R, and AR5R). No major shifts were observed in population composition, i.e., percent by number, weight, order or species.

The standing crop (total number) of benthos populations, as expressed by total number per unit area, is indicated to be more representative than total wet weight, mainly because of the random distribution of large-body animals. This observation is supported by the findings of Mason and Lewis (1973) in their study of the Little Miami River in Ohio. An examination of Table 4 indicates that essentially all average values for species diversity and total number derived from replicate samples were within 25-percent coefficient of variance, while those values for wet weight in most cases were not. References to wet weight will be eliminated from the discussion of results because of the high variability in the sizes of specimens collected. No significant reduction in productivity was detected in benthic fishfood populations at station AR5R, just downstream from the cooling water discharge.

Laboratory Effluent Toxicity Testing

Aquatic bioassays are used to establish the character and strength of an effluent by measuring its effect upon laboratory test organisms. There are two basic types of tests:

- Acute toxicity tests, which measure short-term exposure effects but are normally not sensitive to lower concentration exposures, and

- Chronic toxicity tests, which measure long-term exposure effects and are sensitive to relatively low concentration exposures.

Acute toxicity tests are used to determine the effluent concentration, expressed as percent volume, which is lethal to 50 percent of organisms within a prescribed period of time (LC50). Chronic tests measure more subtle parameters such as growth, and reproduction over a relatively longer exposure period and at lower exposure concentrations.

In compliance with the State of Florida Industrial Wastewater Permit issued to Gulf Power Company's Plant Scholz, a series of 96-hour static, acute, screening toxicity tests are to be conducted annually on samples of cooling water effluent. The sampling and testing procedures utilized conform to FDEP protocols.

Four grab samples of cooling water effluent, one taken every six hours during a 24-hour period, are delivered from Gulf Power Company's Plant Scholz to TRAC Laboratories in Pensacola, FL. Methods for the static tests are based on "Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms" (EPA/600/4-90/027) and TRAC's Generic Quality Assurance Plan. Copies of TRAC Laboratories toxicity reports are available in Appendix J.

Gulf Power Company's Environmental Affairs Department forwards a separate report containing test results to the FDEP annually during the month of December. The results of these tests are as follows:

August 25-29, 31 - September 4, 1993, and September 15-19, 22-26, 1993. Freshwater toxicity screening tests were conducted by Barry A. Vittor & Associates during the periods of August 25-29, August 31 - September 4, 1993, and by TRAC Laboratories during the period of September 15-19, 1993, and September 22-26, 1993, on four grab samples of cooling water effluent collected at Gulf Power Company's Plant Scholz on September 15, 1993, (Tackett, et al., 1993). The test animals used were the fathead minnow, Pimephales promelas, (bannerfin shiners were unavailable) and the daphnid, Ceriodaphnia dubia. The results of these tests were as follows:

- None of the four effluent samples Vittor & Associates tested proved to be acutely toxic to fathead minnows. Maximum mortality in the Pimephales test was 15% in 100% effluent collected at 1800 and 2400 hours with no mortality occurring in the controls.

- Three of the four 100% effluent samples tested by Vittor & Associates passed the Ceriodaphnia toxicity-screening test. One of these tests, however, did not prove to be satisfactory; the 2400-hour sample having a maximum mortality of 25%.

- Additional Ceriodaphnia testing was done by Vittor & Associates during the period of August 31, 1993 - September 4, 1993, and by TRAC Laboratories in Pensacola during the periods of September 14-19, 1993, and September 22-26, 1993, on samples collected from the cooling water intake and discharge at midnight. None of these tests proved to be acutely toxic.

August 13-17 and September 16-20, 1994. Freshwater toxicity screening tests were conducted by TRAC Laboratories in Pensacola during the periods of August 13-17, 1994, and September 16-20, 1994. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- In the August test period, none of the four effluent samples tested by TRAC Laboratories appeared to be acutely toxic to daphnids. Maximum mortality in the Ceriodaphnia test was 5% in 100% effluent collected at 1200, 0000, and 0600 hours with no mortality occurring in the controls.

- Three of the four 100% effluent samples tested by TRAC laboratories passed the Cyprinella toxicity-screening test. One of these tests, however, did not prove to be satisfactory; the 0600 hour sample having a maximum mortality of 35%.

- TRAC Laboratories conducted additional testing during the period of September 16-20, 1994, as soon as the generating facilities at Plant Scholz were placed back on line. Toxicity tests were performed on both intake and discharge waters using Cyprinella leedsi. None of these samples proved to be acutely toxic, though control mortalities in excess of 20% were experienced during the final 72-96 hour test period in both the intake and discharge canal tests, however, at this point, Plant Scholz had gone back off-line, and was not scheduled for start-up for the remainder of 1994.

