Florida
Department of Environmental Protection

Biological Assessment of

Florida Power & Light, Co.

Sanford Facility

Volusia County

NPDES #FL0001554

Sampled March 1993

August 1993

Biology Section
Division of Technical Services

Department of Environmental Protection
Results of Fifth Year Inspections

Discharger: Florida Power & Light, Co., Sanford Facility
County: Volusia
NPDES Number: FL0001554
State Permit Expiration Date: 15 January 1994

Toxics Sampling Inspection (XSI)

Date Sampled: 22 March 1993

Results: No organic pollutants were detected in the discharge sample. The only metals found at concentrations above the practical quantitation limit were aluminum (391 µg/L) and iron (409 µg/L). None of these levels are in excess of Class III standards.

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 22 March 1993

Results: Not toxic to either the water flea, *Ceriodaphnia dubia* or the fish, *Notropis leedsi*. No mortality occurred during the 48 hour bioassays.

Impact Bioassessment Inspection (IBI)

Date Sampled: 22 March 1993

Results: Benthic macroinvertebrates were only slightly affected by the facility's discharge, while phytoplankton communities were not harmed. Benthic macroinvertebrate communities were generally stressed throughout the study area, as indicated by the low taxa richness and Florida Index. A high percent contribution of dominant taxon occurred at the test site, due to the high relative population of *Hyalella azteca*. This amphipod was probably favored by the warmer temperatures present in the facility's discharge canal. Phytoplankton communities were nearly identical at both reference and test sites, characterized by high algal abundance and good diversity. Diatoms and blue-green algae made up the majority of the algal populations at both sites.

Water Quality Inspection (WQI)

Date Sampled: 22 March 1993

Results: Nutrients were relatively low in the effluent, and phosphorus-containing compounds were below average at the study sites. No change in nitrate-nitrite or TKN concentrations occurred between reference and test sites, although TKN was somewhat elevated, greater than 72% of typical Florida streams. While algal growth potential was low in the effluent, AGP at the reference and test sites exceeded the "problem threshold" of 5 mg dry wt/L. The relatively high AGP's measured in this study may be related to eutrophication problems in Lake Monroe.

These fifth year inspections provide the necessary information to evaluate the facility's impact on its receiving waters and to provide the basis for specific condition recommendations for permit renewal.

Introduction

The Florida Power & Light Co., Sanford Facility, is located approximately 2.5 miles south of DeBary on Highway 17 & 92 in Volusia County. Three types of effluent are produced at this electrical power generating plant. A daily average of 0.075 MGD of metal cleaning waste and 0.05 MGD of equipment area runoff are discharged to Class G-II groundwater via Konomac Lake, a 1,100 acre cooling pond located on the property. The surface water outfall consists of boiler blowdown (0.046 MGD) and once through cooling water (167 MGD), which is discharged to the St. Johns River via outfall 001. The pH of this effluent must be maintained at ≤ 8.5 and no more than one unit below natural background. No problems concerning the surface water discharge have been documented.

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 at the outflow of Lake Monroe, east of Highway 17 & 92) and a test site (the area downstream of the discharge in the St. Johns River) (see maps in Appendix). 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 *Notropis 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). Additionally, nutrient analyses were performed on 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, vegetation) using discrete dip net sweeps. Phytoplankton was sampled via subsurface grabs. Algal Growth Potential tests, using *Selenastrum capricornutum* as the test organism, followed Miller *et al.* (1978).

Explanation of Measurements of Community Health

Several different measurements of macroinvertebrate and algal community health have been employed in this report, which are briefly explained here. The Florida Index assigns points to stream-dwelling macroinvertebrates based on their sen-

Major characteristics of community structure of control and test sites.

	Reference Site	Test Site
Macroinvertebrate Qualitative		
Number of Taxa	18	18
Florida Index	6	5
% Contribution of Dominant Taxon	25.3	54.1
% Malacostraca	50.5	64.3
% Diptera	34.1	23.5
% Oligochaeta	11.0	2.0
% Pelecypoda	1.1	4.1
% Other	3.3	6.1
% Above Surface Deposit Feeders	38.8	30.6
% Predator/Carnivores	24.5	13.3
% Shredders	13.2	22.1
% Scavengers	8.8	21.4
% Below Surface Deposit Feeders	11.0	2.0
% Suspension Feeders	2.0	7.5
% Other	1.7	3.1
Phytoplankton Algae		
Number of Taxa	27	24
% Contribution of Dominant Taxon	34.9	37.5
Diatom/Diatom + B-G Abundance Ratio	0.54	0.59
% Diatoms	49.3	54.4
% Blue-green	42.5	37.5
% Greens	7.9	8.2
% Euglenophytes	0.3	0
Algal Growth Potential (mg dry wt/l)	10.9	7.8

sitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy (*i.e.*, many clean-water organisms are present). Excessive numerical dominance of a single type of organism (a high % contribution of dominant taxon) is usually associated with disturbance. 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. The determination of the Quantitative Stability Index (for taxonomic % composition) is a two step process. First, the relative proportions of major taxonomic groups are calculated for each site. Then, the lesser of the two percentages for each discrete taxonomic group is totaled. A QSI (for % composition) of 100% means that the two sites being compared are identical. This same type of procedure is used for calculating the QSI (for functional feeding groups).

For graphical purposes, the percent differences between the reference and test sites involving the number of taxa, Florida Index and the diatom to blue-green algae ratio are measured as the reference site minus test site divided by the reference site. The percent differences between sites involving the percent contribution of dominant taxon 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: Phil Kane and Steve Kent (DEP Central District) and Lyn Burton, Marshall Faircloth, Russel Frydenborg, Kathleen Lurding, Elizabeth Miller, Kim Pearce, Urania Quintana, and Greg Wynn (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

Habitat scores were 77 points and 63 points for reference and test sites, respectively (an 18% variation). The reference site received slightly higher scores for available substrate, water velocity, flow alteration factors, and riparian zone vegetation quality. There was an increase in industrial land use surrounding the test site. Both sites, however, appeared to have good habitat characteristics, with an abundance of aquatic vegetation and woody material (snags and roots). The study sites were essentially identical with regard to pH (7.8 SU's), D.O. (9.1 mg/L), and specific conductance (952 to 956 µmho/cm). As would be expected from a cooling water discharge, temperature was considerably higher below the outfall (24.5 °C) compared to the reference (17.9 °C) (Appendix).

