

Biological Assessment of

Arvah B. Hopkins Generating Station

Leon County

NPDES #FL0025518

Sampled June 1996

September 1996

Biology Section
Division of Administrative and Technical Services

Comprehensive Quality Assurance Plan No. 870346G

Department of Environmental Protection

Results of Fifth Year Inspections

Discharger: Arvah B. Hopkins Power Generating Station
County: Leon
NPDES Number: FL0025518
State Permit Expiration Date: 29 February 1996

Toxics Sampling Inspection (XSI)

Date Sampled: 5 June, 1996

Results: Copper was detected in the discharge and at the test site at a concentration of 43 µg/L. Copper was also found 400 m downstream from the discharge at 41 µg/L and at edge of the facility's 800 m mixing zone at 13 µg/L. Even though the copper measured in the effluent and in Beaver Creek (prior to the edge of the mixing zone) exceeded the hardness-based Class III water quality standard, the facility complied with its current permit limit for copper at the edge of the mixing zone. However, the level of copper in the 400 m stretch of Beaver Creek downstream from the discharge was high enough to be chronically toxic to some invertebrates (AQUIRE 1994). Copper was also detected in the sediments of the test site (30 mg/Kg) but not in reference site sediments (with a 3 mg/Kg detection limit).

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 5 June, 1996

Results: The effluent sample was not acutely toxic to the water flea, *Ceriodaphnia dubia*, or to the fish, *Cyprinella leedsi*.

Impact Bioassessment Inspection (IBI)

Date Sampled: 4 June, 1996

Results: Declines in several measures of macroinvertebrate health demonstrated the negative effects of the discharge on Beaver Creek. The 53.8% reduction in diversity indicates non-compliance with the biological integrity criterion (a violation of Rule 62-302.530(11) FAC). The Stream Condition Index (SCI) score at the reference site placed it in the "excellent" category, whereas the test site SCI value ranked it as "poor". The test site biota may have responded to the chronically toxic levels of copper, the relatively high conductivity (900 µmhos/cm), or to an aspect of the discharge not measured during the survey. There did not appear to be phytoplankton community changes at the test site in response to the discharge. Potential effects of this discharge on algae were inconclusive due to the loss of the periphyton samplers.

Water Quality Inspection (WQI)

Date Sampled: 5 May, 1995

Results: Fecal and total coliforms complied with water quality standards in all samples. Phosphorus enrichment, attributable to the facility, was noted at the test site. Nitrate-nitrite enrichment, probably due to stormwater inputs, was observed at the reference site. Algal Growth Potential was elevated at the reference site (22.6 mg dry wt/L, attributable to the nitrate-nitrite enrichment there). The AGP result at the test site suggested algal growth inhibition, possibly related to the elevated copper concentration of the discharge.

Introduction

The Arvah B. Hopkins Generating Station is an oil/natural gas powered electric generating facility owned and operated by the City of Tallahassee. The plant is located west of Tallahassee, on State Road 260, Leon County, Florida (see map in Appendix). Discharge from the Hopkins Power Plant consists of cooling tower blowdown, turbine cooling water, and treatment pond effluent. Effluent is discharged through a drainage ditch to Beaver Creek. The discharge enters Beaver Creek at its headwaters, flows through the Lake Talquin Wildlife Management Area, and feeds into the Class III Lake Talquin near the confluence of the Ochlockonee River. The total length of Beaver Creek is 3,301 m (Dr. Wayne Magley, personal communication). The design flow of the facility is 1.87 MGD. Flow during this survey was 1.78 MGD.

State permit limits are as follows: temperature (maximum of 80 °F or 26.7 °C), pH (6.0 to 8.5 SU), total residual chlorine (maximum of 0.01 mg/L at discharge), oil and grease (maximum of 5.0 mg/L), iron (maximum of 1000 µg/L), chromium (maximum of 50 µg/L), zinc (maximum of 30 µg/L), and copper (maximum of 30 µg/L at the downstream edge of an 800 m mixing zone) (see Facility Summary in Appendix). Additionally, acute toxicity tests are performed on the effluent. Monthly Operating Report data indicate effluent quality complies with permit limits.

In May, 1995, a 5th Year Bioassessment was conducted on this discharge. At that time, adverse effects were noted in the macroin-

Major characteristics of community structure of control and test sites.

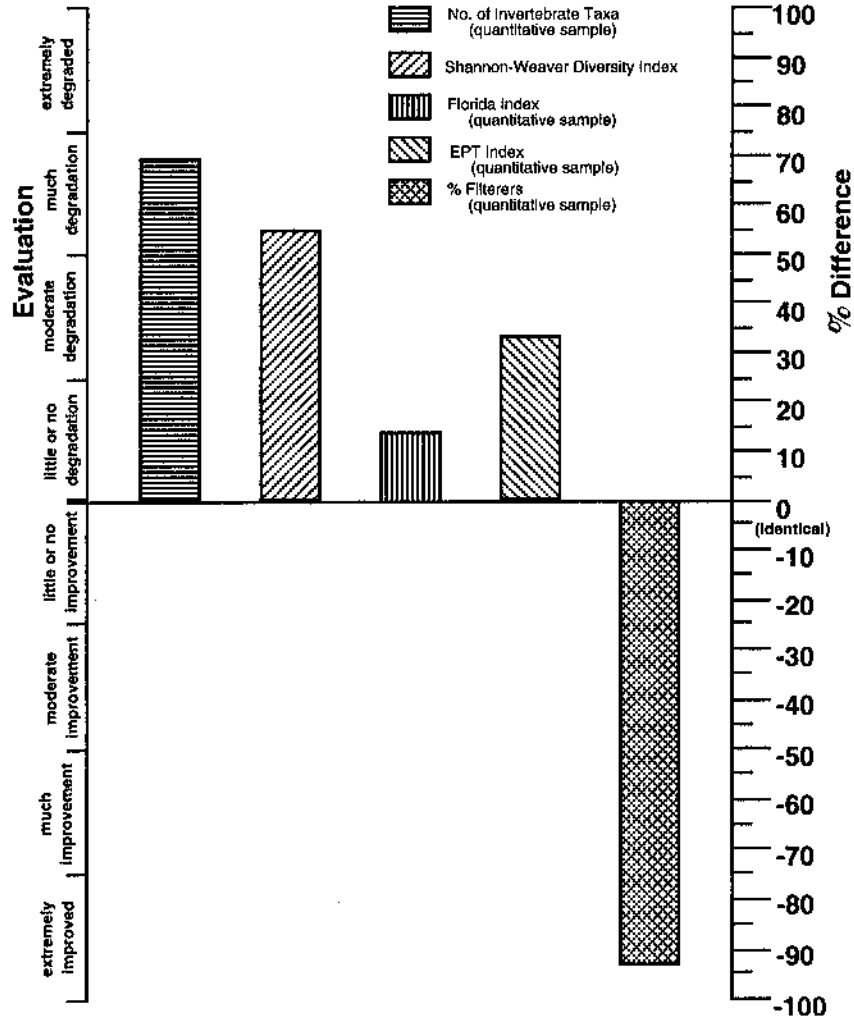
	Reference Site	Test Site
Macroinvertebrate Qualitative		
Number of Taxa	37	22
Florida Index	12	7
SCI	27	15
EPT Index	5	3
% Contribution of Dominant Taxon	12.4	33.1
% Oligochaeta	9.0	0
% Diptera	61.2	92.4
% Ephemeroptera	2.8	0.9
% Trichoptera	2.8	1.7
% Odonata	0	0.9
% Coleoptera	7.3	1.7
% Gastropoda	6.7	0
% Pelecypoda	9.6	0.9
% Predators	7.0	36.4
% Above Surface Deposit Feeders	37.4	41.1
% Below Surface Deposit Feeders	6.7	0
% Suspension Feeders	28.1	1.3
% Scrapers	14.3	5.9
% Shredders	4.2	14.4
% Scavengers	0	0.9
Macroinvertebrate Hester-Dendy		
Number of Taxa	32	10
Florida Index	7	6
Shannon-Weaver Diversity	3.94	1.76
EPT Index	3	2
% Diptera	83.5	42.7
% Ephemeroptera	1.6	0
% Trichoptera	1.2	57.3
% Coleoptera	3.2	0
% Isopoda	0.8	0
% Gastropoda	9.2	0
% Predators	9.2	21.4
% Above Surface Deposit Feeders	44.2	19.1
% Suspension Feeders	29.7	58.4
% Scrapers	11.9	0
% Shredders	3.3	1.1
% Scavengers	1.4	0
Phytoplankton Algae		
Number of Taxa	6	
Shannon-Weaver Diversity	2.22	2.14
Algal Density (#/mL)	116	236
Chlorophyll a (µg/L)	0.6	0.7
% Blue-green	27.3	3.3
% Green	45.5	10.0
% Diatoms	27.3	83.3
Algal Growth Potential (mg dry wt/l)	22.5	10.2

vertebrate and periphyton communities of Beaver Creek, thought to be related to the elevated copper concentration of the discharge.

