

BIOASSAY OF NORTHEAST FLORIDA STATE HOSPITAL

BAKER COUNTY, FLORIDA

NPDES #FL0033758

SAMPLED 1/14/80

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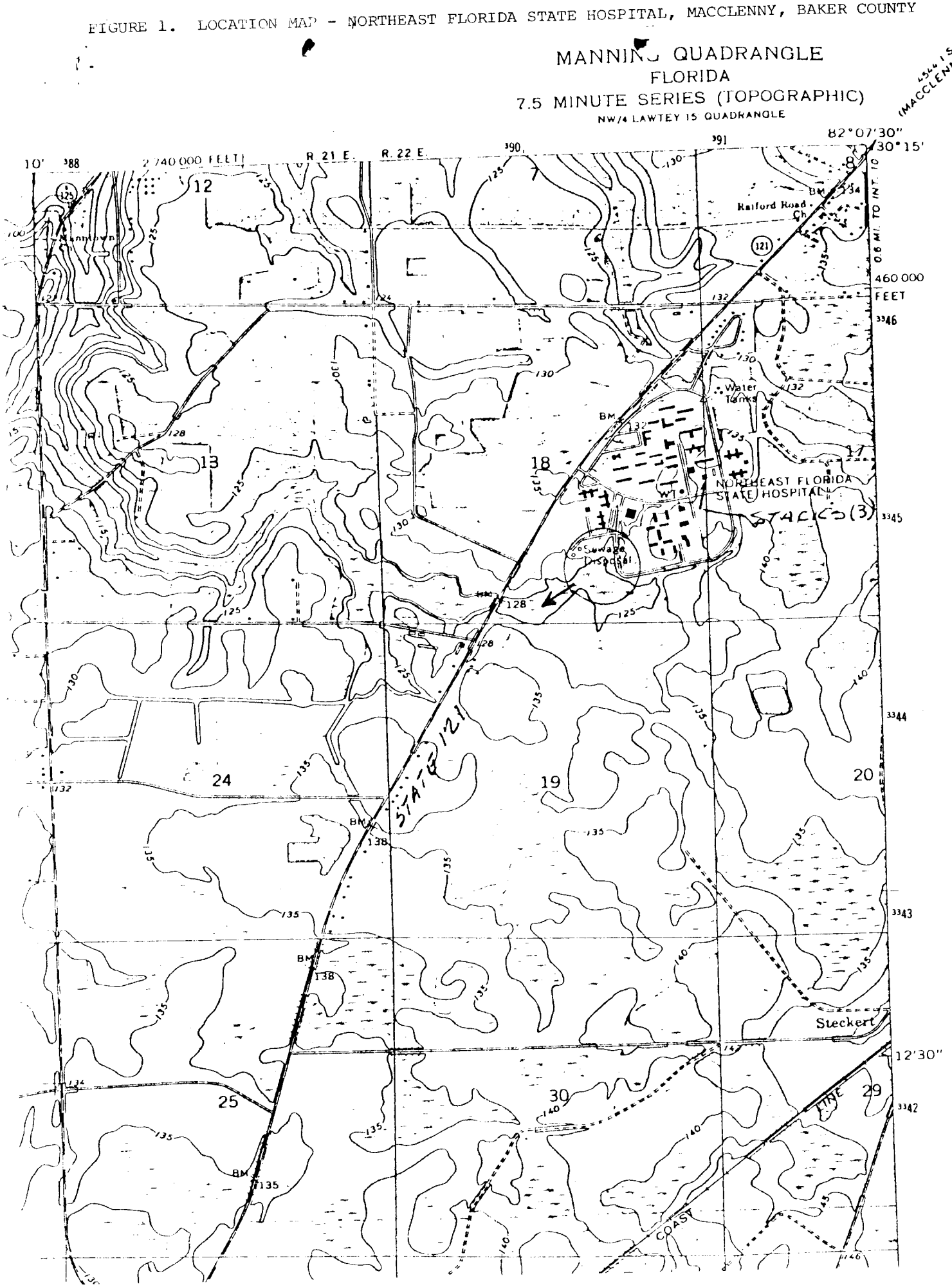
Biological Section
Bureau of Water Analysis
January 15, 1980

INTRODUCTION

The Northeast Florida State Hospital is located on Highway 121, south of MacClenny in Baker County (Fig. 1). Permitted discharge from this facility arises from a domestic sewage treatment plant with a 1.0 MGD capacity. The plant serves a population of 1000 to 5000 persons, with an average flow of 0.2 MGD. The effluent leaves the oxidation ponds through two discharge ponds via a drainage ditch to an unnamed stream, which is a tributary of the Little St. Mary's River.

On 15 January 1980 the Biological Section obtained grab samples from the Northeast Florida State Hospital and performed a static bioassay to determine the toxicity of the effluent. The results of this test are reported here.