July 18-22, 1995. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola during the period of July 18-22, 1995, (Appendix D). The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of these tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners (Appendix D). The maximum mortality was 5 percent in the Ceriodaphnia test and 15 percent in the bannerfin shiner test. The maximum control station mortality in both tests combined was 5 percent.

- As a safeguard against potential unexplainable failed effluent tests, which have occurred in the past, additional toxicity tests were performed on water samples collected from the plant intake canal. Of the four samples collected, one was indicated by the test to be acutely toxic to the bannerfin shiner; the maximum mortality in this instance was 25 percent. The maximum mortality in the daphnid test was 15 percent, while control mortalities for both daphnid and fish tests were found to be no greater than 5 percent. The implication of a toxicity problem in the plant intake canal does not appear to be valid in light of the fact that such toxic effects were not indicated in the discharge canal; i.e., three additional tests confirmed this conclusion.

July 26-30, 1996. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratory in Pensacola, FL during the period of July 26-30, 1996, (Appendix D). The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Cerodaphnia dubia. The results of the tests were as follows:

- None of the four intake samples proved to be acutely toxic to daphnids or bannerfin shiners. A maximum of fifteen percent mortality occurred in sample # 1425 of the bannerfin test and ten percent mortality occurred in the control. No mortality was observed in either the daphnia control or test.

- None of the four discharge samples proved to be acutely toxic to Cyprinella leedsi or Cerodaphnia dubia. A maximum of fifteen percent mortality occurred in sample # 1263 of the Cyprinella leedsi test and five percent mortality occurred in the control. No mortality occurred in any sample of the Cerodaphnia dubia test or the control.

August 6-10, 1997. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola, FL during the period of August 6-10, 1997. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners. There was no mortality experienced in either the Cyprinella leedsi or the Ceriodaphnia dubia tests or controls.

- As a safeguard against potential unexplainable failed effluent tests, which have occurred in the past, additional toxicity tests were performed on water samples collected from the plant intake canal. Of the four samples collected, none were indicated by the test to be acutely toxic to Cyprinella leedsi or Ceriodaphnia dubia. The maximum mortality observed in the daphid test was 5 percent. No mortality was observed in the control group in both daphnid and shiner tests.

July 22-26, 1998. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola, FL during the period of July 22-26, 1998. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners. Maximum mortality observed in the daphnid test was 35% with a 5% mortality observed in the control group. The maximum mortality observed in the bannerfin shiner test was 10% with no mortality observed in the control group.

As a safeguard against potential unexplainable failed effluent tests, which have occurred in the past, additional toxicity tests were performed on water samples collected from the plant intake canal. Of the four samples collected, two were indicated by the test to be acutely toxic to Ceriodaphnia dubia. Samples #2064 and #2066 had a maximum mortality of 55%. Regarding Cyprinella leedsi, the maximum mortality in this test was 5 percent. Control group mortality for the daphnid test was 5%. No mortality was observed in the bannerfin shiner control.

June 24-28, 1999. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola, FL during the period of June 24-28, 1999. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners. There was no mortality observed in either the Ceriodaphnia dubia or the Cyprinella leedsi tests or controls.

- As a safeguard against potential unexplainable failed effluent tests, which have occurred in the past, additional toxicity tests were performed on water samples collected from the plant intake canal. Of the four samples collected, none were indicated by the test to be acutely toxic to Cyprinella leedsi or Ceriodaphnia dubia. The maximum mortality observed in the daphid test was 5%. A 10% mortality was observed in the daphnid control. The maximum mortality observed in the bannerfin shiner test was 5%. A 5% maximum mortality was observed in the bannerfin shiner control test.

July 27-31, 2000. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola, FL during the period of July 27-31, 2000. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners. The maximum mortality observed in the bannerfin shiner test was 5% with no mortality observed in the control group. There was no mortality observed in the Ceriodaphnia dubia tests or control.

- As a safeguard against potential unexplainable failed effluent tests, which have occurred in the past, additional toxicity tests were performed on water samples collected from the plant intake canal. Of the four samples collected, none were indicated by the test to be acutely toxic to Cyprinella leedsi or Ceriodaphnia dubia. The maximum mortality observed in the bannerfin shiner test was 5% with no mortality observed in the control group. There was no mortality observed in the Ceriodaphnia dubia tests or control.

July 26-30, 2001. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola, FL during the period of July 26-30, 2001. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners. The maximum mortality observed in the bannerfin shiner test was 10% with a 5% mortality observed in the control group. There was no mortality observed in the Ceriodaphnia dubia tests and a 5% mortality observed in the control group.

June 27-July 1, 2002. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola, FL during the period of June 27-July 1, 2002. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners. The maximum mortality observed in the bannerfin shiner test was 5% with no mortality observed in the control group. A maximum mortality of 5% was observed in the Ceriodaphnia dubia tests with no mortality observed in the control group.