Methods

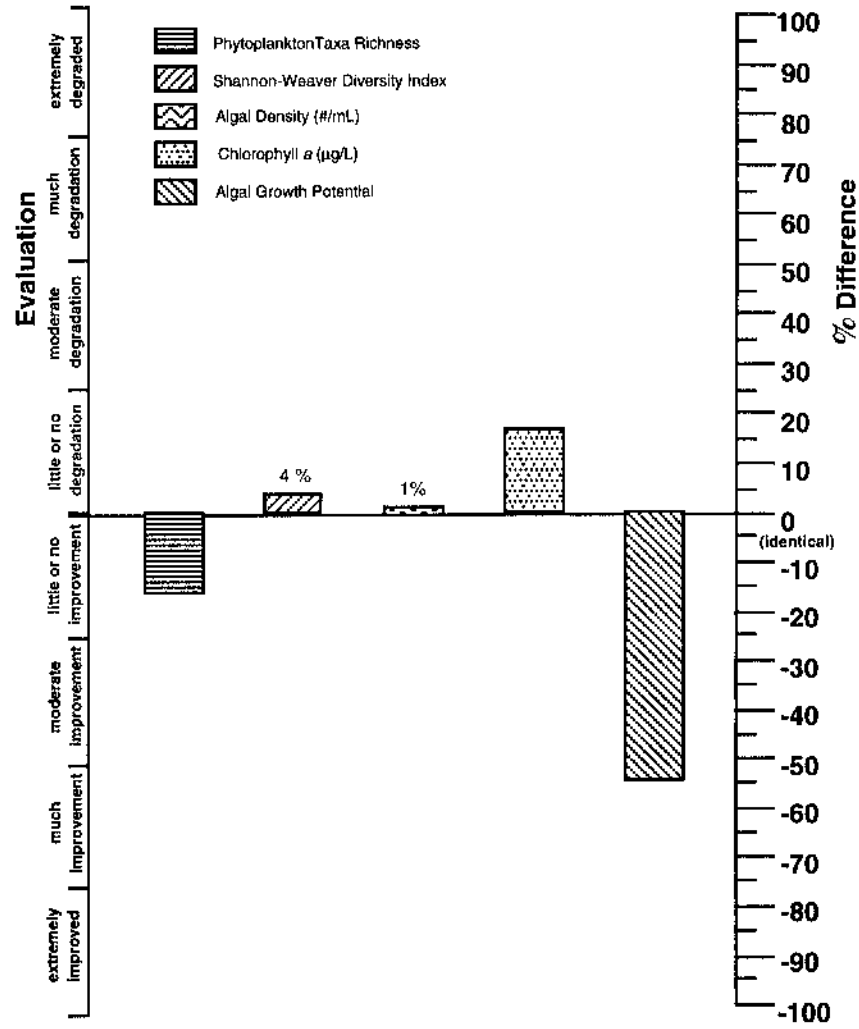
The focus of this investigation was to determine the discharger's effects on the receiving waters. A comparison of biological community health was made between a reference site (located in Three Pole Creek, an adjacent tributary of the Ochlockonee River) and a test site (located in Beaver Creek, approximately 100 m downstream of the discharge). A habitat assessment was performed *in situ* to establish comparability between sites. Supplemental physical/chemical data were also collected on the effluent and study sites. Acute screening toxicity bioassays, using *Ceriodaphnia dubia* and *Cyprinella leedsi* as test organisms, were performed on an effluent sample (Weber 1991). The effluent was analyzed for metals and for organic constituents (base neutral and acid extractables). Additional water column metals samples were taken at the test site, the middle part of the mixing zone (approximately 400 m downstream of the discharge), and at the end of the mixing zone (approximately 800 m downstream of the discharge). Sediment copper analysis was performed on sediments from the reference and test sites. Additionally, nutrient analyses were performed at effluent, reference, and test sites. Methods used for all chemical analyses are on file at the Tallahassee DEP Chemistry Laboratory.

Benthic macroinvertebrate communities were evaluated at reference and test sites. Invertebrates were collected from multiple substrates (*e.g.*, snags, leaf packs, roots) using discrete dip net sweeps. Additional invertebrate collections were accomplished using Hester-Dendy multiplate samplers which were incubated for 28 days (Ross 1990). During recovery of the Hester-Dendy samplers, the top plate of each of the 4 artificial substrate samplers at the test site was partially exposed due to low water in the stream (the facility was not discharging). To provide a valid sample for the determination of the biological integrity criterion (Rule 62-302.530(11) FAC), the organisms are to be collected from a minimum of three Hester-Dendy type artificial substrates. Each Hester-Dendy consists of 16 plates, upon which benthic organisms colonize. The rule implies that a minimum of 48 plates must be successfully colonized. In this case, because four Hester-Dendys were deployed, a total of 60 plates were available for benthic colonization, despite the 4 top plates being dry. Therefore,



Effect of discharge on the benthic macroinvertebrate community.

since loss of the top four plates was offset by the placement of an extra Hester-Dendy, the rule requirement is satisfied. Periphyton samples were attempted by incubating glass microscope slides in a standard periphytometer for 28 days, but the samplers were found dry during recovery. Phytoplankton populations were sampled via subsurface grabs. Chlorophyll *a* was also determined for phytoplankton communities (Ross 1990). Bacterial populations were analyzed for total and fecal coliforms following the methods of APHA (1989). Algal Growth Potential tests, using *Selenastrum capricornutum* as the test organism, followed Miller *et al.* (1978).



Effect of discharge on the algal community.

Explanation of Measurements of Community Health

Several different measurements of macroinvertebrate and algal community health have been employed to determine the effects of a discharge. These are briefly discussed here.

Habitat Assessment: Seven attributes known to have potential effects on the stream biota were evaluated and scored, with 20 points possible for each factor. Based on the sum of these individual scores, overall habitat quality is assigned to one of four categories: Optimal (105-140 points); Suboptimal (70-104 points); Marginal (35-69 points); and Poor (0-34 points).

Taxa richness: Stress tends to reduce the number of different types of organisms present in a system, although moderate nutrient enrichment may sometimes be correlated with increased algal taxa richness.

Shannon-Weaver diversity: This index is specified in the Florida Administrative Code as a measure of biological integrity. Low diversity scores are undesirable. They represent conditions where only a few organisms are abundant, to the exclusion of other taxa. Excessive numerical dominance of a single type of organism (a high % contribution of the dominant taxon) is a related measure which is also associated with disturbance.

Numbers of pollution sensitive taxa: Some organisms become rare or absent as the intensity or duration of disturbance increases. For example, the Florida Index assigns points to stream-dwelling macroinvertebrates based on their sensitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy. Species sensitivity data from other sources, such as Hudson *et al.* (1990), Lenat (1993), and Chang *et al.* (1992) are used as appropriate.

Ephemeroptera/Plecoptera/Trichoptera Index: This index is the sum of the number of EPT taxa present. Higher EPT values are associated with healthier systems.

Community structure: Substantial shifts in proportions of

major groups of organisms, compared to reference conditions, may indicate degradation.

Algal biomass: High algal biomass (algal density or chlorophyll *a*) implies nutrient stress. A decreased diatom to blue-green algae ratio (calculated by dividing the number of individuals in the Bacillariophyta by the number of individuals in the Bacillariophyta + Cyanophyta) is often indicative of nutrient enriched conditions in flowing streams.

Trophic composition/feeding guilds: Disturbance can shift the feeding strategies of invertebrates. In Florida for example, pollution may be responsible for reducing the numbers of filter-feeders (FDEP 1994) and shredders (EA Engineering 1994).

The Stream Condition Index for Florida (SCI) is a composite macroinvertebrate metric (Barbour *et al.* 1996). The SCI assigns points to a variety of parameters, depending on how closely each parameter approaches an expected reference condition (see SCI calculation table in Appendix).

For graphical purposes, the percent differences between the reference and test sites involving the number of taxa, the diversity index, the Florida Index, the EPT Index, the diatom to blue-green algae ratio, and the % filter-feeders are measured as the reference site minus test site divided by the reference site. The percent differences between sites involving algal density, chlorophyll *a*, and algal growth potential are measured as the test site minus reference site divided by the reference site.

The following personnel were involved in this investigation: Marshall Faircloth, Russel Frydenborg, Joy Jackson, Kathleen Lurding, Tina Mikulski, Elizabeth Miller, Urania Quintana, Bart Richard, Lisa Tamburello, David Whiting, and Vicki Whiting (Tallahassee Biology Laboratory). The report was reviewed by the Point Source Studies Review Committee, consisting of Wayne Magley, Jan Mandrup-Poulsen, and Michael Tanski, as well as District representatives.

