Bioassay of the Cecil Field Naval Air Station
Sewage Treatment Plant

Duval County

NPDES #FL0020966

SAMPLED 10/22/79

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INTRODUCTION

The Cecil Field Naval Air Station Sewage Treatment Plant serves the personnel of Cecil Field NAS, and has a design capacity of 0.82 MGD. Additionally, this plant provides secondary treatment for a variety of effluents generated as a result of the Naval Air Station's standard operating and maintenance procedures. A list of effluent sources, suspected contaminants and permit limitations is provided in Table 1. According to NPDES permit specifications this facility is required to remove 90% of the BOD_5 and suspended solids content of the influent. Additionally, the effluent shall not contain more than 0.5 mg/l copper and 0.001 mg/l phenols.

The plant discharges treated effluent to the Caldwell Branch of Sal Taylor Creek (also known as Rowell Creek) which is a tributary of Yellow Water Creek (Figure 1). Yellow Water Creek eventually joins the North fork of Black Creek. Maintenance of good effluent standards is especially important in this case because of the low flow and consequent minimal dilution capability of Yellow Water Creek. Indications are that Black Creek has exhibited signs of water quality degradation as a result of nutrient enrichment for some time. However, water quality data regarding the extent of this eutrophication and the suspected cause(s) are not available at this time.

On 27 October 1979 the Biological Section obtained effluent samples from the Cecil Field Facility outfall #001 at Rowell Creek and performed static bioassays to determine the existence and extent of toxicity to the biota of the receiving waters. Toxicants suspected in this effluent include chromium, zinc, phenols and chlorinated organic compounds. The results of these tests are reported here.

METHODS AND MATERIALS

Test methods used for conducting these static bioassays are extensively described by Peltier (1978). The organisms selected for this study are among those recommended by Peltier (1978) and the U.S. EPA (1978). Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

History and Maintenance of Bioassay Organisms

Daphnia pulex (water flea)

A breeding culture of *Daphnia pulex* was obtained from the EPA laboratory in Athens, Georgia on March 9, 1979. This culture has been maintained continually since their arrival, in 2½ gallon all

glass aquaria using a 16:8 hour light-dark cycle. Organisms have been fed a liquified blend of Purina trout chow® and Cerophyl® twice daily. Daphnia used in this bioassay were syphoned into a large culture dish through a series of nested stainless screens to isolate the proper size and age organisms (neonates). These neonates were then pipetted individually from the culture dish and placed randomly into the test chambers at the beginning of the test.

Pimephales promelas (fathead minnow)

A breeding culture of approximately 100 adult fathead minnows were obtained from the EPA laboratory in Cincinnati, Ohio on 12 May 1979. The fish were transferred to three 125 gallon aquaria filled with unchlorinated City of Tallahassee well water and reared at 24-25°C under 16:8 hour light-dark cycle. Water circulation, aeration and purification was accomplished with heavy-duty outside motor filters. These fish were fed Purina Trout Chow® at a rate of .75g/30 fish twice daily. Breeding was encouraged by placing several halved clay pots in each tank to serve as a substrate for eggs and to provide cover for the fish. Tanks were examined twice daily (at feeding time) for egg production. Clay pots containing egg clusters were immediately transferred to 15 gallon aerated aquaria for hatching. A new aquaria was prepared for each week's production of eggs thereby segregating fish into even age groups to be used for testing. After hatching fathead fry were fed twice daily with freshly hatched Artemia (brine shrimp). The fish used in this test were all four weeks old at the time of the test.

Test Methods

Two separate 48 hour static bioassays were conducted from 23 October to 25 October 1979 on a grab sample of effluent from Cecil Field Naval Air Station S.T.P., outfall #001. The sample was collected by Mr. John Shailer of DER's St. John's River Subdistrict using standard waste water sampling procedures. Separate samples were obtained for chemical and biological testing. Samples for metal analysis were prepared with HNO_3 (2ml/liter). Sample for organic chemical analysis and the bioassays were unpreserved. The samples were iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

Fresh water for dilution of the effluent sample was obtained from the same City of Tallahassee well that is used to culture the test organisms. The concentration series selected for this study are those recommended by APHA (1976) (Table 2).