FIGURE 1. LOCATION MAP - NORTHEAST FLORIDA STATE HOSPITAL, MACCLENNY, BAKER COUNTY



METHODS AND MATERIALS

Test methods used for conducting this static bioassay are extensively described by Peltier (1978). The organism selected for this study is among those recommended by Peltier (1978) and the U.S. EPA (1978). The life history of this test organism and maintenance procedures used to culture it 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 its 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^{R} and Cerophyl^{R} twice daily. *Daphnia* used in this bioassay were siphoned into a large culture dish through a series of nested stainless steel 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.

Test Methods

A 48 hour static bioassay was conducted from 15 January to 17 January 1980 on a grab sample of effluent from outfall #001. The sample was collected by Bureau of Water Analysis personnel on 14 January 1980 using standard wastewater sampling procedures. The unpreserved sample was iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

Freshwater 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 1).

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 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. Total alkalinity, total hardness and conductivity were recorded at the beginning of the test for the controls and high concentrations. These values were recorded daily on the bioassay data forms and are presented in Table 2. The organisms were not fed during this test.

Table 1

CONCENTRATION SERIES AND VOLUMES USED FOR THIS STATIC BIOASSAY

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
18.0%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	112 ml	200 ml
100%	-	200 ml	200 ml

Table 2. Data recorded during 48-hour, Daphnia pulex, static acute toxicity bioassay performed on the Northeast Florida State Hospital Wastewater Treatment Plant, Macclenny, Baker County, Florida. 15 Jan. to 17 Jan. 1980. NPDES Permit #FL0033758.

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 $CaCO_3$)					Conductivity (umhos)				
		0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96
Control	A	10	10	10			8.2	8.8	8.9			8.5	8.3	8.5			115					120					235				
Control	B	10	10	10			8.4	8.8	8.8			8.5	8.3	8.5																	
5.6	A	10	10	10			8.1	9.3	9.2			8.4	8.4	8.5																	
5.6	B	10	10	10			8.3	9.2	9.1			8.4	8.4	8.5																	
10.0	A	10	10	10			8.0	9.9	9.8			8.3	8.5	8.6																	
10.0	B	10	10	10			8.2	9.7	9.8			8.3	8.5	8.6																	
18.0	A	10	10	10			8.2	10.5	11.2			8.2	8.6	8.7																	
18.0	B	10	10	10			8.2	10.4	11.0			8.2	8.6	8.7																	
32.0	A	10	9	2			8.0	12.0	13.8			8.1	8.7	8.8																	
32.0	B	10	9	3			8.2	11.5	12.8			8.1	8.7	8.8																	
56.0	A	10	0	0			7.9	13.5				7.9	8.9																		
56.0	B	10	2	2			8.0	12.0	14.2			7.9	8.7	8.9																	
100	A	10	0	0			7.2	15.2				7.7	9.0																		
100	B	10	0	0			7.3	13.6				7.7	9.0				150					115					450				

Remarks:

1. Total chlorine residual of 100% effluent not detectable.
2. Temperature range during test 21.5° to 23.5°C.
3. The effluent sample contains a large algae population which resulted in the supersaturated dissolved oxygen values noted at 24 and 48 hours.

RESULTS AND DISCUSSION

This particular grab sample from the Northeast Florida State Hospital proved to be toxic to Daphnia pulex. Twenty-four and forty-eight hour LC_{50} values of 42% and 27 - 30%, respectively, were calculated for this effluent sample (Table 3). Since no chemical analyses were performed on this sample and no chlorine was detectable the cause of the observed toxicity is unknown.

Chapter 17-3.051, Florida Administrative Code, indicates that "all waters of the State shall at all places and at all times be free from...components of discharges which...are acutely toxic". "Acute toxicity" is defined in Chapter 17-3.021(1) to mean "the presence of one or more substances...in amounts which are greater than one-third (1/3) of the amount lethal to 50% of the test organisms in 96 hours (96 hr LC_{50})...". Mixing zones are not relevant to this criterion, and the restriction on acute toxicity, therefore, applies at the point of discharge. Essentially this provision means that an effluent at the poing of discharge can not cause 50% mortality in the test organisms even if the effluent is concentrated three-fold. Since the testing procedure used here does not involve any concentrating of the effluent, and since mortality is only measured for 48 hours, any toxicity reported here may be considered to be substantially in excess of allowable limits.

Table 3. LC_{50} Data

Organism	Data Analysis	24 hr. LC_{50}	48 hr. LC_{50}
Daphnia pulex	Binomial method	42.3%	27.4%
	Moving average method	42.4%	31.7%
	Probit method	42.3%	30.1%

LITERATURE CITED

American Public Health Association. 1976. Standard Methods for the Examination of Water and Wastewater. 14th ed. pp. 1193.

Peltier, William. 1978. Methods for measuring the acute toxicity of effluents to aquatic organisms. Environmental Research Laboratory. Athens, Georgia. EPA-600/4-78-012 (Revised July 1978) 51p.

U.S. Environmental Protection Agency. 1978. Bioassay procedures for the Ocean Disposal Permit Program. Environmental Research Laboratory. Gulf Breeze, Florida. EPA-600/9-78-010.