No organic pollutants were detected in the discharge sample. Aluminum (391 µg/L) and iron (409 µg/L) were found at concentrations above the practical quantitation limit (PQL), and cadmium was detected below the PQL at 0.21 µg/L. None of these levels are in excess of Class III standards.

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

Nutrients were relatively low in the effluent. At the study sites, the concentrations of phosphorus-containing compounds were below average, compared to representative Florida stream systems (see table of typical values in Appendix). No change in nitrate-nitrite (0.12 mg/L) or TKN (1.3 mg/L) concentrations occurred between reference and test sites, although TKN was above average (72nd percentile) at both stations. Substantial ammonia contamination was found in the trip blank. This finding suggests that the somewhat elevated ammonia concentrations in the effluent and at the test site were sampling artifacts.

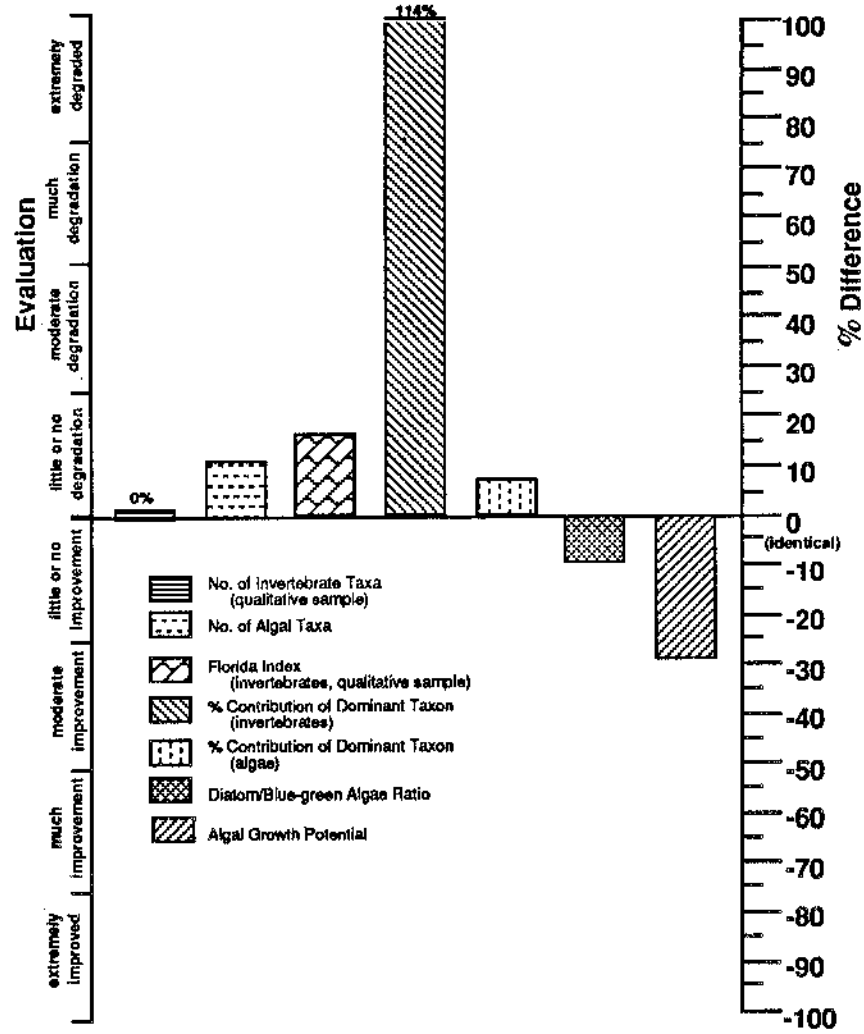
Algal growth potential (AGP) was very low in the effluent, at 0.1 mg dry wt/L. Reference and test site AGP (10.9 and 7.8 mg dry wt/L, respectively) exceeded the "problem threshold" of 5 mg dry wt/L. Freshwater systems with AGP's above this level are likely to suffer detrimental consequences of nutrient enrichment, such as abundant macrophyte or algal growth, D.O. sags, and fish kills (Raschke and Schultz 1987). Lake Monroe, located upstream of the study area, has a history of eutrophication problems (Hand and Paulic, 1992), which may have contributed to the relatively high AGP's found during this study.

Benthic macroinvertebrate communities showed signs of stress throughout the study area, but very little degradation could be associated with the discharge. The figure on p. 3 indicates the degree of difference between the control and test sites. Larger differences (that is, higher percentages) correspond with greater degrees of degradation. Negative values mean that the test site is better than the control. The figure on p. 4 summarizes similarities between the sites. Smaller similarities (low-

er percentages) generally correspond with greater degradation, unless the test sites are better than the reference site. In this case, no substantial degradation or improvement is indicated. The relative abundance of each individual taxon appears in the Appendix.

Taxa richness (18 at both sites) was lower than 80% of typical streams in Florida. Florida Index (6 and 5 at reference and test sites, respectively) was lower than the 15 points expected in an undisturbed, flowing stream in the central part of the State. These data do not indicate that the discharger was making conditions any worse than those prevailing upstream. However, the percent contribution of dominant taxon, which was increased by 114%, did suggest more degraded conditions at the test site. This was due to the dominance of the amphipod, *Hyalella azteca*, at the test site. Although a similar number of amphipods was present at the reference site, *Gammarus* sp. and *H. azteca* were co-dominant there. Since *H. azteca* seems to be able to tolerate higher temperatures (Edwards and Cowell 1992), the warmer water in the area of the test site may have given it a competitive advantage over *Gammarus* sp.

A rich, diverse phytoplankton population was present at both reference and test sites. Diatoms dominated at both areas, particularly *Synedra* sp., followed by blue-green algae. All measurements of algal community health indicated little or no degradation or improvement connected to the discharge. Species composition was nearly identical, demonstrated by the Quantitative Stability Index of 94.7%. Although chlorophyll *a* was not collected at reference and test sites (a sampling error), the highly elevated chlorophyll *a* (28.9 µg/L) of the discharge is worth discussing. This chlorophyll *a* value is higher than 90% of other streams in the State, and represents a eutrophic situation. The effluent consists of once-through cooling water, derived from the St. Johns River directly upstream of the facility. It is suspected that the source of this chlorophyll *a* is not the facility, but the St. Johns River/Lake Monroe.