Four replicates of six concentrations and a control were implemented for the fathead bioassay. The fish were transferred individually or

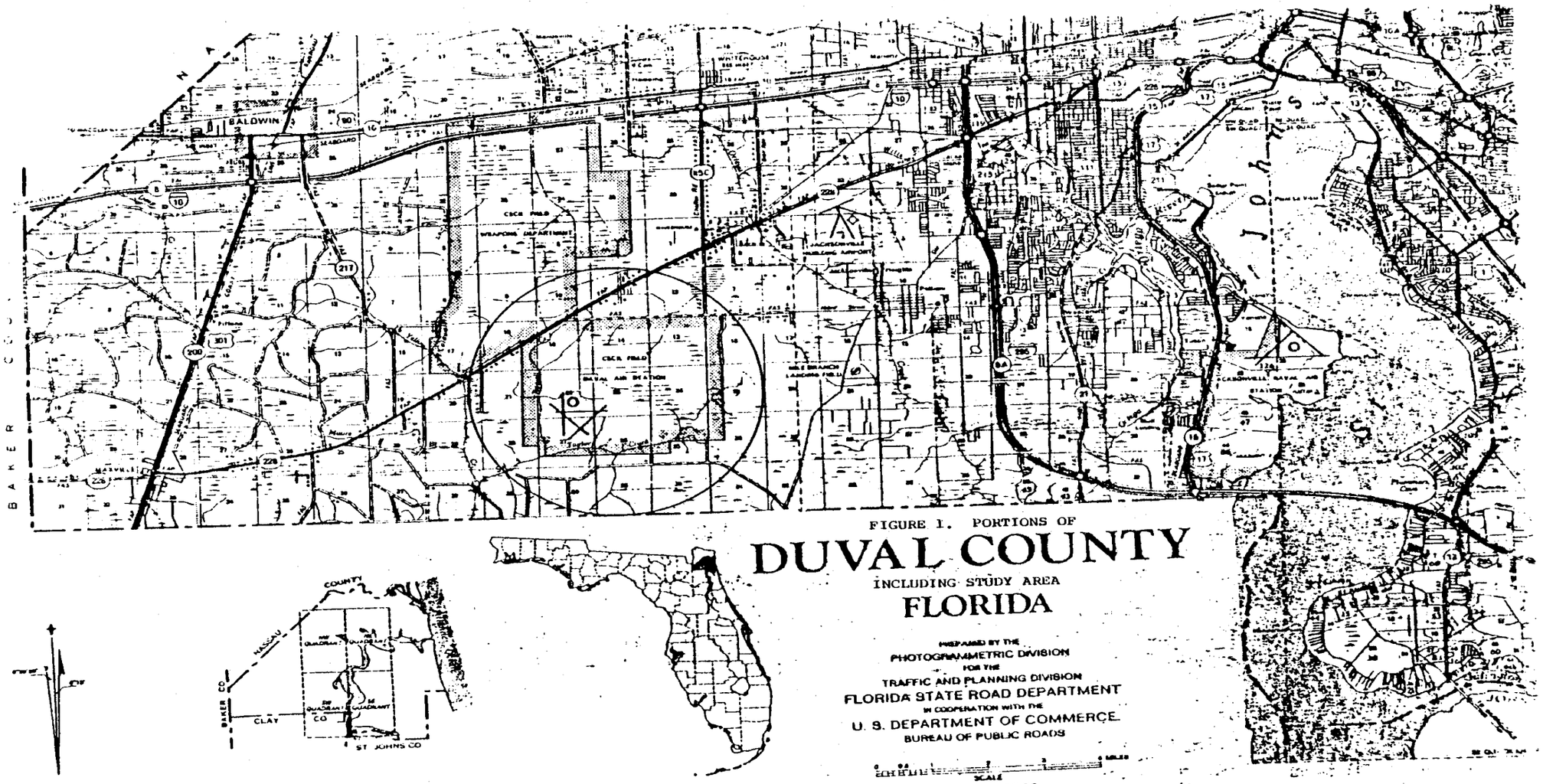


FIGURE 1. PORTIONS OF

DUVAL COUNTY

INCLUDING STUDY AREA

FLORIDA

PREPARED BY THE
PHOTOGRAMMETRIC DIVISION
FOR THE
TRAFFIC AND PLANNING DIVISION
FLORIDA STATE ROAD DEPARTMENT
IN COOPERATION WITH THE
U. S. DEPARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS

SCALE

MARCH, 1960

Table 1. List of Additional Sources of Waste Water for Treatment by the Cecil Field Naval Air Station Sewage Treatment Plant