Results and Discussion

The two streams studied in this survey, Three Pole Creek (the reference site) and Beaver Creek (the test site) share a common drainage basin divide. The test site predominately receives cooling water discharge and stormwater runoff from the facility and surrounding areas, while the reference stream receives some stormwater from the facility as well as runoff from forested areas. Although both sites were in the "optimal" habitat assessment category, habitat quality at Beaver Creek (the test site), with 117 points, was somewhat reduced compared with Three Pole Creek (the reference stream), which had 131 points. The test site lost points in the categories of substrate availability and water velocity, mostly because the facility was not discharging during the day biological sampling occurred, resulting in lower flow (and water velocity) in the stream. The following day, the facility was discharging as normal, and water samples were taken.

Except for specific conductance, physical/chemical measurements were comparable at the two sites. Water at both sites was adequately oxygenated (dissolved oxygen was above 7.0 mg/L) and similar in pH (7.6 and 7.9 SU at reference and test sites, respectively). Temperature at the test site (22.2 °C) was slightly higher than the reference site (19.9 °C), but within the permitted limit of 26.7 °C. Conductivity at the test site (800 µmhos/cm) was substantially elevated above that of the reference site (198 µmhos/cm), although it still complied with Class III standards.

The effluent sample was not acutely toxic to the water flea, *Ceriodaphnia dubia*, or to the fish, *Cyprinella leedsi*. No mortality occurred during the two 48 hour acute bioassays (Appendix).

No organic pollutants were detected in the effluent. Of the metals analyzed for, copper (43 µg/L), iron (67 µg/L), and zinc (15 µg/L) were detected in the effluent. Copper was also found 100 m downstream from the discharge (test site = 43 µg/L), 400 m downstream from the discharge (mid-mixing zone = 41 µg/L), and at edge of the facility's 800 m mixing zone (13 µg/L). Even though the copper measured in the effluent and in Beaver Creek (prior to the edge of the mixing zone) exceeded the hardness-based Class III water quality standard, the facility complied with its current permit limit for copper at the edge of the mixing zone. However, the level of copper in the 400 m stretch of Beaver Creek downstream from the discharge was high enough to be chronically toxic to some invertebrates (AQUIRE 1994). Copper was also detected in the sediments of the test site (30 mg/Kg) but not in reference site sediments (with a 3 mg/Kg detection limit).

Total coliform bacteria were measured to be 22 organisms/100

mL at the reference site, 400 organisms/100 mL at the test site, and 300 organisms/100 mL in the effluent. Fecal coliforms at the reference site (165 organisms/100 mL), the test site (80 organisms/100 mL), and in the effluent (30 organisms/100 mL) also complied with Class III standards.

The total phosphorus concentration at the test site (0.56 mg/L) was higher than the values found in approximately 85% of other Florida streams (see Table of Typical Water Quality Parameters in Appendix). This test site phosphorus enrichment could be directly attributed to the discharge, which had a similar total phosphorus concentration (0.58 mg/L). Nitrogenous compounds in the effluent and at the test site were fairly average. In contrast, nitrate-nitrite was elevated at the reference site (0.25 mg/L), where it was higher than the values found in approximately 75% of other Florida streams. Total phosphorus at the reference site (0.13 mg/L) was average for a Florida stream.

Algal Growth Potential (AGP) exceeded the 5 mg dry wt/L "problem threshold" at both the reference site (22.6 mg dry wt/L) and at the test site (10.3 mg dry wt/L) (Raschke and Schultz 1987). The effluent AGP was 8.5 mg dry wt/L. The elevated AGP at the reference site (attributable to the nitrate-nitrite enrichment there) is probably the result of stormwater inputs. The AGP of the test site was somewhat lower than expected, based upon the nutrient results. This suggests algal growth inhibition, possibly related to the elevated copper concentration of the discharge.

Most measures of macroinvertebrate health indicated the discharge was adversely affecting the community. The Figure on p. 2 indicates the degree of difference between the invertebrate populations of the reference and test sites. Larger differences (higher percentages) correspond with greater degrees of degradation. Negative values mean the test site is better than the reference site.

In the Hester-Dendy samples, declines in taxa richness (32 taxa at the reference site, 10 at the test site) and Shannon-Weaver diversity (3.9 at the reference site, 1.8 at the test site) demonstrated the negative effects of the discharge. The 53.8% reduction in diversity indicates non-compliance with the biological integrity criterion (a violation of Rule 62-302.530(11) FAC). Although there were reductions in the Florida Index (7 at the reference site, 6 at the test site) and the EPT Index (3 at the reference site, 2 at the test site) they were not substantial. Since copper was detected in the discharge and at the test site at a level which is chronically toxic to some invertebrates (AQUIRE 1994), it could have contributed to observed biological problems. Additionally, the elevated conductivity at the test site (900 µmhos/cm) may have stressed the fauna there.

Dip net results showed a similar trend of declining community health at the test site. Taxa richness, the Florida Index, and the EPT Index decreased by 40.5%, 41.6%, and 40%, between the reference site and test sites, respectively. The Stream Condition Index for Florida (SCI) score at the reference site (with 27 points) placed it in the upper range of the "excellent" category, whereas the test site SCI value (15 points) ranked it at the lower range of the "poor" category (Appendix). In summary, the macroinvertebrate data suggest the discharge is degrading the biota of Beaver Creek, resulting in an imbalance of aquatic fauna.

The Figure on p. 3 represents changes in the phytoplankton algal community. As was noted with the macroinvertebrates, larger differences (that is, higher percentages) correspond with greater degrees of degradation. Phytoplankton taxa richness (6 at the reference site, 7 at the test site) and diversity (2.2 at the reference site, 2.1 at the test site) were virtually unchanged between the two streams. Chlorophyll *a* was low in both streams (0.6 µg/L at the reference site, 0.7 µg/L at the test site). There did not appear to be phytoplankton community changes at the test site in response to the discharge. Potential effects of this discharge on algae were inconclusive due to the loss of the periphyton samplers, since the attached community is preferred for assessing algal populations in flowing systems.

Conclusions

The effluent sample was not acutely toxic to the water flea, *Ceriodaphnia dubia*, or to the fish, *Cyprinella leedsi*.

No organic pollutants were detected in the effluent.

Copper was detected in the discharge and at the test site at a concentration of 43 µg/L. Copper was also found 400 m downstream from the discharge at 41 µg/L, and at edge of the facility's 800 m mixing

zone at 13 µg/L. Even though the copper measured in the effluent and in Beaver Creek (prior to the edge of the mixing zone) exceeded the hardness-based Class III water quality standard, the facility complied with its current permit limit for copper at the edge of the mixing zone. However, the level of copper in the 400 m stretch of Beaver Creek downstream from the discharge was high enough to be chronically toxic to some invertebrates (AQUIRE 1994). Copper was also detected in the sediments of the test site (30 mg/Kg) but not in reference site sediments (with a 3 mg/Kg detection limit).

Fecal and total coliforms complied with water quality standards in all samples.

Phosphorus enrichment, attributable to the facility, was noted at the test site. Nitrate-nitrite enrichment, probably due to stormwater inputs, was observed at the reference site.

Algal Growth Potential was elevated at the reference site (22.6 mg dry wt/L, attributable to the nitrate-nitrite enrichment there. The AGP of the test site was somewhat lower than expected, based upon the nutrient results. This suggests algal growth inhibition, possibly related to the elevated copper concentration of the discharge.

Declines in several measures of macroinvertebrate health demonstrated the negative effects of the discharge on Beaver Creek. The 53.8% reduction in diversity indicates non-compliance with the biological integrity criterion (a violation of Rule 62-302.530(11) FAC). The Stream Condition Index (SCI) score at the reference site placed it in the "excellent" category, whereas the test site SCI value ranked it as "poor". The test site biota may have responded to the copper (which was present in the discharge at chronically toxic levels), the relatively high conductivity (800 µmhos/cm), the nutrient enrichment, or to an aspect of the discharge not measured during the survey.

There did not appear to be phytoplankton community changes at the test site in response to the discharge. Potential effects of this discharge on algae were inconclusive due to the loss of the periphyton samplers, since the attached community is preferred for assessing algal populations in flowing systems.

Literature Cited

American Public Health Assoc., American Water Works Assoc., and Water Pollution Control Federation. 1989. Standard Methods for the Examination of Water and Wastewater, 17th ed. New York, N.Y. 1268 p.

Aquatic Toxicity Information Retrieval Data Base (AQUIRE). 1994. U.S. EPA Environmental Research Laboratory, Duluth, MN.