Effect of discharge on receiving stream
(measured as difference between control and test sites).

Conclusions

The effluent sample was not toxic to either the water flea, *Ceriodaphnia dubia* or the fish, *Notropis leedsi*. No mortality occurred during the 48 hour bioassays.

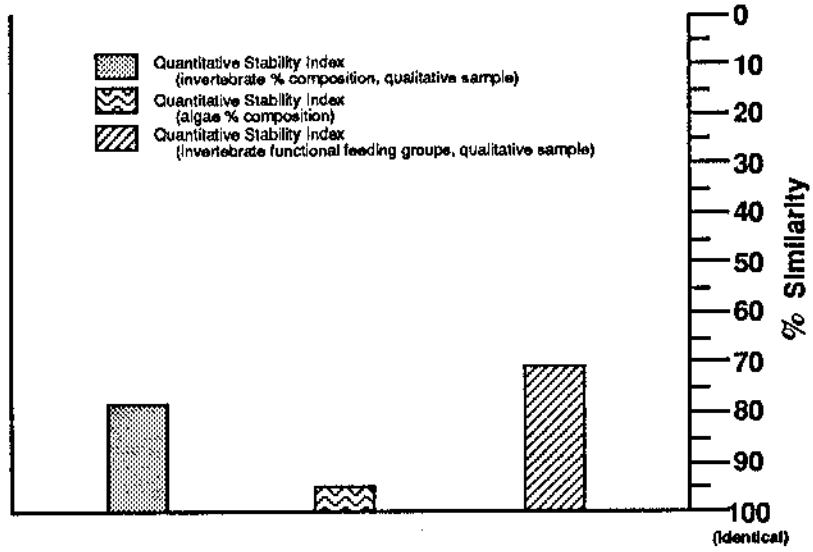
No organic priority pollutants were detected in the discharge sample. The only metals found at concentrations above practical quantitation limits were aluminum (391 µg/L) and iron (409 µg/L). None of these

levels are in excess of Class III standards.

Nutrients were relatively low in the effluent, and concentrations of phosphorus-containing compounds were below average at the study sites. No change in nitrate-nitrite or TKN concentrations occurred between reference and test sites, although TKN was somewhat elevated, greater than 72% of typical Florida streams.

While algal growth potential (AGP) was low in the effluent, the reference and test sites exceeded the "problem threshold" of 5 mg dry wt/L. The high AGP's measured in this study may be related to eutrophication problems in Lake Monroe.

Benthic macroinvertebrate communities were generally stressed throughout the study area, as indicated by the low taxa richness and Florida Index. An increased percent contribution of dominant taxon occurred at the test site, due to the high relative population of *Hyalella azteca*. This amphipod was probably favored by the warmer temperatures present in the facility's discharge canal.



Effect of discharge on receiving stream
(measured as similarity between control and test sites).

Phytoplankton communities were abundant and diverse at both reference and test sites. Diatoms and blue-green algae made up the majority of the algal population. All measurements of community health indicated nearly identical characteristics, with no changes caused by the discharge.

Literature Cited

Edwards, T. D. and B. C. Cowell. 1992. Population dynamics and secondary production of Hyale*lla azteca* (Amphipoda) in *Typha* stands of a subtropical Florida lake. JNABS 11(1): 69-79.

Hand, J. and M. Paulic. 1992. 1992 Florida Water Quality Assessment, 305(b) Technical Appendix. Bureau of Surface Water Management, FDER, 355 p.

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.

Chemistry summary table for

Florida Power & Light at Sanford	Effluent	Reference Site	Test Site
Organic Constituents (ug/L)			
None detected			
Metals (ug/L)			
Aluminum	391		
Antimony	15 U		
Arsenic	20 U		
Cadmium	0.21 T		
Copper	5 U		
Chromium	10 U		
Iron	409		
Lead	15 U		
Mercury	0.1 U		
Nickel	5 U		
Selenium	30 U		
Silver	0.05 U		
Zinc	5 U		
Nutrients (mg/L)			
Ortho-phosphate	0.020 U	0.058	0.020 T
Total phosphorus	0.086	0.097	0.075
Ammonia	0.17	0.046 T	0.13
Nitrate+Nitrite	0.12	0.12	0.12
TKN	1.5	1.3	1.3
Other Parameters			
Habitat Assessment		77	63
D.O. (mg/L)	9.1	9.1	9.1
pH (SU's)	7.7	7.8	7.8
Conductivity (µmhos/cm)	964	952	966
Temperature (°C)	24.6	17.9	24.5
Hardness (mg CaCO3)	161		
TSS (mg/L)	25	37	22 A
BOD5 (mg/L)	5.0	8.7	6.0
Algal Growth Potential (mg dry wt/L)	0.1	10.9	7.8
Bioassay Fish	Not toxic		
Bioassay Invertebrate	Not toxic		

A - Value reported is the mean of two or more determinations
T - Value reported is less than the practical quantitation limit
U - Material analyzed for but not detected; value reported is the minimum detection limit

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

EE 6/13

Facility Name: FLORIDA POWER and Light, Co.		Date Summary Prepared: 6-11-93
Location (attach detailed map): SEE ATT. MAP.	County: VOLUSIA	District: CENTRAL
Federal Permit # FL0001554 and expiration date: June 30, 1997	State GMS # and 3064P00993 State expiration date: IC64-211485 1-15-94	Facility Type: 2 (Industrial) Municipal Federal Agricultural Other (list):

Function of facility: STEAM ELECTRIC GENERATION

Description of treatment process:
Facility has 3 turbine units: #5 and #4 Discharge to ~~Koo~~ Konomac Lake (cooling pond) and intake is from Konomac lake for units #5 + #4 no treatment. (726 MGD)

Unit # 3 has intake and discharge to St. Johns River, No Treatment. No Additives or cleaners are used in all once through non-contact cooling H2O's (150 MGD)

Receiving waters: St. Johns River	Classification: I II (III)	
Design Flow: 150 MGD	Mean Flow: 150 MGD	Flow during survey: 150 MGD

Discharge is: Continuous Intermittent (Seasonal) Rainfall dependent
Other (describe)

therefore, the best time to sample is: During HOT Summer months during Peak power needs.