Discharge Source	Functions of Source	Suspected Contaminants	Permit Limitations	
			Daily Average	Daily Maximum
Potable and industrial water treatment facility	Removal of suspended solids (TSS), odor, taste, hardness and dissolved solids	Brines and ion exchange regeneration wastes	TSS 30 mg/l	50 mg/l
Cooling systems	Removal of waste heat	Blow down, once through cooling water and wastes from cleaning of system	Chromium - Zinc 0.5mg/l Copper 0.5mg/l Heat 35°C Chlorine residual -	1.0 mg/l 1.0 mg/l 1.0 mg/l 38°C 0.2 mg/l
Boilers	Heat water for steam	Blow down, bleed off and cleaning wastes	Heat 35°C	38°C
Vehicle and equipment cleaning facility	Cleaning of aircraft, motor vehicles and other equipment	Methods include washing, brushing abrasion, steam cleaning, paint stripping, chemical degreasing and others	Oil and grease 10 mg/l TSS 25 mg/l Phenols 1.0 mg/l BOD_5 30 mg/l Fecal coliforms 200/100ml	15 mg/l 40 mg/l 2.0 mg/l 45 mg/l -
Painting and corrosion control facility	For painting and corrosion control	Waste paint and corrosion control chemicals	Oil and grease 10 mg/l TSS 25 mg/l Phenols 1.0 mg/l	15 mg/l 40 mg/l 2.0 mg/l
Petroleum storage and handling areas	Storage and transfer of fuels, lubricants, solvents and other petroleum products	Surface runoff	Oil and grease -	<15 mg/l
Vehicle and equipment maintenance areas	Maintenance and engineering of equipment	Surface runoff	Oil and grease -	<15 mg/l
Fire lighting training area	Fire control and training	Fire extinguishing material	Oil and grease - BOD_5 - TSS -	15 mg/l 45 mg/l 50 mg/l
Swimming pool	Recreational and training	Filter backwash	TSS - Chlorine residual -	40 mg/l 0.2 mg/l
Storm sewers	Storm water drainage	Surface runoff	Oil and grease TSS	15 mg/l 50 mg/l

Table 2

CONCENTRATION SERIES AND VOLUMES USED FOR THESE STATIC BIOASSAYS

Fathead Minnow (Pimephales promelas)

Concentration	Dilution Water	Effluent	Total Vol.
Control	500 ml	-	500 ml
5.6%	472 ml	28 ml	500 ml
10.0%	450 ml	50 ml	500 ml
18.0%	410 ml	90 ml	500 ml
32.0%	340 ml	160 ml	500 ml
56.0%	220 ml	280 ml	500 ml
100.0%	-	500 ml	500 ml

Water flea (Daphnia pulex)

Concentration	Dilution Water	Effluent	Total Vol.
Control	200 ml	-	200 ml
5.6%	189 ml	11 ml	200 ml
10.0%	180 ml	20 ml	200 ml
18.07%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	123 ml	200 ml
100.0%	-	200 ml	200 ml

Table 3. Data recorded during 48 hour, Pimephales promelas, static acute toxicity bioassay performed on Cecil Field S.T.P., Duval County, Florida 23 October to 25 October 1979 NPDES Permit #0020966

Conc. or %	Test Container Number	Number of Live Organisms					Dissolved Oxygen (mg/l)					pH					Total Alkalinity (mg/l as $CaCO_3$)					Total Hardness (mg/l as $CaCO_3$)					Temperature				
		0	24	48	72	96	2	24	48	72	96	2	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
																											Range 22° to 25°C				
Control	A	5	5	5			7.9	6.9	5.9			8.5	7.7	8.0																	
Control	B	5	5	5			8.1	6.6	5.95			8.6	7.95	8.0																	
Control	F	5	5	5			8.9	6.7	5.75			8.6	8.0	7.95																	
Control		5	5	5			8.7	6.3	5.55			8.6	7.9	7.9																	
5.6	A	5	5	5			8.7	5.95	5.3			8.6	7.9	7.8																	
5.6	B	5	5	5			8.9	6.15	5.9			8.55	7.9	7.85																	
5.6	F	5	5	5			9.1	6.5	5.7			8.6	8.0	7.85																	
5.6		5	5	5			9.0	6.25	5.7			8.6	7.95	7.8																	
10.0	A	5	5	5			8.7	5.6	5.2			8.4	7.9	7.75																	
10.0	B	5	5	5			9.1	6.2	5.6			8.5	8.0	7.8																	
10.0	F	5	5	5			9.2	6.55	5.8			8.4	8.0	7.8																	
10.0		5	5	5			8.6	6.0	5.3			8.45	7.95	7.7																	
18.0	A	5	5	5			8.6	6.5	5.8			8.35	7.95	7.75																	
18.0	B	5	5	5			8.9	6.7	5.95			8.3	8.0	7.8																	

Remarks:

Table 3 (cont.)
Cecil Field S.T.P.