- As a safeguard against potential unexplainable failed effluent tests, which have occurred in the past, additional toxicity tests were performed on water samples collected from the plant intake canal. Of the four samples collected, none were indicated by the test to be acutely toxic to Cyprinella leedsi or Ceriodaphnia dubia. The maximum mortality observed in the bannerfin shiner test was 5% with a 10% mortality observed in the control group. There was no mortality observed in the Ceriodaphnia dubia tests or control.

June 26-June 30, 2003. Freshwater toxicity screening tests were conducted on samples collected from both the intake canal and the discharge canal and delivered to TRAC Laboratories in Pensacola, FL during the period of June 26-June 30, 2003. The test animals used were the bannerfin shiner, Cyprinella leedsi, and the daphnid, Ceriodaphnia dubia. The results of the tests were as follows:

- None of the four effluent samples tested by TRAC Laboratories were found to be acutely toxic to either daphnids or bannerfin shiners. No mortality was observed in the bannerfin shiner test group or control group. Additionally, no mortality was observed in either the Ceriodaphnia dubia test or control groups.

- As a safeguard against potential unexplainable failed effluent tests, which have occurred in the past, additional toxicity tests were performed on water samples collected from the plant intake canal. Of the four samples collected, none were indicated by the test to be acutely toxic to Cyprinella leedsi or Ceriodaphnia dubia. No mortality was observed in the bannerfin shiner test group or control group. There was no mortality observed in the Ceriodaphnia dubia tests and a 5% mortality observed in the control.

Laboratory Sediment Toxicity Testing

Two grab samples of river bottom sediment, one from ER3R and one from ER5R, were delivered from Gulf Power Company's Plant Scholz to TRAC Laboratories in Pensacola, FL. Methods for the static tests are based on "Guide for Conducting 10-day Static Sediment Toxicity Tests with Freshwater Invertebrates" (ASTM E 1383-93) and TRAC's Generic Quality Assurance Plan.

July 16 – 26, 1999. Sediment toxicity screening tests were conducted by TRAC Laboratories in Pensacola, FL during the period of July 16-26, 1999. The test animal used was Hyalella azteca. The results of the test were as follows:

- Neither of the two sediment samples (AR3R or AR5R) tested by TRAC Laboratories were found to be acutely toxic to Hyalella azteca. The maximum mortality observed in both the samples was 12 percent. A 6 percent maximum mortality was observed in the control test.

August 11 – 21, 2000. Sediment toxicity screening tests were conducted by TRAC Laboratories in Pensacola, FL during the period of August 11-21, 2000. The test animal used was Hyalella azteca. The results of the test were as follows:

Neither of the two sediment samples (AR3R or AR5R) tested by TRAC Laboratories were found to be acutely toxic to Hyalella azteca. The maximum mortality observed in the intake sample (AR3R) was 6%. The maximum mortality observed in the discharge sample (AR5R) was 14%. An 8 percent maximum mortality was observed in the control test.

August 24 – September 3, 2001. Sediment toxicity screening tests were conducted by TRAC Laboratories in Pensacola, FL during the period of August 24-September 3, 2001. The test animal used was Hyalella azteca. The results of the test were as follows:

Neither of the two sediment samples (AR3R or AR5R) tested by TRAC Laboratories were found to be acutely toxic to Hyalella azteca. The maximum mortality observed in the intake sample (AR3R) was 2%. No mortality occurred in the discharge sample or in the control group.

June 28 – July 8, 2002. Sediment toxicity screening tests were conducted by TRAC Laboratories in Pensacola, FL during the period of June 28-July 8, 2002. The test animal used was Hyalella azteca. The results of the test were as follows:

Neither of the two sediment samples (AR3R or AR5R) tested by TRAC Laboratories were found to be acutely toxic to Hyalella azteca. No mortality occurred in either the discharge or intake samples. 4% mortality was observed in the control group.

July 19 – July 29, 2003. Sediment toxicity screening tests were conducted by TRAC Laboratories in Pensacola, FL during the period of July 19-July 29, 2003. The test animal used was Hyalella azteca. The results of the test were as follows:

After 10 days of exposure, statistically significant mortality was observed in both intake and discharge sediments. Twenty four percent mortality occurred in the discharge canal (3394) sediment and twenty percent mortality occurred in the intake canal (3395) sediment. Four percent mortality occurred in the control sediment.

5. CONCLUSIONS AND RECOMMENDATIONS

Selected physical, chemical, and biological parameters are collected annually from 16 strategic points along 11.75 kilometers (7.30 miles) of the Apalachicola River. The study area extends from Jim Woodruff Dam, approximately 5.38 kilometers (3.34 miles) upstream from the confluence of the cooling water discharge canal from Plant Scholz, to 5.50 kilometers (3.42 miles) downstream. The major observations to date are as follows:

- Stream bottom profiles taken since the inception of the environmental monitoring program show that the Apalachicola River during low-flow periods varies in depth and width, from approximately 9-21 feet and 180-260 yards, respectively, Appendix C.