If facility has a mixing zone, give details (size, parameters affected, etc.):

no mixing zones

List effluent limits (if necessary, attach relevant paperwork):

Parameter	Limit (units)
Total Residual oxidant	Daily max. 0.2 mg/L
Chlorine addition	120 min
Oil/Grease	15.0 – 20.0 mg/L
TSS	30 – 100 mg/L
	Daily Avg Daily MAX.

Describe special permit conditions and permit modifications:

Chlorine Addition to lines No more than a total of 2 HRS / 24 HR'S

EPL
(Facility)

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

Description of permitted outfall(s): 001: Unit 3 once through Cooling Water to St. Johns River.
004: Tank Farm Storm Water 002: Boiler blowdown to Unit 3 intake canal (St. Johns River
003: Neutralization basin stormwater

List permit violations (from MOR data or other source) and plant upsets that occurred within past year:

Groundwater Data in 1991 Showed Slightly high levels of Fe, TDS, SO4, Cl above 4-II Standards.

Describe previous impact bioassessments, WQBEL's, and previous or current enforcement actions:

no Current Enforcement activities
no bioassements or Toxicity tests of Record.

Discuss comparability of MOR results to past DER results and whether there are trends (improving, declining) in the data set:

No Change in Data Set, However a treatment System is being Constructed + permitted for discharge of Metal Cleaning waste and Stormwater from the power block. This Discharge is to Cooling Pond.

Additional information:
This Facility is doing more in the way of good treatment + Disposal methods than any other Power plant in our district. Even though they are the oldest and most antiquated.

Staff contributing to this review (signature):

Dr. Phil Kane	(Biologist)
Clayton J Smith	(Inspector)
	(Engineer)
	( )
	( )
	( )



GENERAL LEGEND

- CANAL OR DRAINAGE DITCH
- INTRACOASTAL WATERWAY
- INTERMITTENT STREAM
- NARROW STREAM
- WIDE STREAM
- LAKE, RESERVOIR OR POND
- INTERMITTENT POND
- MARSH
- SWAMP
- MANGROVES
- HIGHWAY BRIDGE
- SMALL BRIDGES CLOSELY SPACED
- DRAWBRIDGE
- HIGHWAY GRADE SEPARATION
- COUNTY BOUNDARY LINE
- CIVIL TOWNSHIP BOUNDARY
- EXTENDED TOWNSHIP LINE
- LAND GRANT LINE
- LAND SECTION LINE
- STATE PARK BOUNDARY
- WILDLIFE MANAGEMENT AREA BOUNDARY
- LOCATION OF INSET BOUNDARY WITHIN MAP
- COUNTY SEAT
- OTHER CITY OR VILLAGE
- CORPORATE LIMITS
- DELIMITED URBAN COMPACT AREA BOUNDARY
- PICNIC GROUND
- PLAYGROUND, BALL FIELD
- SCENIC SITE
- CAMP SITE, TRAILER PARK
- TOURIST COURT OR MOTEL
- CAMP OR LODGE
- WAYSIDE PARK
- WAYSIDE PARK WITH BOAT RAMP
- BOAT RAMP
- FIRE CONTROL HEADQUARTERS
- LOOKOUT TOWER
- GAME CHECKING STATION

- PISTOL CLUB
- GOLF COURSE
- YACHT CLUB OR BASIN
- FAIR GROUND, RACE COURSE, SPEEDWAY
- DOG TRACK
- RECREATION AREA, HISTORIC SITE
- DWELLING
- GROUP OF DWELLINGS
- HOTEL OR INN
- CHURCH
- CEMETERY
- CHURCH AND CEMETERY
- FRESH AIR FARM OR REST HOME
- HOSPITAL
- HUMANE SOCIETY QUARTERS
- BUSINESS
- FACTORY OR INDUSTRIAL PLANT
- GAUGING OR SMALL PUMPING STATION
- DAIRY
- PACKING HOUSE
- NURSERY
- STOCK YARD, LOADING PEN OR CORRAL
- SCHOOL
- COMMUNITY HALL
- COUNTY PRISON FARM OR COUNTY ROAD DEPARTMENT
- STATE ROAD DEPARTMENT CAMP
- CORRECTIONAL INSTITUTION
- POST OFFICE
- COUNTY BARN
- GARBAGE DUMP
- WATER TANK
- POWER PLANT
- POWER SUBSTATION
- RADIO OR TV CONTROL TOWER
- ORPHANAGE
- LOCKED GATE OR FENCE
- DIRECTIONAL ARROW
- COUNTRY CLUB
- WOMAN'S CLUB

This map was compiled from U
Survey quadrangle maps, aerial
flown in 1964, General Land Offi
inventory surveys November, 19
map data.

This map was prepared on th
Mercator projection, East Zone, F
of plane coordinates.

The railroad station symbol as s
map does not necessarily denote
of a depot or like facility. It may b
designated for the receipt or deliv
such as a platform or siding.

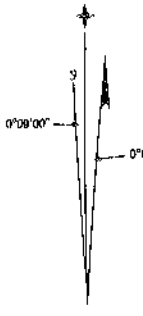
Portions of railroads and other su
bols are omitted in order to show

In congested rural areas local r
cated by a single line only. For c
insets prepared for this county.