Conc. or %	Test Container Number	Number of Live Organisms					Dissolved Oxygen (mg/l)					pH					Total Alkalinity (mg/l as $CaCO_3$)					Total Hardness (mg/l as $CaCO_3$)					Temperature				
		0	24	48	72	96	0	24	48	72	96		24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
																											Range 22° to 25°C				
18.0	F	5	5	5			9.05	6.0	5.35			8.35	7.95	7.75																	
18.0		5	5	5			9.1	6.6	5.95			8.4	8.0	7.75																	
32.0	A	5	5	5			8.4	5.6	4.9			8.2	7.85	7.6																	
32.0	B	5	5	5			8.5	6.1	5.3			8.2	7.9	7.7																	
32.0	F	5	5	5			8.7	6.1	5.65			8.1	7.9	7.7																	
32.0		5	5	5			8.8	6.4	5.9			8.2	7.9	7.75																	
56.0	A	5	5	5			8.6	6.6	5.8			7.8	7.9	7.7																	
56.0	B	5	5	5			8.3	6.3	5.55			7.8	7.9	7.65																	
56.0	F	5	5	5			8.4	6.4	5.65			7.75	7.9	7.65																	
56.0		5	5	5			8.3	6.1	5.8			7.75	7.9	7.7																	
100.0	A	5	5	5			7.95	6.4	5.6			7.6	7.8	7.6																	
100.0	B	5	5	5			7.5	6.6	5.6			7.55	7.85	7.6																	
100.0	F	5	5	5			7.35	5.6	5.1			7.5	7.75	7.6																	
100.0		5	5	5			7.7	6.1	5.4			7.55	7.8	7.6																	

Remarks:

Table 4. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay performed on Cecil Field S.T.P., Duval County, Florida 23 October to 25 October 1979 NPDES Permit # FL0020966

Conc. or %	Test Container Number	Number of Live Organisms					Dissolved Oxygen (mg/l)					pH					Total Alkalinity (mg/l as $CaCO_3$)					Total Hardness (mg/l as $CaCO_3$)					Temperature				
		0	24	48	72	96	2	24	48	72	96	2	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
																											22° to 25°C				
Control	1	10	10	10			10.0	8.6	7.35			8.7	8.3	8.35																	
Control	2	10	10	10			10.2	8.8	7.6			8.7	8.5	8.4																	
5.6	3	10	10	10			10.1	8.9	7.6			8.7	8.5	8.3																	
5.6	4	10	10	10			10.2	8.8	7.55			8.7	8.5	8.3																	
10.0	5	10	10	10			10.4	8.8	7.7			8.7	8.55	8.3																	
10.0	6	10	10	10			10.3	8.7	7.65			8.7	8.55	8.3																	
18.0	7	10	10	10			9.6	8.7	7.5			8.6	8.55	8.25																	
18.0	8	10	10	10			9.6	8.5	7.45			8.6	8.55	8.2																	
32.0	9	10	10	10			9.4	8.8	7.5			8.45	8.5	8.15																	
32.0	10	10	10	10			9.6	8.6	7.5			8.4	8.5	8.15																	
56.0	11	10	10	10			9.4	8.7	7.5			8.0	8.4	8.1																	
56.0	12	10	10	10			9.1	8.7	7.5			8.0	8.35	8.1																	
100.0	13	10	10	10			8.2	8.6	7.55			7.6	8.25	8.05																	
100.0	14	10	10	10			8.1	8.5	7.5			7.65	8.25	8.05																	

Remarks:

Table 5. Results of Chemical Analysis of Cecil Field NAS S.T.P. Effluent

Parameter	Results	Replicate
Zinc	15.6 µg/l	16.2 µg/l
Chromium	< 5 µg/l	< 5 µg/l

Pesticide screen - very small early unidentified peaks similar to but not PCB's

Phenols - None detectable

by twos by net into wide mouth quart jars containing 500 ml each of the appropriate test concentration (Table 2). Fatheads were loaded 5 per chamber resulting in 20 organisms per concentration.

Two replicates each with six concentrations and a control were used to test with Daphnia pulex. Flint glass jars of 250 ml capacity were used as test chambers; 200 ml of the appropriate test concentration was placed in each chamber (Table 2). Daphnia were transferred individually by glass pipette and were loaded 10 per chamber, resulting in 20 organisms per test concentration.

Dissolved oxygen, pH and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours and 48 hours. These values were recorded daily on the Bioassay Data forms and are presented in Tables 3 and 4. Organisms were not fed during these tests.

Results & Discussion

This particular grab sample of effluent from Cecil Field NAS S.T.P. gave no indication of toxicity during these tests. In fact not a single test organism, Daphnia or fathead, died during the test period, even at a concentration of 100 percent effluent.

Results of Chemical Analysis (Table 5) indicated that parameters measured were not present in toxic amounts.