Chang, S., F. W. Steimle, R. N. Reid, S. A. Fromm, V. S. Zdanowicz, and R. A. Pikanowski. 1992. Association of benthic macrofauna with habitat types and quality in the New York Bight. Mar. Ecol. Prog. Ser. 89: 237-251.

EA Engineering, Science, and Technology and Tetra Tech, Inc. 1994. Bioassessment for the nonpoint source program (draft). Prepared for the Fla. Dept. Environ. Protection. Unpaginated.

Engle, V. D., J. K. Summers, and G. R. Gaston. 1994. A benthic index of environmental condition of Gulf of Mexico estuaries. Estuaries 17(2): 372-384.

Farrell, D. H. 1992. A community based metric for marine benthos. Fla. Dept. Environ. Reg. SW Dist. Office. unpublished rept. 15 p.

FDEP. 1994. Lake bioassessments for the determination of nonpoint source impairment in Florida. Fla. Dept. Environ. Prot. Biology Section, Tallahassee, Fla. 73 p.

Hudson, P. L., D. R. Lenat, B. A. Caldwell, and D. Smith. 1990. Chironomidae of the Southeastern United States: A checklist of species and notes on biology, distribution, and habitat. U. S. Fish Wildl. Serv., Fish. Wildl. Res. 7. 46 pp.

Hulbert, J. L. 1990. A proposed lake condition index for Florida. North Amer. Benth. Soc. 38th Ann. Mtg., Blacksburg, VA, 11 p.

Lenat, D. R. 1993. A biotic index for the southeastern United States: derivation and list of tolerance values, with criteria for assigning water-quality ratings. J. N. Am. Benthol. Soc. 12(3): 270-290.

Miller, W. E., T. E. Maloney, and J. C. Greene. 1978. The *Selenastrum capricornutum* Printz algal assay bottle test. U. S. Environ. Prot. Agency, EPA-600/9-78-018. 126 p.

Raschke, R. L. and D. A. Schultz. 1987. The use of the algal growth potential test for data assessment. J. Wat. Poll. Cont. Fed. 59(4): 222-227.

Ross, L. T. 1990. Methods for aquatic biology. Fla. Dept. Environ. Reg. Tech. Ser. 10(1): 1-47.

Weber, C. I. 1991. Methods for measuring the acute toxicity of effluents to freshwater and marine organisms. 4th edition. EPA/600/4-90/027. U. S. EPA, Cincinnati, Ohio. 216 pp.

Whitmore, T. J. 1989. Florida diatom assemblages as indicators of trophic state and pH. Limnol. Oceanogr. 34(5): 882-895.

Chemistry summary table for

Arvah B. Hopkins Generating Station	Effluent	Reference Site	Test Site	Mid-mixing Zone	End mixing Zone
Organic Constituents (ug/L)					
	None found				
Metals (ug/L)					
Aluminum	100 U				
Arsenic	10 U				
Cadmium	0.02 U				
Copper	43		43	41	13
Sediment Copper (mg/Kg)		3 U	30		
Chromium	10 U				
Iron	67				
Lead	10 U				
Mercury	0.1 U				
Nickel	4 U				
Selenium	30 U				
Silver	0.04 U				
Zinc	15 I				
Nutrients (mg/L)					
Ortho-phosphate	0.09 A	0.12 A	0.092 A		
Total phosphorus	0.58 A	0.13	0.56		
Ammonia	0.02 U	0.036 I	0.02 U		
Nitrate+Nitrite	0.096 A	0.25 A	0.1		
TKN	0.07 I	0.13	0.089 I		
General Phys-Chem Parameters					
Habitat Assessment		131	117		
D.O. (mg/L)	8.4	7.3	7.0		
pH (SU)	7.3	7.6	7.9		
Conductivity (µmhos/cm)	890	198	800		
Temperature (°C)	22.5	19.9	22.2		
Total Dissolved Solids (mg/L)	641 A				
Chloride (mg Cl/L)	68	5	71		
Sulfate (mg SO4/L)	240	1.2	240		
Hardness (mg CaCO3)	408		408	409	409
Algal Growth Potential (mg dry wt/L)	8.5	22.6	10.3		
Toxicity					
Bioassay Fish-Chlorinated	Not toxic				
Bioassay Invertebrate-Chlorinated	Not toxic				
Microbiological Communities (org/100 mL)					
Fecal coliform	30	165 A	80		
Total coliform	300	22 A	400		

A - Value reported is the mean of two or more determinations

I - Value reported is less than the minimum quantitation limit, and greater than or equal to the minimum detection limit

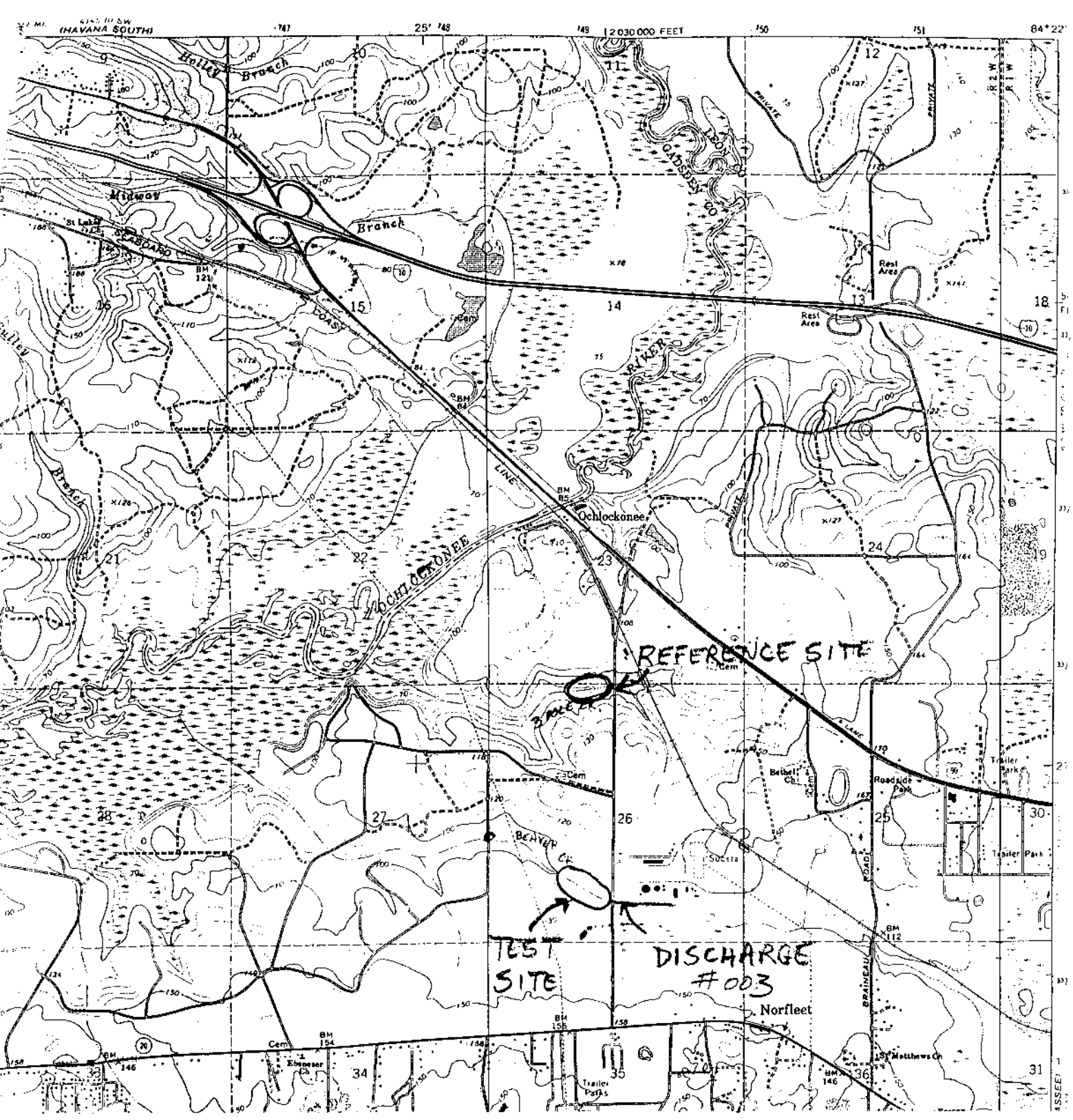
U - Material analyzed for but not detected; value reported is the minimum detection limit

Typical Values for Selected Parameters in Florida Waters

Adapted from Joe Hand, FDER, personal communication, 1991
(data was collected between 1980 and 1989)