- Daily and average monthly stream discharges for gauging station #02358000 located on the Apalachicola River near Chattahoochee, Florida are obtained annually from the U. S. Geological Survey office in Tallahassee, Florida, (Table 4-1, Figure 4-1 and Appendix F). The data indicate that significantly higher stream flows occur during the winter and spring seasons, with the lowest stream flows occurring during the summer and fall. The average stream flow (cubic feet per second) recorded during each 30-day study period since 1993 was 11,422 ft^3/s, 31,671 ft^3/s, 10,882 ft^3/s, 24,552 ft^3/s, 23,520 ft^3/s, 11,531 ft^3/s, 11,066 ft^3/s, 11,965 ft^3/s and 5,969 ft^3/s respectively.

- Water temperatures are recorded continuously at 16 sampling stations, for each 30-day study period, through the use of Ryan TempMentors, Onset temperature sensors, and Hydrolab and/or YSI datasondes. The data for each sampling period since 1993 are summarized in Table 4-2. A brief examination of the data shows that average daily surface water temperatures found in the study area are relatively uniform in distribution. In general, differences in temperature can be attributed to stream flow velocity/volume.

Analyses of routine surface water grab samples collected from 16 stations from the inception of the monitoring program in 1993 are presented in Table 4-5. The ranges of surface water analyses found thus far are as follows:

Table 5-1 Review of Surface Water Analyses

Parameter	Apalachicola River*
Dissolved oxygen (mg/l)	4.03 to 11.02
pH (units)	7.24 to 8.91
Turbidity (NTU)	1.3 to 22.0
Conductivity (mmhos/cm)	0.026 to 0.219
Hardness (mg/l)	28 to 52
Alkalinity (mg/l)	24 to 60
Total Kjeldahl nitrogen (mg/l)	<0.20 to 2.9
Total phosphorus (mg/l)	<0.020 to 0.880
Total organic carbon (mg/l)	1.4 to 15.0
Chloride (mg/l)	3.1 to 28.0
Total suspended solids (mg/l)	**2.0** to 61.0
Sulfate (mg/l)	2.7 to 29.0

***Bold** text denotes changes made this year (2003).

Surface water grab samples and stream bottom sediment samples have been collected for trace metal analysis from up to 16 locations on the Apalachicola River since the monitoring program began in 1993. In addition, ISCO composite water samplers were used to collect 24-hour composite water samples from three additional locations around the ash pond discharge, which is situated on the cooling water discharge canal just upstream from confluence with the Apalachicola River. In 1999, fish tissues were added to the metals analysis. The results of these analyses are detailed in Table 4-7, Table 4-9 and Table 4-11. The range of values for river stations and fish tissues, since 1993 (1999 for fish tissue), are presented as follows:

Table 5-2 Review of Trace Metal Analysis in Water, Sediment and Fish Tissues

Trace Metals	Water (mg/l)*	Sediment (mg/kg)*	Fish Tissue (mg/kg)*
Aluminum	0.10 to 2.00	310 to 26000	<20 to 24
Arsenic	<0.002 to 0.0021	0.096 to 3.3	<1.0 to 3.2
Boron	<0.050 to <0.050	3.9 to 22.0	<5.0
Calcium	9.3 to 17	62 to 43000	980 to 11000
Chromium	<0.010 to 0.059	1.7 to 36.0	<1.0
Copper	<0.002 to 0.010	<0.50 to 24	1.2 to 7.6
Iron	0.13 to 1.90	960 to 32000	11 to 38
Lead	<0.005 to 0.0071	0.58 to 13.0	<0.50 to 0.85
Magnesium	1.0 to 2.1	52 to 25000	1300 to 16000
Mercury	<0.0002 to 0.0002	<0.005 to .046	0.033 to 0.10
Nickel	<0.02 to <0.04	0.75 to 11.0	<4.0
Potassium	0.8 to 2.5	40 to 1800	9700 to 20000
Selenium	<0.002 to <0.010	<0.050 to 1.1	1.7 to 3.3
Sodium	3.5 to 12	11 to 340	2100 to 4500
Vanadium	<0.010	1.3 to 50.0	<1.0
Zinc	<0.020 to 0.032	3.0 to 52.0	33 to 77

***Bold** text denotes changes made this year (2003).

In general, higher trace metal concentrations are found in the upper part of the study area (AR1-AR4), nearest Jim Woodruff Dam. Evidently, Lake Seminole acts as a natural sink in which various species of trace metals flocculate and precipitate out of solution and are then redistributed downstream.