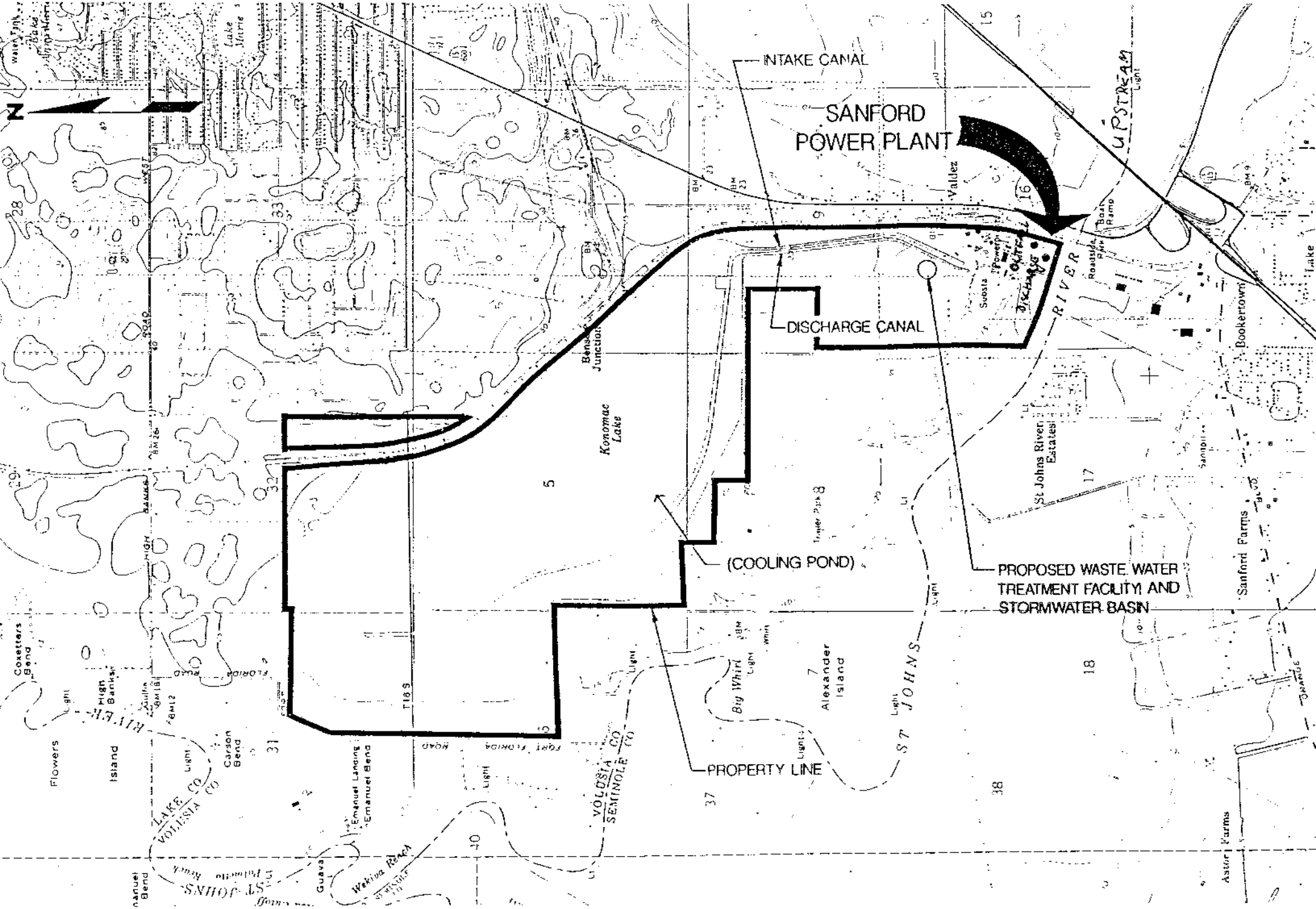
City populations are taken from
for 1970.

The Wildlife Management Are
shown on this map is approxima
to change by the Florida Game an
Fish Commission.