Parameter	Percentile Distribution 5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
STREAMS (1617 stations)											
Phytoplankton Chlorophyll *a*	0.22	0.52	0.94	1.60	3.02	4.63	6.72	9.87	14.68	27.35	48.70
Periphyton Chlorophyll *a*	0.31	0.43	0.77	1.04	2.16	2.94	6.45	10.51	17.00	39.51	60.85
H-D Diversity	0.84	2.12	2.48	2.74	2.88	3.09	3.25	3.40	3.52	3.76	3.90
Qualitative Taxa Richness	9.00	12.00	17.00	20.00	22.00	24.50	26.00	28.00	31.00	37.00	53.00
H-D Taxa Richness	6.00	6.50	9.00	11.50	13.00	15.00	17.00	21.50	26.00	29.00	32.00
TKN	0.30	0.39	0.56	0.73	0.87	1.00	1.11	1.26	1.49	1.93	2.80
Ammonia	0.02	0.02	0.04	0.05	0.06	0.08	0.11	0.14	0.20	0.34	0.60
NO2-NO3	0.01	0.01	0.03	0.05	0.07	0.10	0.14	0.20	0.32	0.64	1.05
Total Phosphorus	0.02	0.03	0.05	0.06	0.10	0.13	0.18	0.25	0.39	0.74	1.51
Ortho Phosphorus	0.01	0.01	0.03	0.04	0.05	0.08	0.11	0.17	0.27	0.59	1.37
Turbidity	0.60	0.90	1.20	1.45	2.10	2.80	3.60	4.50	6.65	10.45	16.30
LAKES (477 stations)											
Phytoplankton Chlorophyll *a*	0.80	1.71	2.88	4.28	10.06	13.40	20.00	30.10	47.20	65.44	113.90
Dredge Diversity	0.71	0.97	1.43	1.74	1.98	2.12	2.21	2.59	2.85	3.15	3.17
Dredge Taxa Richness	3.00	5.00	6.50	7.00	9.00	10.00	11.00	13.00	15.00	17.00	21.00
TKN	0.36	0.49	0.67	0.83	1.08	1.26	1.40	1.51	1.68	2.11	3.46
NH3+NH4	0.01	0.02	0.02	0.03	0.04	0.06	0.08	0.12	0.15	0.21	0.28
NO2-NO3	0.00	0.00	0.01	0.01	0.01	0.02	0.04	0.05	0.10	0.14	0.23
Total Phosphorus	0.01	0.02	0.02	0.03	0.05	0.07	0.09	0.11	0.14	0.23	0.42
Ortho-Phosphorus	0.00	0.01	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.21	0.32
Turbidity	1.00	1.25	1.55	2.05	2.75	4.50	6.45	9.60	14.10	26.00	40.00
ESTUARIES (690 stations)											
Phytoplankton Chlorophyll *a*	2.14	3.28	4.49	5.13	6.00	6.93	7.94	9.60	12.40	17.60	22.20
Dredge Diversity	1.34	1.53	1.91	2.28	2.56	2.90	3.15	3.59	4.01	4.53	4.98
Dredge Taxa Richness	4.00	6.00	9.00	11.00	15.00	18.50	25.00	35.00	41.00	62.00	90.00
TKN	0.26	0.34	0.42	0.50	0.59	0.69	0.76	0.82	0.95	1.30	1.49
NH3+NH4	0.01	0.02	0.03	0.04	0.05	0.06	0.08	0.09	0.13	0.22	0.28
NO2-NO3	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.05	0.08	0.17	0.23
Total Phosphorus	0.01	0.02	0.06	0.07	0.10	0.11	0.14	0.17	0.23	0.43	0.59
Ortho-Phosphorus	0.01	0.02	0.03	0.04	0.04	0.05	0.07	0.09	0.12	0.21	0.44
Turbidity	3.50	4.00	4.50	5.05	5.40	5.60	6.30	6.80	8.00	11.40	11.75

Units:
Phytoplankton Chlorophyll *a* (ug/L), Periphyton Chlorophyll *a* (mg/m^2), Nutrients (mg/L), Turbidity (NTU), Taxa richness and diversity values are for macroinvertebrates


REFERENCE SITE
TEST SITE
DISCHARGE #003
Ochlockonee
Norfleet
Midway
Holly Branch
Beaver Ck.
Rest Area
Roadside Park
Trailer Park
Ebenezer Ch.
Bethel Ch.
Sucsta
Cem
BM 85
BM 84
BM 112
BM 146
BM 154
BM 156
BM 124
25' 148
149
12030000 FEET
150
151
84°22'

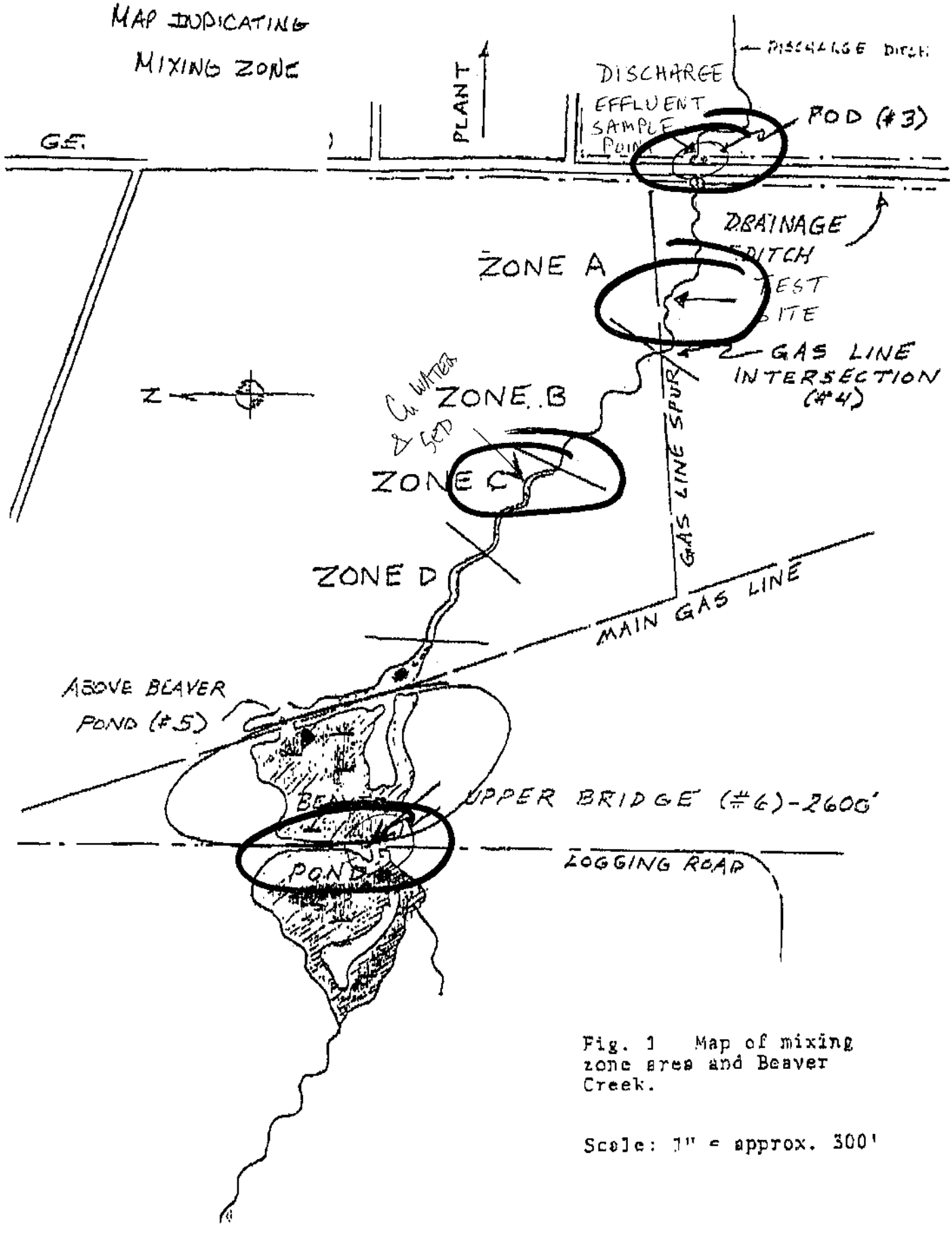


Fig. 1 Map of mixing zone area and Beaver Creek.