Vertical profiles of the water column are made on an as needed basis. The profiles include measurements of dissolved oxygen (mg/l), temperature (C°), pH (su) and conductivity (mhos/cm). The measurements are made from boat at each of the sampling locations within the study area using a Hydrolab Surveyor 3 or YSI water quality logging system. Parameters are recorded in 2-ft intervals from surface to bottom, and the resulting data are printed out by computer program. The resulting data are presented in Appendix H. Principle findings since the 1993 study period are as follows:

- The vertical distributions of temperature, pH, and conductivity values have remained relatively homogeneous throughout the study area during each study period. With respect to dissolved oxygen concentrations, however, there is a decided influence exerted by water releases during low-flow periods from Jim Woodruff Dam. In 1993, according to U.S. Geological Survey records, a 50 percent increase in stream flow (from 9590 ft^3/s on 7/22 to 14,100 ft^3/s on 8/19) resulted in approximately a 50 percent increase in dissolved oxygen along the river bottom (from an average of 3.28 mg/l on 7/22 to 5.69 mg/l on 8/19). Earlier investigators have reported similar findings. State fishery biologists studying the ecological impact of channel maintenance by the U. S. Army Corps of Engineers described the upper river as having significant low dissolved oxygen for approximately 25 miles below Jim Woodruff Dam (Florida Game and Fresh Water Fish Commission, 1986).

Beginning with the 1993 study period, two self-contained, battery powered, submersible water quality dataloggers (datasondes) were installed in the Apalachicola River just above and below its confluence with the Plant Scholz cooling water discharge canal; at stations AR4R and AR5R, respectively. These datasondes were programmed to measure temperature, dissolved oxygen, pH, and conductivity at fifteen-minute intervals continuously for 30 days. The datasonde data are summarized on Tables 4-14 through 4-17. A brief review of the data collected thus far is presented as follows:

Table 5-3 Review of Datasonde Water Monitoring Data

	Avg. Temp.(°C)		Avg. pH (Units)		Avg. Cond. (mhos/cm)		Avg. D.O. (mg/l)	
Year	AR4R	AR5R	AR4R	AR5R	AR4R	AR5R	AR4R	AR5R
1993	30.01	30.95	6.90	6.99	0.155	0.270	*	*
1994	26.86	26.12	7.34	7.00	0.122	0.171	*	*
1995	29.45	30.70	7.96	7.87	0.145	0.165	5.19	4.55
1996	29.26	30.22	7.59	7.35	0.145	0.158	5.33	5.19
1997	28.96	29.44	7.30	7.32	0.062	0.159	6.04	*
1998	29.50	30.70	*	7.23	0.135	0.134	5.67	5.31
1999	28.02	28.70	7.34	6.90	0.122	0.147	6.57	6.60
2000	28.87	29.50	7.15	7.10	0.147	0.150	4.86	5.24
2001	29.11	30.18	6.68	6.60	0.116	0.106	5.25	5.65
2002	29.10	29.78	7.21	7.17	0.149	0.155	5.92	5.52
2003	27.60	27.96	6.86	7.07	0.090	0.100	8.22	9.93

* No data available.

As part of the annual Environmental Monitoring Program, population characteristics of macroscopic bottom dwelling invertebrate fishfood organisms are used to biologically assess water quality conditions in the Apalachicola River study area near Plant Scholz. Beginning in 1993, three modified Hester-Dendy artificial substrate samplers were placed at 16 strategic locations along a 7.3-mile stretch of the Apalachicola River for one 28-day period each year. An evaluation of the data is presented briefly in the following (for details, see Table 4-18, Figures 4-3 and 4-4, and Appendix I).

Since monitoring activities began in 1993, the biological stability and productivity of bottom-dwelling fishfood populations in the Apalachicola River indicate that water quality conditions have been essentially unaffected by the discharge of cooling water from Plant Scholz. Neither the population species diversity value nor the total number (productivity) of benthic animals per unit area at either station AR5R, or any of the other test stations, have been reduced in excess of 25 percent of the minimum control station values for the study area.

The study results indicate that relatively high water quality conditions have existed throughout the entire study area; from the Apalachicola River, near Jim Woodruff Dam, downstream beyond I-10 bridge. The average control station species diversity values ranged from 0.50 to 4.66; while "test" station average values ranged from 1.06 to 4.19.

Two significant biological changes have been observed in the study area since 1993:

- The incidence in 1993 (a normal low-flow year) of decreased species diversity and increased productivity in the upstream portion of the study area nearest to the Jim Woodruff Dam. This is likely due to fluctuating stream flow velocity, resulting from the operation of Jim Woodruff Dam and accelerated phytoplankton productivity which originated from the enriched, quiescent waters of Lake Seminole; and

- A general decrease in biological stability (10%) and productivity (45%) in the study area, which accompanied severe flooding during the 1994-study period.