1970 Volusia county popul



GRID NORTH AT DELAND IS 0°09'00" W
MAGNETIC NORTH IN JUNE, 1965 IS APPROXIMATE
ANNUAL MAGNETIC CHANGE IS APPROXIM



SITE LOCATION PLAN

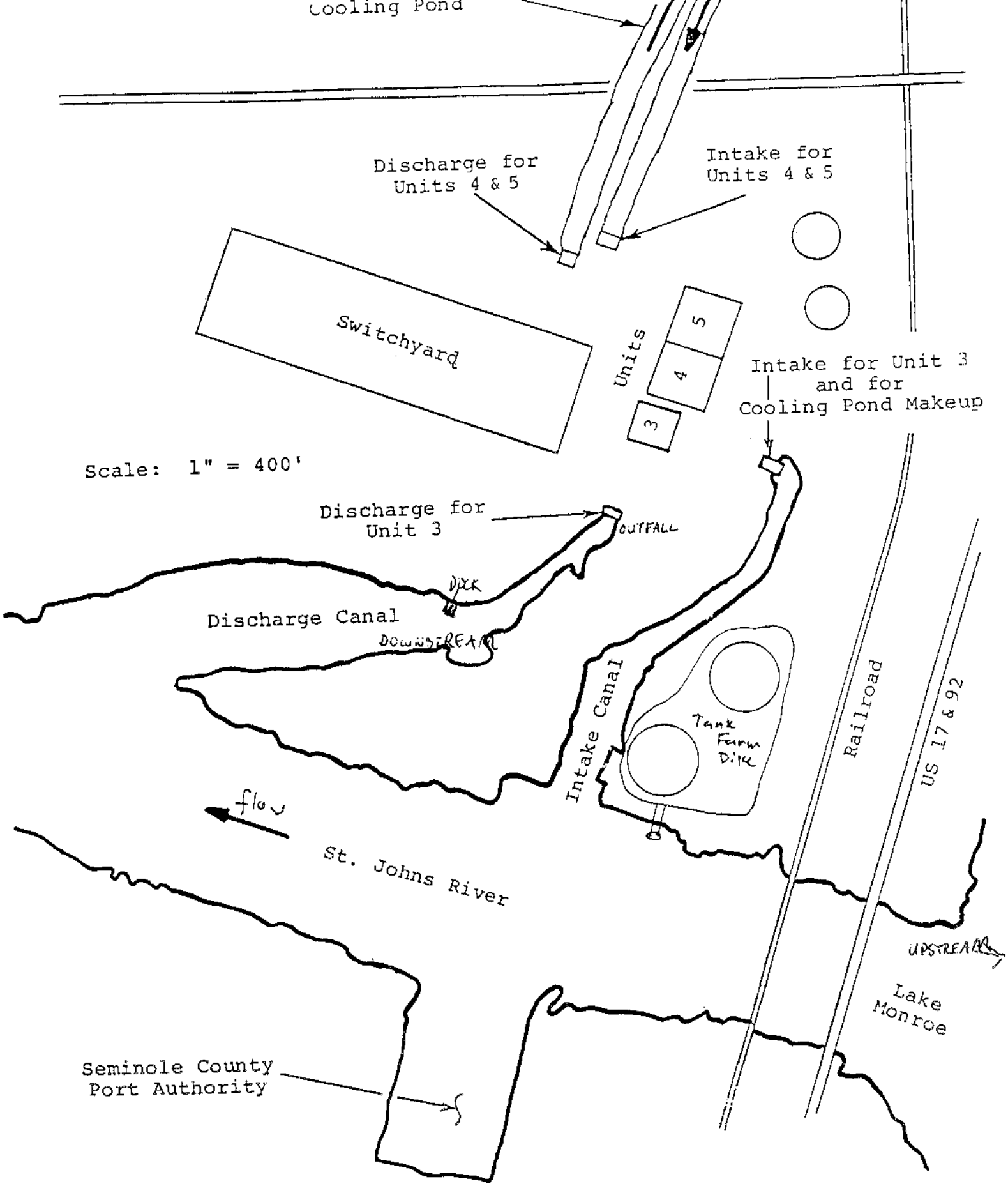


Figure 2. Sanford Plant Site Arrangement

UPSTREAM

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: 30 SUBMITTING AGENCY NAME: FDER CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 03/22/93	RECEIVING BODY OF WATER: ST. JOHN'S RIVER

REMARKS:	LOCATION:	FIELD ID/NAME:
UPSTREAM	FP+L SANFORD N. HWY 17-92 SANFORD, FL.	FP+L AT SANFORD

Habitat Parameter score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover 22	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 15	Max. observed: >0.3 m/sec. but < 1 m/sec **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec, or spate occurring; > 2 m/sec **0-7 points**
Artificial Channel/ Flow Alteration 15	No artificial channelization. Little activity (impervious surface) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability 10	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 10	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments		TOTAL SCORE
5	Add **5 points** if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.	77

COMMENTS:

ANALYSIS DATE:	ANALYST:	SIGNATURE:
03/22/93	P. KANE	Philip N. Kane

DOWNSTREAM

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET

SUBMITTING AGENCY CODE: 30 / SUBMITTING AGENCY NAME: FDER CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 03/22/93	RECEIVING BODY OF WATER: ST. JOHN'S RIVER

REMARKS:	LOCATION:	FIELD ID/NAME:
DOWNSTREAM	FP+L SANFORD N. HWY 17-92 SANFORD, FL.	FP+L AT SANFORD

Habitat Parameter score	Excellent	Good	Fair	Poor
Bottom Substrate/ Available Cover 20	Greater than 40% snags, logs, tree roots, emergent vegetation, leaf packs, undercut banks, rubble, or other stable habitat. **23-30 points**	20% to 40% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Adequate habitat. **16-22 points**	5% to 20% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Less than desirable habitat. **8-15 points**	Less than 5% snags, logs, tree roots, emergent vegetation, leaf packs, etc. Lack of habitat is obvious. **0-7 points**
Water Velocity 10	Max. observed: >0.3 m/sec. but < 1 m/sec **23-30 points**	Max. observed; 0.1 to 0.3 m/sec **16-22 points**	Max. observed; 0.05 to 0.1 m/sec **8-15 points**	Max. observed; <0.05 m/sec, or spate occurring; > 2 m/sec **0-7 points**
Artificial Channel/ Flow Alteration 10	No artificial channelization. Little activity (impervious surface) in watershed which would cause scouring during spates. **12-15 points**	—	—	Artificially channelized, or scouring present during spates because of excess impervious surface in watershed. **0-3 points**
Bank Stability 10	Stable. No evidence of erosion or bank failure. Little potential for future problems. **9-10 points**	Moderately stable. Infrequent or small areas of erosion, mostly healed over. **6-8 points**	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. **3-5 points**	Unstable. Many raw, eroded areas. Obvious bank sloughing. **0-2 points**
Riparian Zone Vegetation Quality 8	Over 80% of streambank surfaces consist of native plants, classified as: bottomland hardwoods, understory shrubs, or non-woody macrophytes. **9-10 points**	50% to 80% of riparian zone is vegetated, but one class of plants is not represented. **6-8 points**	25% to 50% of riparian zone is vegetated, but one or two classes of plants are not represented. **3-5 points**	Less than 25% of streambank surfaces are vegetated. Poor plant community (e.g. grass monoculture) present. **0-2 points**

Adjustments		TOTAL SCORE
5	Add **5 points** if cross-sectional area of flow is estimated to be greater than one square meter during periods of normal flow.	63

COMMENTS:

ANALYSIS DATE:	ANALYST:	SIGNATURE:
03/22/93	P. KANE	Philip N. Kane

UPSTREAM

DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 4)

SUBMITTING AGENCY CODE: 30 / SUBMITTING AGENCY NAME: FD&R CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 03/22/93	TIME 0930	RECEIVING BODY OF WATER: ST. JOHN'S RIVER

REMARKS:	LOCATION:	FIELD ID/NAME:
UPSTREAM	FP&L SANFORD N. HWY 17-92 SANFORD, FL. (NEAR CHEMISTRY STATION)	FP&L AT SANFORD

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
80%				20%	10%	

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

Local Watershed NPS Pollution (check box): No evidence ☐ Some potential sources ☑ Obvious sources ☐

Point-Source Pollution (list location and describe):

Estimated System Width (range, m): 500M	Estimated System Depth (range, m): 1.5	N/A	yes
High Water Mark (m above bed): 0.5	Velocity (range, m/s): 0.25 m/s	Impounded ☐	
Canopy Cover % : 10 Open : ☑	Lightly Shaded (11-45%): ☐	Moderately Shaded (46-80%): ☐	Heavily Shaded: ☐
		Channelized ☐	

SEDIMENT/SUBSTRATE

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

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

Sediment Deposits: Sludge: ☐ Paper Fiber: ☐ Mud: ☑ Sand: ☐ Shell: ☐ Other: ☑ DETRITUS

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)				Riffles			
Leaf Packs				Sand (PK)	10	NET	2
Aquatic Vegetation (	50	10	NET	Mud/Muck/Silt (PK)	30	NET	6
Rock or Shell Rubble	10 PK	2	NET	Benthic leaf mats			
Undercut Banks/Roots	20	24 PK	NET	Other:			