Scale: 1" = approx. 300'

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		6-4-96	9:15	THREE POLE CREEK

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	LEON	HOPKINS	REFERENCE

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category):

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
90				5			5 ROAD

Local Watershed Erosion (check box): None ☐ Slight ☒ Moderate ☐ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☒ Moderate potential ☐ Obvious sources ☐

Width of riparian vegetation (m) on least buffered side: >18 m

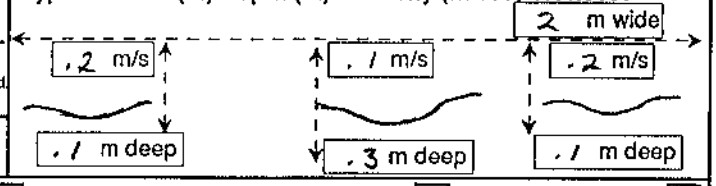
List & map dominant vegetation on back

Artificially Channelized ☒ no ☐ recent, severe ☐ some recovery ☐ mostly recovered, more sinuous

Artificially Impounded ☐ yes

High Water Mark: .5 (m above present water level) + .2 (present depth in m) = .7 (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



Canopy Cover % : Open : ☐ Lightly Shaded (11-45%): ☐ Moderately Shaded (46-80%): ☐ Heavily Shaded: ☒

SEDIMENT/SUBSTRATE

Sediment Odors: Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☐ Other: ☐

Sediment Oils: Absent: ☒ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none (slight) moderate severe Silt smothering: none (slight) moderate severe Other:

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)	10	6	DIPNET	Sand	55	2	DIPNET
Leaf Packs or Mats	5	4	DIPNET	Mud/Muck/Silt	10	-	
Aquatic Vegetation	0	-		Other:			
Rock or Shell Rubble	0	-		Other:			
Undercut banks/Roots	20	8	DIPNET	*Draw aerial view sketch of habitats found in 100 m section*			

WATER QUALITY	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm) or Salinity (ppt):			Secchi (m):
Top								
Mid-depth	.2	19.9	7.6	7.3	198			VOB
Bottom								

System Type : Stream: ☒ (1st - 2nd order / 3rd - 4th order / 5th - 6th order / 7th order or greater) Lake: ☐ Wetland: ☐ Estuary: ☐ Other: ☐

Water Odors (check box): Normal: ☒ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☐

Water Surface Oils (check box): None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity (check box): Clear: ☒ Slightly turbid: ☐ Turbid: ☐ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☐ Clear: ☒ Other: ☐

Weather Conditions/Notes:

SLIGHT / PARTLY CLOUDY BREEZE

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☒	☐	☐	☐
Fish	☒	☐	☐	☐
Aquatic Macrophytes	☒	☐	☐	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
J. JACKSON, L. TAMBURELLO, B RICHARD, J. EICHELBERGER		6/4/96

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		6-4-96	10:30	BEAVER CREEK

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	LEON	HOPKINS	TEST SITE

RIPARIAN ZONE/INSTREAM FEATURES

Predominant Land-Use in Watershed (specify relative percent in each category): POWER PLANT

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
80				5		10	5- ROAD

Local Watershed Erosion (check box): None ☐ Slight ☒ Moderate ☐ Heavy ☐

Local Watershed NPS Pollution (check box): No evidence ☒ Slight ☐ Moderate potential ☐ Obvious sources ☐

Width of riparian vegetation (m) on least buffered side: >18 m

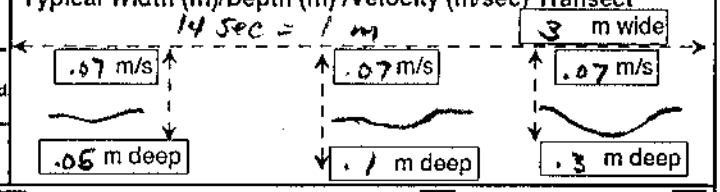
List & map dominant vegetation on back

Artificially Channelized ☐ no ☐ ☐ ☒ (recent, severe / some recovery / mostly recovered, more sinuous)

Artificially Impounded ☐ yes

High Water Mark: 1 (m above present water level) + -3 (present depth in m) = 1.3 (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



Canopy Cover % : Open : ☐ Lightly Shaded (11-45%): ☐ Moderately Shaded (46-80%): ☒ Heavily Shaded: ☐

SEDIMENT/SUBSTRATE

Sediment Odors: Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Anaerobic: ☒ Other: ☐

Sediment Oils: Absent: ☒ Slight: ☐ Moderate: ☐ Profuse: ☐

Sediment Deposition: Sludge: ☐ Sand smothering: none (slight) moderate severe Silt smothering: none (slight) moderate severe Other:

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)	2	2	DIPNET	Sand	85	4	DIPNET
Leaf Packs or Mats	4	6	DIPNET	Mud/Muck/Silt	4	Ø	—
Aquatic Vegetation	Ø			Other:			
Rock or Shell Rubble	Ø			Other:			
Undercut banks/Roots	5	8	DIPNET	*Draw aerial view sketch of habitats found in 100 m section*			

WATER QUALITY	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm) or Salinity (ppt):			Secchi (m):
Top								
Mid-depth	0.1	22.2	7.9	7.0	800			VOB
Bottom								

System Type : Stream: ☒ (1st (2nd) order, 3rd - 4th order, 5th - 6th order, 7th order or greater) Lake: ☐ Wetland: ☐ Estuary: ☐ Other: ☐

Water Odors (check box): Normal: ☐ Sewage: ☐ Petroleum: ☐ Chemical: ☐ Other: ☒ ANEROBIC

Water Surface Oils (check box): None: ☒ Sheen: ☐ Globs: ☐ Slick: ☐

Clarity (check box): Clear: ☒ Slightly turbid: ☐ Turbid: ☐ Opaque: ☐

Color (check box): Tannic: ☐ Green (algae): ☐ Clear: ☒ Other: ☐

Weather Conditions/Notes:

PARTLY CLOUDY, SLIGHT BREEZE —

VERY LITTLE FLOW ESPECIALLY AT TOP OF REACH - MD 10% DRY, PERIPHYTON COMPLETELY DRY

OVER

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☒	☐	☐	☐
Fish	☐	☐	☒	☐
Aquatic Macrophytes	☒	☐	☐	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE
J JACKSON, L TAMBURELLO, B. RICHARD, J EICHELBERGER	Jon A Jackson	6/14/96

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (4-22-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		6-4-96	THREE POLE CREEK

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	LEON	HOPKINS	REFERENCE

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Substrate Types & Availability [20]	Greater than 30% snags, logs, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock, or other stable habitat. 20 19 18 17 16	16% to 30% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 15% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	Less than 5% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Water Velocity [13]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 18 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 1
Artificial Channelization [20]	No artificial channelization or dredging. Stream with normal, sinuous pattern 20 19 18 17 16	May have been channelized in the past (>20 yrs), but mostly recovered, fairly good sinuous pattern 15 14 13 12 11	Channelized, somewhat recovered, but > 80% of area affected 10 9 8 7 6	Artificially channelized, box-cut banks, straight, instream habitat highly altered 5 4 3 2 1
Habitat Smothering [18]	Less than 20% of habitats affected by sand or silt accumulation 20 19 18 17 16	20%-50% of habitats affected by sand or silt accumulation 15 14 13 12 11	Smothering of 50%-80% of habitats with sand or silt, pools shallow, frequent sediment movement 10 9 8 7 6	Smothering of >80% of habitats with sand or silt, a severe problem, pools absent 5 4 3 2 1
Bank Stability [20]	Stable. No evidence of erosion or bank failure. Little potential for future problems. 20 19 18 17 16	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 15 14 13 12 11	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 10 9 8 7 6	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 5 4 3 2 1
Riparian Buffer Zone Width [20]	Width of native vegetation (least buffered side) greater than 18 m 20 19 18 17 16	Width of native vegetation (least buffered side) 12 m to 18 m 15 14 13 12 11	Width of native vegetation 6 to 12 m, human activities still close to system 10 9 8 7 6	Less than 6 m of native buffer zone due to intensive human activities 5 4 3 2 1
Riparian Zone Vegetation Quality [20]	Over 80% of riparian surfaces consist of native plants, including trees, understory shrubs, or non-woody macrophytes. Normal, expected plant community for given sunlight & habitat conditions. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, and/or one class of plants normally expected for the sunlight & habitat conditions is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, and/or one or two expected classes of plants are not represented. Patches of bare soil or closely cropped vegetation, disruption obvious. 10 9 8 7 6	Less than 25% of streambank surfaces are vegetated and/or poor plant community (*e.g.* grass monoculture or exotics) present. Vegetation removed to stubble height of 2 inches or less. 5 4 3 2 1

[ ] Add **5 points** if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

Comments

[131] **TOTAL SCORE**

ANALYSIS DATE:	ANALYST:	SIGNATURE:
6/4/96	JAY JACKSON	Jay Jackson

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (4-22-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		6-4-96	BEAVER CREEK