In compliance with the State of Florida Industrial Wastewater permit (Appendix D) for Plant Scholz, annual Biological Integrity Tests, of limited scope and intensity, have been conducted on the Apalachicola River since 1993. (Note: These tests are not a requirement of the current permit) In addition, a series of static, acute, screening toxicity tests have been performed annually on samples of cooling water effluent. The results of these tests are submitted by Gulf Power Company, under separate cover, to FDEP before December 31 of each year. Portions of these reports are incorporated within the body of this report. A brief summary of these tests is as follows:

- No adversities have been indicated from the results of toxicity tests conducted since monitoring activities began in 1993 on samples of cooling water effluent collected from Gulf Power Company's Plant Scholz.

- The results of a biological integrity test conducted on the Apalachicola River above and below the confluence of the Plant Scholz cooling water discharge canal indicates that healthy water quality conditions have existed during each test period since 1993.

- According to biological integrity tests performed to date, the Shannon-Weaver Diversity Index has not been reduced to less than 75% of established background levels due to the discharge of cooling water from Plant Scholz.

In 1999, sediment toxicity tests were added to the Plant Scholz Environmental Monitoring Program. It is hoped that the addition of sediment toxicity testing to the program will provide a better understanding of the effects, if any; the river bottom sediments play in the surrounding ecosystem. A brief summary of the tests is as follows:

- No adversities have been indicated from the results of toxicity tests conducted since monitoring activities began in 1999 on samples of river bottom sediment collected from Gulf Power Company's Plant Scholz.

6. LITERATURE CITED

Ager, L. A., Mesing, C., Hill, M., 1985. *Fishery Study, Apalachicola River Maintenance Dredging Disposal Site Evaluation Program*, Florida Game and Fresh Water Fish Commission, 72 pp.

Abel,, P. D., *Water Pollution Biology*, Ellis Harwood Limited, 231 pp., 1989.

Allen, T. K., 1983. *The Impact on Sediment Distribution by Structural Alterations to the Apalachicola River, Florida (Masters Thesis)*, Florida State University.

American Public Health Association, "Biological Sampling and Analysis," *Standard Methods for the Examination of Water and Wastewater*, 18th ed., p. 1448, 1992.

Arthur, J. W., and Horning, W. H., "The Use of Artificial Substrates in Pollution Surveys," *American Midland Naturalist 82 (1)*, pp. 83-89, 1969.

Barrett, G. W., and Rosenburg, R. (eds.), *Stress Effects on Natural Ecosystems*, John Wiley and Sons, Inc., 305 pp., 1981.

Bass, D. G., Jr., and Hitt, V. G., "Sport Fishery Ecology of the Apalachicola River, Florida, Northwest Streams Research Project," *Florida Game and Freshwater Fish Commission*, pp.2-5, 1978.

Bass, D. G., Jr., *Rivers of Florida and Their Fishes*, Florida Game and Fresh Water Fish Commission, 1980-1983, 130 pp.

Browder, J. A. (ed.), *Aquatic Organisms as Indicative of Environmental Pollution*, American Water Resources Association, pp. 927-1017, 1988.

Brown, J. T., Miller, P. J., 1964. *Lake and Stream Survey, The Apalachicola River Watershed*, Florida Game and Fresh Water Fish Commission, 60 pp.

Cairns, J., Jr., Arnold, J. C., and Dickson, K. L., "An Evaluation of the Use of a Basket-Type Artificial Substrate for Sampling Macroinvertebrate Organisms," *Transactions of the American Fisheries Society 100 (3)*, pp. 553-559, 1971.

Cairns, J., Jr., and Dickson, K. L., "A Simple Method for the Biological Assessment of the Effects of Waste Discharges on Aquatic Bottom-Dwelling Organisms," *Journal of Water Pollution Control, Federation 43 (5)*, pp. 775-772, 1971.

Cairns, J., Jr., and Dickson, K. L., (eds.). *Biological Methods for the Assessment of Water Quality*, American Society for Testing and Materials, 256 pp., 1973.

Cairns, J., Jr., Dickson, K. L., and Livingston, R. J., (eds.). *Biological Data in Water Pollution Assessment: Quantitative and Statistical Analyses*, American Society for Testing and Materials, 184 pp., 1978.

Cox, D. T., Vosatka, E., Mannes, D., 1974. *Annual Progress Report for Investigations Project, Upper Apalachicola River Study, 1973-1974*, Florida Game and Fresh Water Fish Commission, 29 pp.

EA Engineering, Science, and Technology (EA), and Tetra Tech, Inc., 1994. *Bioassessment for the Non-point Source Program*. Prepared for FDEP. Report Number 60226.01.0001.

Edmiston, H. L., Tuck, H. A., 1987. *Resource Inventory of the Apalachicola River and Bay Drainage Basin,* FDEP, 210 pp.

Elder, J. F., Mattraw, H. C., Jr., 1984. "Accumulation of Trace Elements, Pesticides, and Polychlorinated Biphenyls in Sediments and the Clam, Corbicula manilensis, of the Apalachicola River," *Arch. Environ. Contam. Toxicol.*, 13, 453-469, U.S. Geological Survey, 1984.