WATER QUALITY

	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (µmho/cm):			Secchi (m):
Top	0.3	17.86	7.79	9.1	mS/cm .0952			
Mid-depth	0.6	17.81	7.77	8.91	.0953			
Bottom	1.2	17.79	7.76	8.86	.0952			

System Type : Stream: ☐ (Sand Bottomed, Sand Bot w/ Spring, Swamp & Bog, Calcareous, Alluvial, Misc.) Lake: ☒ (Exit Monroe) Wetland: ☐ Estuary: ☐ Other: ☐ RIVER

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: ☒ BROWN (MUDDY)

Weather Conditions:
WIND 12K @ 100°
20% cloud cover

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

SAMPLING TEAM:	SIGNATURE:	DATE:
KANE, KENT	Philip N. Kane	03/22/93

DOWNSTREAM DEPARTMENT OF ENVIRONMENTAL REGULATION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 4)

SUBMITTING AGENCY CODE: 30 / SUBMITTING AGENCY NAME: FDER CENTRAL DISTRICT	STORET STATION NUMBER:	DATE (M/D/Y): 03/22/93	TIME	RECEIVING BODY OF WATER: ST. JOHN'S RIVER

REMARKS: DOWNSTREAM	LOCATION: FP & L SANFORD N. HWY 17-92 SANFORD, FL.	FIELD ID/NAME: FP&L AT SANFORD

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
50			10		40	

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

Local Watershed NPS Pollution (check box): No evidence ☐ Some potential sources ☐ Obvious sources ☑

Point-Source Pollution (list location and describe):

BOAT LANDING AND DOCK

Estimated System Width (range, m): 15M	Estimated System Depth (range, m): 1.0M	yes
High Water Mark (m above bed): 0.5M	Velocity (range, m/s): 0.2M/S	Impounded ☐ Channelized ☑

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 Deposits: Sludge: ☐ Paper Fiber: ☐ Mud: ☑ Sand: ☐ Shell: ☐ Other: ☑ DETRITUS

Substrate Types	% coverage	# times sampled	method	Substrate Types	% coverage	# times sampled	method
Woody Debris (Snags)	5	2	NET	Riffles			
Leaf Packs				Sand			
Aquatic Vegetation	50	12	NET	Mud/Muck/Silt ✓	45	6	NET
Rock or Shell Rubble				Benthic leaf mats			
Undercut Banks/Roots				Other:			

WATER QUALITY

	Depth (m):	Temp. (°C):	pH (SU):	D.O. (mg/l):	Cond. (umho/cm):			Secchi (m):
Top	0.3	24.5	7.77	9.14	.0966			
Mid-depth	0.6	24.5	7.72	8.90	.0969			
Bottom	1.3	24.5	7.71	8.90	.0969			

System Type : Stream: ☐ (Sand Bottomed ☐ Swamp & Bog ☐ Alluvial ☐ Sand Bot w/ Spring ☐ Calcareous ☐ Misc. ☐) 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:

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

SAMPLING TEAM: KANE, KENT	SIGNATURE: Philip N. Kane	DATE: 03/22/93

DER Biology Section

Sample Source: Sanford
Location:
County: Volusia
Contact/District: Phillip Kane / Central
NPDES Permit #: FL0001554 Outfall #:

Sample Collection: Date 3/22/93 Time 11:52
Test Beginning: Date 3/23/93 Time 12:30
Test Ending: Date 3/25/93 Time 1300
Organism Batch #: 13 Diluent Batch #: 4
Organism Age: < 24 hrs.
Test Organism: Ceriodaphnia dubia

9/3/AR 2372 - 5245

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

Test Number: 1 of 2
Remarks:

Instrument Calibrations:

	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
0 hr	7.0 @ 7.0 9.0 @ 9.0	24.0 @ 24.1	8.4 @ 24.0	999 @ 1,000 @24.7 19000 @ 10,000
24 hr	7.0 @ 7.0 9.0 @ 9.0	24.4 @ 24.5	8.3 @ 24.9	1000 @ 1,000 @24.7 10,100 @ 10,000
48 hr	7.0 @ 7.0 9.0 @ 9.0	24.3 @ 24.5	8.35 @ 24.2	1000 @ 1,000 10100 @ 10,000 24.5

		Number Live			pH			Temperature (°C)			D.O. (mg/L)			Cond. (mmhos/cm) Cond. (µmhos/cm)		
Conc.	Chamber #	0	24	48	0	24	48	0	24	48	0	24	48	0	24	48
Control	A	5	5	5	8.2		8.4	23.9		23.5	8.0		8.3	165		185
Control	B	5	5	5			8.4						8.4			175
Control	C	5	5	5			8.4						8.4			175
Control	D	5	5	5			8.4						8.4			175
100%	A	5	5	5	8.0		8.4	24.1		23.6	8.0		8.4	910		975
100%	B	5	5	5			8.4						8.4			960
100%	C	5	5	5			8.4						8.4			960
100%	D	5	5	5			8.4						8.4			970
Measured/Loaded by:		MF	TM	TM	MF		MF	MF		MF	MF		MF	MF		MF
Recorded by:		TM	TM	TM	TM		KP	TM		KP	TM		KP	TM		KP

Investigators' Signatures

Tina M. Kubelis
Marshall Faircloth
Kim Pearce

Reviewer

form updated 10/20/92

	Salt Water/ Well Water	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:					
Lab Total Residual Cl2:	<0.03	<0.03	0.04	DR-100	TM
Alkalinity:	125	70	55	Hach	TM
Hardness:	125	80	165	Hach	TM
Total Ammonia:	<0.017	<0.017	<0.017	Orion	MF

Cl_2 Blank: _____ Ammonia Meter Slope: -56.3 Ammonia Blank: <0.017 Sample Salinity: 0 ppt

DER Biology Section — Acute Bioassay Bench Sheet

Sample Source: Sanford
Location:
County: Volusia
Contact/District: Philip Kane/Central
NPDES Permit #: FL0001554 Outfall #:

Sample Collection: Date 3/22/93 Time 11:52
Test Beginning: Date 3/23/93 Time 12:30
Test Ending: Date 3/25/93 Time 1340
Organism Batch #: 13 Diluent Batch #: well
Organism Age: 9 days
Test Organism: Notropis 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
0 hr	7.0 @ 7.0 9.0 @ 9.0	24.0 @ 24.1	8.4 @ 24.0	999 @ 1,000 @ 24. 10,000 @ 10,000
24 hr	7.0 @ 7.0 9.0 @ 9.0	24.4 @ 24.5	8.3 @ 24.9	1000 @ 1,000 @ 24 9,900 @ 10,000
48 hr	7.0 @ 7.0 9.0 @ 9.0	24.2 @ 24.5	8.35 @ 24.2	1000 @ 1,000 @ 24. 10,000 @ 10,000

Conc.	Chamber #	Number Live 0	24	48	pH 0	24	48	Temperature (°C) 0	24	48	D.O. (mg/L) 0	24	48	Cond. (mmhos/cm) Cond. (µmhos/cm) 0	24	48
Control	48	5	5	5	8.0	8.2	8.5	24.5	23.4	23.2	7.8	8.2	7.7	250	245	245
Control	22	5	5	5	8.0	8.2	8.5				7.6	8.2	8.0	250	245	245
100%	29	5	5	5	7.7	7.8	8.0	24.6	23.4	23.2	7.7	8.0	7.9	970	930	940
100%	65	5	5	5	7.7	7.8	8.0				7.7	8.0	7.8	970	935	940
Measured/Loaded by:		TM	TM	TM	mF	mF	MF	mF	mF	MF	mF	mF	MF	mF	mF	MF
Recorded by:		TM	TM	TM	TM	TM	RT	TM	TM	RT	TM	TM	RT	TM	TM	RT

Investigators' Signatures

Tina Mikulski
Marshall Faircloth
Kim Pearce
Rosalyn Tobias

	Salt Water/ Well Water	Water Quality Parameters 20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2:					
Lab Total Residual Cl2:	<0.03	<0.03	0.04	DR-100	TM
Alkalinity:	125	70	55	Hach	TM
Hardness:	125	80	165	Hach	TM
Total Ammonia:	<0.017	<0.017	<0.017	Orion	MF

Ammonia Slope: -56.3 Ammonia Blank: <0.017 Sample Salinity: 0 ppt

Typical Values for Selected Parameters in Florida Waters

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

Percentile Distribution

Parameter	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

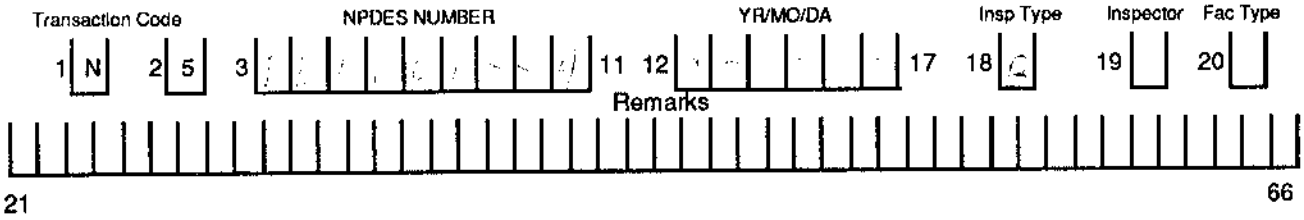
Phytoplankton taxa list and densities (#/mL) for Florida Power & Light at Sanford, collected via subsurface grabs in the St. Johns River, on 22 March, 1993.

	Reference Site	Test Site
Diatoms		
Achnanthes sp.	1473	2083
Cocconeis sp.	123	–
Coscinodiscus sp.	–	130
Cyclotella sp.	982	2083
Melosira sp.	368	391
Navicula sp.	–	130
Nitzschia sp.	614	651
Synedra sp.	12521	17315
Unidentified pennate diatom	1596	2343
Chlorophyta		
Ankistrodesmus sp.	–	391
Chlamydomonas sp.	123	–
Closterium sp.	123	–
Cosmarium sp.	246	–
Dictyosphaerium sp.	–	130
Gloeocystis sp.	123	–
Kirchneriella sp.	–	260
Pediastrum sp.	–	130
Scenedesmus sp.	1841	2604
Tetraedron sp.	123	–
Tetrastrum sp.	–	130
Ulothrix sp.	–	130
Zygnemopsis sp.	246	–
Cyanophyta		
Anabaena sp.	123	130
Anabaenopsis sp.	246	–
Aphanocapsa sp.	7242	4036
Aphanothece sp.	246	–
Chroococcus sp.	2946	2213
Dactylococcopsis sp.	368	391
Gloeocapsa sp.	1105	521
Gloeothece sp.	123	–
Lyngbya contorta	1228	1562
Lyngbya limnetica	368	260
Merismopedia sp.	491	651
Microcystis sp.	737	7551
Euglenophyta		
Lepocinclis sp.	123	–
Total density	35848	46216

Benthic macroinvertebrate taxa list for Florida Power & Light at Sanford, collected via 20 discrete dip net sweeps in the St. Johns River, on 22 March, 1993.

	Reference Site	Test Site
Diptera		
Cladotanytarsus sp.	–	84
Clinotanypus sp.	28	–
Coelotanypus concinnus	252	28
C. tricolor	84	–
Endochironomus nigricans	–	28
Endotribelos hesperium	–	28
Glyptotendipes sp. G Epler	28	–
Polypedilum halterale grp.	280	112
P. illinoense	56	196
Procladius sp.	112	84
Tanytarsus sp. G Epler	28	84
Ephemeroptera		
Caenis sp.	28	56
Gastropoda		
Littoridinops sp.	–	56
Malacostraca		
Amphipoda		
Gammarus sp.	616	–
Hyalella azteca	644	1484
Decapoda		
Palaemonetes paludosus	28	280
Megaloptera		
Chauliodes rastricornis	28	–
Neuroptera		
Climacia areolaris	28	–
Odonata		
Ischnura sp.	–	28
I. ramburii	–	28
Oligochaeta		
Aulodrilus pigueti	168	–
Eclipidrilus palustris	–	28
Haemonais waldvogeli	28	–
Limnodrilus hoffmeisteri	84	28
Pelecypoda		
Corbicula sp.	–	28
Elliptio buckleyi	28	56
Sphaerium or *Musculium* sp.	–	28
Total	2548	2744

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



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