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	LEON	HOPKINS	TEST SITE

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Substrate Types & Availability [8]	Greater than 30% snags, logs, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock, or other stable habitat. 20 19 18 17 16	16% to 30% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 15% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	Less than 5% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Water Velocity [8]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 18 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 1
Artificial Channelization [18]	No artificial channelization or dredging. Stream with normal, sinuous pattern 20 19 18 17 16	May have been channelized in the past (>20 yrs), but mostly recovered, fairly good sinuous pattern 15 14 13 12 11	Channelized, somewhat recovered, but > 80% of area affected 10 9 8 7 6	Artificially channelized, box-cut banks, straight, instream habitat highly altered 5 4 3 2 1
Habitat Smothering [18]	Less than 20% of habitats affected by sand or silt accumulation 20 19 18 17 16	20%-50% of habitats affected by sand or silt accumulation 15 14 13 12 11	Smothering of 50%-80% of habitats with sand or silt, pools shallow, frequent sediment movement 10 9 8 7 6	Smothering of >80% of habitats with sand or silt, a severe problem, pools absent 5 4 3 2 1
Bank Stability [20]	Stable. No evidence of erosion or bank failure. Little potential for future problems. 20 19 18 17 16	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 15 14 13 12 11	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 10 9 8 7 6	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 5 4 3 2 1
Riparian Buffer Zone Width [20]	Width of native vegetation (least buffered side) greater than 18 m 20 19 18 17 16	Width of native vegetation (least buffered side) 12 m to 18 m 15 14 13 12 11	Width of native vegetation 6 to 12 m, human activities still close to system 10 9 8 7 6	Less than 6 m of native buffer zone due to intensive human activities 5 4 3 2 1
Riparian Zone Vegetation Quality [20]	Over 80% of riparian surfaces consist of native plants, including trees, understory shrubs, or non-woody macrophytes. Normal, expected plant community for given sunlight & habitat conditions. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, and/or one class of plants normally expected for the sunlight & habitat conditions is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, and/or one or two expected classes of plants are not represented. Patches of bare soil or closely cropped vegetation, disruption obvious. 10 9 8 7 6	Less than 25% of streambank surfaces are vegetated and/or poor plant community (*e.g.* grass monoculture or exotics) present. Vegetation removed to stubble height of 2 inches or less. 5 4 3 2 1

[5] Add **5 points** if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

[117] **TOTAL SCORE**

Comments THE EFFLUENT HAD BEEN TURNED OFF CAUSING LOW FLOW & VELOCITY.

ANALYSIS DATE:	ANALYST:	SIGNATURE:
6-4-96	JOY JACKSON	Joy Jackson

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Hopkins Power Plant
County:
Contact / District:
NPDES Permit #: FL00
LIMS Sample #: 140942 (sample log 6/10/96 MF) LIMS Job #: 96-JUN-06-06
Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through
Test Number: 1 of 2
Remarks:

Sample Collection: Date 6-5-96 Time 1130
Test Beginning: Date 6-5-96 Time 1500
Test Ending: Date 6-7-96 Time 1500
Organism Batch #: 26 Diluent Batch #: 25
Organism Age: < 24 hours
Test Organism: Ceriodaphnia dubia

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	24.1 @ 24.2	8.2 @ 25.2 °C	108.6 @ 105.4 1033 @ 1025 @ 25.2°C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.9 @ 23.9	8.1 @ 25.7 °C	107.3 @ 105.4 1028 @ 1025 @ 25.0 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	24.5 @ 24.6	8.2 @ 25.2 °C	105.8 @ 105.4 1022 @ 1025 @ 24.9 °C

Conc.	Chamber #	Number Live 0 hr	Number Live 24 h	Number Live 48 h	pH 0 hr	pH 24 h	pH 48 h	Temperature (°C) 0 hr	Temperature (°C) 24 h	Temperature (°C) 48 h*	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 h	D.O. (mg/L) 48 h	UNCORRECTED Cond. (mmhos/cm) (Cond. (µmhos/cm)) 0 hr	UNCORRECTED Cond. (mmhos/cm) (Cond. (µmhos/cm)) 24 h	UNCORRECTED Cond. (mmhos/cm) (Cond. (µmhos/cm)) 48 h
Control A	A	5	5	5	8.3		8.3	24.0		24.2	7.9		8.0	200		220
Control B	B	5	5	5			8.3			24.1			8.1			220
Control C	C	5	5	5			8.3			24.3			8.1			250
Control D	D	5	5	5			8.3			24.5			8.1			235
100% A	A	5	5	5	7.6		8.5	23.3		24.3	7.9		7.7	920		910
100% B	B	5	5	5			8.5			24.4			7.7			950
100% C	C	5	5	5			8.5			24.6			7.8			935
100% D	D	5	5	5			8.5			24.7			7.8			1030
11									* 48 hour temperatures were verified/checked 2 Times MF 6/7/96							
Measured/Loaded by:		MF	MF	MF	MF		MF	MF		MF	MF		MF	MF		MF
Recorded by:		MF	MF	MF	JN		MF	JN		MF	JN		MF	JN		MF

Investigators' Signatures
Marshall Faircloth
Joseph Martin
by MF

A H Wolfe
reviewer

form updated 5/05/95

Water Quality Parameters	Salt Water / Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			—	—	—
Lab Total Residual Cl2 (mg/L):	—	< 0.03	< 0.03	DR-100	MF
Alkalinity (mg/L as $CaCO_3$):	—	75 —	160	Hach	JN
Hardness (mg/L as $CaCO_3$):	—	95	400	Hach	JN
Total ammonia (mg/L as N):	< 0.017	< 0.017	< 0.017	Orion	JN

Ammonia Meter #98136 Meter Slope: < -57.2
Ammonia Blank: < 0.017
Control Salinity: 0 ppt
Sample Salinity: 0 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Hopkins Power Plant
County:
Contact / District:
NPDES Permit #: FL00
LIMS Sample #: 140942 **LIMS Job #:** 96-JUN-06-06
sample log 6-10-96 mf

Sample Collection: Date 6-5-96 Time 1130
Test Beginning: Date 6-5-96 Time 1500
Test Ending: Date 6-5-96 Time 1500
Organism Batch #: 41 **Diluent Batch #:** well
Organism Age: 9 days
Test Organism: Cyprinella leedsi

Test Type: (Screening) | Definitive
(Static) | Static Renewal | Flow-through

Test Number: 2 of 2

Remarks:

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	24.1 @ 24.2	8.2 @ 25.2 °C	108.6 @ 105.4 1033 @ 1025 @ 25.2 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	23.9 @ 23.9	8.1 @ 25.7 °C	107.3 @ 105.4 1028 @ 1025 @ 25.0 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	24.5 @ 24.6	8.2 @ 25.2 °C	105.8 @ 105.4 1022 @ 1025 @ 24.9 °C

Conc.	Chamber #	Number Live			pH			Temperature (°C)			D.O. (mg/L)			UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm)		
		0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h	0 hr	24 h	48 h
Control A	763	5	5	5	8.3	8.3	8.4	24.6	24.3	24.3	7.8	7.8	7.8	250	250	255
Control B	775	5	5	5	8.3	8.3	8.4	24.5	24.2	24.2	7.8	7.9	7.9	250	250	250
Control C	602	5	5	5	8.3	8.3	8.4	24.5	24.2	24.2	7.8	8.0	7.9	250	250	250
Control D	309	5	5	5	8.3	8.3	8.4	24.5	24.2	24.3	7.8	8.0	7.9	250	250	250
100% A	26	5	5	5	7.5	8.1	8.4	23.1	24.3	24.3	8.1	8.1	7.9	940	960	960
100% B	25	5	5	5	7.5	8.1	8.4	23.0	24.3	24.3	8.1	8.1	7.9	940	960	960
100% C	219	5	5	5	7.5	8.1	8.4	23.0	24.3	24.3	8.1	8.1	7.9	940	960	965
100% D	21	5	5	5	7.5	8.1	8.4	23.0	24.2	24.3	8.0	8.1	7.9	940	960	970
Measured/Loaded by:		MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	MF	
Recorded by:		MF	MF	MF	JN	JN	MF	JN	JN	MF	JN	JN	MF	JN	JN	

Investigators' Signatures
Marshall Fairbrother
Jennifer Smith
Lynn Mondy

Water Quality Parameters	Salt Water / Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			—	—	—
Lab Total Residual Cl2 (mg/L):	<0.03	—	<0.03	DR-100	MF
Alkalinity (mg/L as $CaCO_3$):	115	—	160	Hach	JN
Hardness (mg/L as $CaCO_3$):	125	—	400	Hach	JN
Total ammonia (mg/L as N):	<0.017	—	<0.017	ORION	JN