Ellis, M. M., "Detection and Measurement of Stream Pollution," p. 156, *Biology of Water Pollution*, FWPCA, p. 290, 1967.

Flemming, C. A., and Trevors, J. T., "Copper Toxicity and Chemistry in the Environment," *Water, Air and Soil Pollution 44/1-2*, p. 145, 1988.

Florida Bureau of Sanitary Engineering, 1964. *Survey of the Chattahoochee, Flint, and Apalachicola River System, June 29, 1964 - July 10, 1964*, Florida State Board of Health, 5 pp.

Florida Department of Environmental Regulation, 1984. "Appendix A: Petition to Designate the Upper Apalachicola River as an Outstanding Florida Water," *Report to the Environmental Regulation Commission on the Proposed Designation of the Upper Apalachicola River as an Outstanding Florida Water*, 54 pp.

Florida Department of Environmental Regulation, 1986. *1986 Florida Water Quality Assessment, 305(b) Technical Report*, pp. 17-23.

Florida Department of Environmental Regulation, 1986. "Apalachicola River Basin Technical Report," *The 305(b) Water Quality Inventory for the State of Florida.*

Florida Department of Environmental Regulation, 1986. "An Investigation of the Effects on Water Quality in North Florida," *Stream Impoundments*, 86 pp.

Florida Department of Environmental Regulation, 1988. *Florida Non-point Source Assessment - Volume I*, pp. 49-50.

Florida Department of Environmental Regulation, 1988. *Water Quality Assessment for the State of Florida*, 83 pp.

Florida Department of Environmental Regulation, 1990. *Biological Assessment of Scholz Generating Plant*, pp. 1-4.

Florida Department of Environmental Protection 1991. Biological Assessment of Gulf Power Company's Scholz Electric Generating Plant, Jackson County, NPDES #FL0002283, Sampled 8 October 1990.

Florida Department of Environmental Protection, 1992. Surface Water Standards, REG Files, Inc., of Tallahassee, Florida.

Florida Department of Environmental Protection, 1993. Permit Number I032-189371 to operate the Scholz Electric Generating Plant.

Florida Game and Fresh Water Fish Commission, 1986. *Five Year Completion Report on the Fisheries Ecology and Dredging Impacts on the Apalachicola River System, 1981-1986*, 97 pp.

Frey, D. G., *Limnology in North America*, The University of Wisconsin Press, 734 pp. 1966.

Fullner, R. S., "A Comparison of Macroinvertebrates Collected by Basket and Modified Multiple Plate Samplers," *Journal of Water Pollution Control Federation 43*, pp. 494-499, 1971.

Gaufin, A. R., and Tarzwell, C. M., "Aquatic Invertebrates as Indicators of Stream Pollution," *Public Health Report 67 (1)*, pp. 57-64 USPHS, 1952.

Gholson, A., Jr., 1986. *Vegetation Analysis for the Apalachicola River Maintenance Dredging - Disposal Site Evaluation Study*, U.S. Army Corps of Engineers, 188 pp.

Gibbons, J. W., and Sharitz, R. R., (eds.), *Thermal Ecology*, Technical Information Center, U. S. Atomic Energy Commission, 671 pp., 1974.

Gibbons, J. W., Thorp, J. H., (eds.), *Energy and Environmental Stress in Aquatic Systems*, Technical Information Center, U. S. Department of Energy, 854 pp., 1978.

Gordon, N. D., McMahon, T. A., and Finlayson, B. L., (eds.), *Stream Hydrology, An Introduction for Ecologists*, John Wiley and Sons, Inc., 526 pp., 1992.

Gulf Power Company, *Welcome to Plant Scholz*, 1992.

Hackney, C. T., Adams, C. M., and Martin, W. H., (eds.), *Biodiversity of the Southern United States, Aquatic Communities*, John Wiley and Sons, Inc., 779 pp., 1992.

Hart, C. W., Jr., and Fuller, L. H., *Pollution Ecology of Freshwater Invertebrates*, Academic Press, 389 pp., 1974.

Hester, F. E., and Dendy, J. S., "A Multiple-Plate Sampler for Aquatic Macroinvertebrates," *Transactions of the American Fisheries Society 91*, pp. 420-421, 1962.

Hill, M. J., Long, E. A., Rousseau, R. W., 1990. *Apalachicola River Watershed Investigations: Study I. General Fisheries and Aquatic Habitat Survey; and Study II. Fisheries Survey, 1985-1990*, Florida Game and Fresh Water Fish Commission, 69 pp.

Hynes, H. B. N., "The Biological Assessment of Water Pollution," p. 155, *The Biology of Polluted Waters*, Liverpool University Press, p. 202, 1966.

Ingram, W. M., and Mackenthun, K. M., "Biological Field Investigative Data for Water Pollution Surveys," *FWPCA Special Publication WP-13*, p. 139, 1966.