Ammonia Meter #98136 Meter Slope: -57.2 Ammonia Blank: <0.017 Control Salinity: 0 ppt Sample Salinity: 0 ppt

reviewer

form updated 5/05/95

Arvah B. Hopkins Generating Station SCI

Reference Site

Summer Index Period: Stream Condition Index for Florida (SCI) (April 1996)													
Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	**Value**	**Panhandle**				**Peninsula**				**Northeast**			
		5	3	1	Score	5	3	1	Score	5	3	1	Score
Total Number of Taxa	37	≥ 31	30-16	<16	5	≥ 26	25-14	<14		≥ 22	21-12		
EPT Index	5	≥ 7	6-4	<4	3	≥ 4	3-2	<2		-	≥2	<2	
# Chironomid Taxa	23	≥9	8-5	<5	5	≥7	6-4	<4		≥7		<4	
% Contribution of Dominant Taxon	12	≤22	23-61	>61	5	≤29	30-64	>64		≤31	32-66	>66	
% Diptera	61	-	≤50	>50	1	-	≤37	>37			≤47	> 47	
Florida Index	12	≥ 16	15-8	<8	3	≥7	6-4	<4		≥ 8	7-4	<5	
% Suspension feeders/Filterers	28	≥ 12	11-6	<6	5	-	≥7	<7		-	≥7	<7	
Total Score		Panhandle			27	Peninsula				Northeast			
Interpretation of Score		Excellent			27-33	Excellent			26-32	Excellent			25-29
		Good			21-26	Good			20-25	Good			19-24
		Poor			14-20	Poor			13-19	Poor			13-18
		Severely Degraded			7-13	Severely Degraded			7-12	Severely Degraded			7-12

Test Site

Summer Index Period: Stream Condition Index for Florida (SCI) (April 1996)													
Macroinvertebrate Dip Net (20 sweeps of most productive substrates)	**Value**	**Panhandle**				**Peninsula**				**Northeast**			
		5	3	1	Score	5	3	1	Score	5	3	1	Score
Total Number of Taxa	22	≥ 31	30-16	<16	3	≥ 26	25-14	<14		≥ 22	21-12		
EPT Index	3	≥ 7	6-4	<4	1	≥ 4	3-2	<2		-	≥2	<2	
# Chironomid Taxa	13	≥9	8-5	<5	5	≥7	6-4	<4		≥7		<4	
% Contribution of Dominant Taxon	33	≤22	23-61	>61	3	≤29	30-64	>64		≤31	32-66	>66	
% Diptera	92	-	≤50	>50	1	-	≤37	>37			≤47	> 47	
Florida Index	7	≥ 16	15-8	<8	1	≥7	6-4	<4		≥ 8	7-4	<5	
% Suspension feeders/Filterers	1	≥ 12	11-6	<6	1	-	≥7	<7		-	≥7	<7	
Total Score		Panhandle			15	Peninsula				Northeast			
Interpretation of Score		Excellent			27-33	Excellent			26-32	Excellent			25-29
		Good			21-26	Good			20-25	Good			19-24
		Poor			14-20	Poor			13-19	Poor			13-18
		Severely Degraded			7-13	Severely Degraded			7-12	Severely Degraded			7-12

Benthic macroinvertebrate taxa list for the Arvah B. Hopkins Generating Station, collected via Hester-Dendy artificial substrates on 4 June 1996. The test site was located 100 meters downstream from the discharge, and the reference site was located in Three Pole Creek. Densities, in number/m^2, represent the mean of four replicates.

	Reference Site	Test Site
Coleoptera		
Dineutus sp.	10	–
Dubiraphia sp.	4	–
Stenelmis sp.	2	–
Diptera		
Ablabesmyia mallochi	34	–
Ablabesmyia rhamphe grp.	2	–
Atrichopogon sp.	–	2
Chironomidae	26	–
Chironomus sp.	2	–
Conchapelopia sp.	4	8
Cryptochironomus sp.	–	2
Dicrotendipes sp.	12	–
Dicrotendipes modestus	18	–
Dicrotendipes simpsoni	6	–
Hemerodromia sp	–	56
Orthocladiinae	4	–
Paramerina sp.	2	–
Parametriocnemus sp.	14	–
Paratanytarsus sp.	14	2
Paratanytarsus sp. A Epler	103	–
Paratendipes sp.	2	–
Paratendipes albimanus	16	–
Polypedilum sp.	2	–
Polypedilum fallax	26	2
Polypedilum illinoense grp.	–	2
Polypedilum scalaenum	2	–
Rheotanytarsus sp.	4	–
Rheotanytarsus distinctissimus grp.	8	–
Rheotanytarsus exiguus grp.	2	–
Stempellinella sp.	38	–
Tanytarsus sp.	20	–
Tanytarsus sp. A Epler	6	2
Tanytarsus sp. C Epler	2	–
Tanytarsus sp. G Epler	2	–
Tanytarsus sp. L Epler	30	–
Tanytarsus sp. O Epler	6	–
Tanytarsus sp. T Epler	6	–
Zavreliella sp.	2	–
Ephemeroptera		
Caenis sp.	4	–
Ephemeroptera	2	–

Leptophlebia intermedia	2	–
Gastropoda		
Ancylidae	44	–
Micromenetus sp.	2	–
Isopoda		
Isopoda	4	–
Odonata		
Enallagma signatum	2	–
Trichoptera		
Cheumatopsyche sp.	–	79
Hydropsyche sp.	–	4
Hydropsychidae	–	8
Lype diversa	6	–
Trichoptera	–	10

Benthic macroinvertebrate taxa list for Arvah B. Hopkins Generating Station, collected via 20 discrete dipnet sweeps on 4 June 1996. The test site was located 100 meters downstream from the discharge, and the reference site was located in Three Pole Creek.

	Reference Site	Test Site
Acarina		
Neumania sp.	1	–
Coleoptera		
Ancyronyx variegatus	2	–
Dubiraphia sp.	10	–
Elmidae	–	1
Macronychus glabratus	1	–
Neoporus sp.	–	1
Decapoda		
Procambarus sp.	–	2
Diptera		
Ablabesmyia mallochi	4	38
Chironomidae	3	1
Chironomus sp.	2	1
Clinotanypus sp.	1	–
Conchapelopia sp.	5	–
Cryptochironomus sp.	–	1
Dicrotendipes modestus	1	1
Dicrotendipes simpsoni	5	–
Hemerodromia sp.	–	9
Labrundinia pilosella	1	–
Nanocladius sp.	1	–
Orthocladiinae	–	1
Paracladopelma sp.	–	1
Parametriocnemus sp.	7	1
Paratanytarsus sp.	1	–
Paratanytarsus sp. A Epler	21	–
Paratendipes albimanus	15	–
Phaenopsectra punctipes grp.	5	10
Polypedilum aviceps	2	–
Polypedilum fallax	9	2
Polypedilum halterale grp.	–	2
Polypedilum illinoense grp.	1	2
Polypedilum scalaenum grp.	–	23
Procladius sp.	–	15
Rheotanytarsus distinctissimus grp.	8	–
Rheotanytarsus exiguus	1	–
Stempellinella sp.	3	–
Tanytarsus sp.	1	–
Tanytarsus sp. G Epler	5	–
Tanytarsus sp. L Epler	6	–
Tanytarsus sp. V Epler	1	–
Xestochironomus sp.	–	1

Ephemeroptera		
Caenis sp.	5	1
Gastropoda		
Ancylidae	4	–
Hebetancylus excentricus	4	–
Micromenetus sp.	3	–
Physella sp.	1	–
Odonata		
Odonata	–	1
Oligochaeta		
Dero trifida	2	–
Haber speciosus	4	–
Limnodrilus hoffmeisteri	10	–
Pelecypoda		
Pisidiidae	17	1
Trichoptera		
Cheumatopsyche sp.	1	–
Lype diversa	1	–
Nectopsyche sp.	1	–
Neotrichia sp.	1	1
Triaenodes sp.	–	1
Trichoptera	1	–

Phytoplankton taxa list and densities (#/mL) for the Arvah B. Hopkins Generating Station, collected via subsurface grab on 4 June 1996. The test site was located 100 meters downstream from the discharge, and the reference site was located in Three Pole Creek.

	Reference Site	Test Site
Bacillariophyceae		
Achnanthes sp.	21	32
Amphora sp.	–	8
Navicula sp.	–	8
Nitzschia sp.	–	79
Pennales	–	71
Pinnularia sp.	11	–
Chlorophyceae		
Chlamydomonas sp.	11	–
Chlorophyta	42	16
Scenedesmus sp.	–	8
Cyanophyceae		
Anabaena sp.	11	–
Oscillatoria sp.	11	–
Phormidium sp.	–	8
Raphidiopsis sp.	11	–
Euglenophyceae		
Trachelomonas sp.	–	8

Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0025518		960605		X	S	1

Remarks

21 66

Fill Out This Section For All Surface Water Discharger Inspections (CEI, CSI, CBI, PAI, XSI - RI Optional)

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0625518		960605		B	S	1

Remarks

21 66