Krenkel, P. A., and Parker, F. L. (eds.), *Biological Aspects of Thermal Pollution*, Vanderbilt University Press, 407 pp. 1969.

Krenkel, P. A. (ed.), *Heavy Metals in the Aquatic Environment*, Pergamon Press, 352 pp., 1975.

Lowe, E. A., *Aquatic Pollution*, John Wiley and Sons, Inc., 611 pp., 1993.

Lloyd, M., Karr, J. R., and Zar, J. H., "On the Calculation of Information - Theoretical Measures of Diversity," *American Midland Naturalist 79(2)*, pp. 257-272, 1968.

Loeb, S. L., and Spacie, A. (eds.), *Biological Monitoring of Aquatic Systems*, Lewis Publishers, 381 pp., 1994.

Margalef, D. R., "Information Theory in Ecology," *General Systems 3*, pp. 36-71, (English Translation by W. Hall), 1957.

Mason, W. T., Jr., and Lewis, P. A., "Comparing the Usefulness of Biomass and Individual Counts of Macroinvertebrates in Evaluating Water Quality," *Proceedings of the Annual Meeting of Limnologists and Oceanographers 36*, 1973.

Mason, C. F., *Biology of Freshwater Pollution, Second Edition*, Longman Scientific and Technical, 351 pp., 1991.

Neel, J. K., Hirsh, J., and Nicholson, H. P., "Main Stem Reservoir Effects on Water Quality in the Central Missouri River," p. 21, *Biological Associated Problems in Freshwater Environments*, FWPCA, p. 287, 1967.

Northwest Florida Water Management District, 1982. *Apalachicola River Flood Plain Processes in Nutrient Transport*, April 6, 7, & 8, 1982, 138 pp.

Northwest Florida Water Management District, "Apalachicola River and Bay Project: Point Source Assessment of the Apalachicola River and Bay Drainage Basin," *Surface Water Improvement and Management (S.W.I.M.) Program*, 119 pp., 1990.

Northwest Florida Water Management District, *Apalachicola River and Bay Management Plan; Series 92-2*, 1992.

Oglesby, R. T., Carlson, C. A., and McCann, J. A. (eds.) *River Ecology and Man*, 465 pp., 1972.

Reid, G. K., *Ecology of Inland Waters and Estuaries*, Van Nostrand Reinhold Company, 375 pp., 1961.

Spearman, C., (1904), Rank Correlation, pp. 193-195 and 593, in Snedecor, G. W., and Cochran, W. G., *Statistical Methods*, 6th Edition, Iowa State University Press, 1971.

Stanford, J. A., and Ward, J. V. (eds.), *The Ecology of Regulated Streams*, 398 pp., 1979.

Tackett, J. H., and Ammons, R. W., *Laboratory Effluent Bioassay Monitoring and In Situ Receiving Stream Biological Integrity Testing for Gulf Power Company's Scholz Electric Generating Plant located in Jackson County, Florida, in compliance with State Industrial Wastewater Permit #I032-189371 during the Sampling Period of 07/21/93-08/20/93*, Southern Company Services, Inc., 1993.

Tackett, J. H., and Ammons, R. W., *Laboratory Effluent Bioassay Monitoring and Insitu Receiving Stream Biological Integrity Testing for Gulf Power Company's Scholz Electric Generating Plant located in Jackson County, Florida, in compliance with State Industrial Wastewater Permit #I032-189371 during the Sampling Period of 07/28/94-08/28/94*, Southern Company Services, Inc., 1994.

U. S. Army Corps of Engineers, 1985. *Interim Drought Management Plan for the Apalachicola - Chattahoochee - Flint Basin*, 142 pp.

U. S. Environmental Protection Agency, "Macroinvertebrates," *Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents*, (EPA-670/4-73-991), pp. 16-17, 1973.

U. S. Environmental Protection Agency/Corps of Engineers, *Procedures for Handling and Chemical Analyses of Sediment and Water Samples*, Technical Report EPA/CE-81-1.

U. S. Environmental Protection Agency, *Methods for Chemical Analysis of Water and Wastes*, EPA-600/4-79-017, March 1984.

U. S. Environmental Protection Agency, "Macroinvertebrates," *Biological Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters*, (EPA/600/4-90/030), pp. 57-66, 1990.

U. S. Environmental Protection Agency, *Laboratory Manual Physical/Chemical Methods*, SW-846, Third Edition, Volume 1A, November 1986.

Ward, J. V., *Aquatic Insect Ecology, 1. Biology and Habitat*, John Wiley and Sons, Inc., 438 pp., 1992.

Welch, P. S., *Limnological Methods*, McGraw-Hill Book Company, Inc., 381 pp., 1948.

Wilhm, J. L., and Dorris, J. C., "Species Diversity of Benthic Macroinvertebrates in a Stream Receiving Domestic and Oil Refinery Effluents," *American Midland Naturalist 76 (2)*, pp. 427-449, 1966.