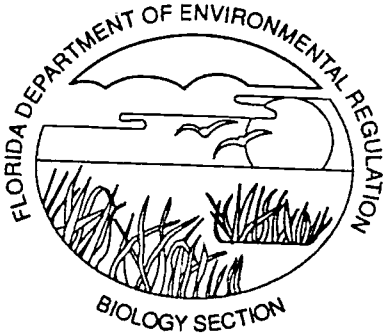


Bioassays of

Marshall Street Sewage Treatment Plant

Clearwater, Pinellas County, Florida

NPDES #FL0021857

Sampled 7/11/88

December 15, 1988

Biology Section
Division of Administrative and Technical Services

Bioassays of

Marshall Street Sewage Treatment Plant

Clearwater, Pinellas County, Florida

NPDES #FL0021857

Biology Section
Bureau of Laboratories
December 15, 1988

Executive Summary

City of Clearwater, Marshall Street STP, NPDES #FL0021857, Clearwater, Pinellas County, Florida on 12 to 14 July, 1988.

The sample of chlorinated discharge from the Marshall Street STP, was acutely toxic to the bioassay test organisms, *Ceriodaphnia dubia* and *Notropis leedsi,* with screening tests producing LC_{50}'s of less than 100%. The chlorinated sample was also toxic to the test organism, *Daphnia pulex*, producing 25% mortality. The chlorinated sample was toxic to the Microtox® test organism, *Photobacterium phosphoreum*, producing an EC_{50} of 33.92%.

The dechlorinated sample proved acutely toxic to the bioassay test organism, *C. dubia,* producing an LC_{50} of 50%, and also toxic to the Microtox® test organism, *P. phosphoreum*, producing an EC_{50} of 49.55%.

Laboratory analyses indicated that the concentration of total residual chlorine in the sample (0.5 mg/l Hach; 0.7 mg/l Iodometric) was sufficient to have contributed to the observed mortality in the chlorinated sample. Chemical analyses revealed the presence of the organics, g-BHC (Lindane) (0.03 µg/l) and several unidentified components sensitive to electron capture and nitrogen/phosphorus detection. The metal, zinc (11 µg/l), was also detected in the sample.

The cause of the toxicity in the dechlorinated sample was not determined, although the combined organics in the sample may have contributed to the toxicity.

Introduction

The City of Clearwater, Marshall Street Sewage Treatment Plant, NPDES #FL0021857, is located at 1605 Harbor Drive, Clearwater, Pinellas County, Florida (Figure 1). The facility discharges to Clearwater Bay (an Outstanding Florida Water) via Stevenson's Creek. It has a design capacity of 10 MGD and the annual average daily flow is 6.18 MGD. This plant serves a population of 50,000 (1985) and is designed to serve a population of 100,000. The facility serves western and northern Clearwater and adjacent unincorporated areas within the service area.

Treatment at the facility consists of comminution, grit removal, primary sedimentation, carbonaceous activated sludge, secondary carbonaceous settling, nitrification activated sludge, aeration, and nitrification settling, followed by chlorination. Primary sludge is digested aerobically. Waste-activated sludges are digested aerobically with centrifugal thickening (Figure 2). Digested sludges are disposed of by land spreading in the northern area of the county on city owned property.

The Biology Section, at the request of the FDER Southwest District Office, performed 6 (six) static acute bioassays and 2 (two) Microtox® assays on a sample of discharge from this facility. The results of those tests are presented in this report. Those involved in performing the tests and in preparation of this report were: J. M. Faircloth, R. B. Frydenborg, K. M. Lurding, L. A. Williams, and S. H. Wolfe.

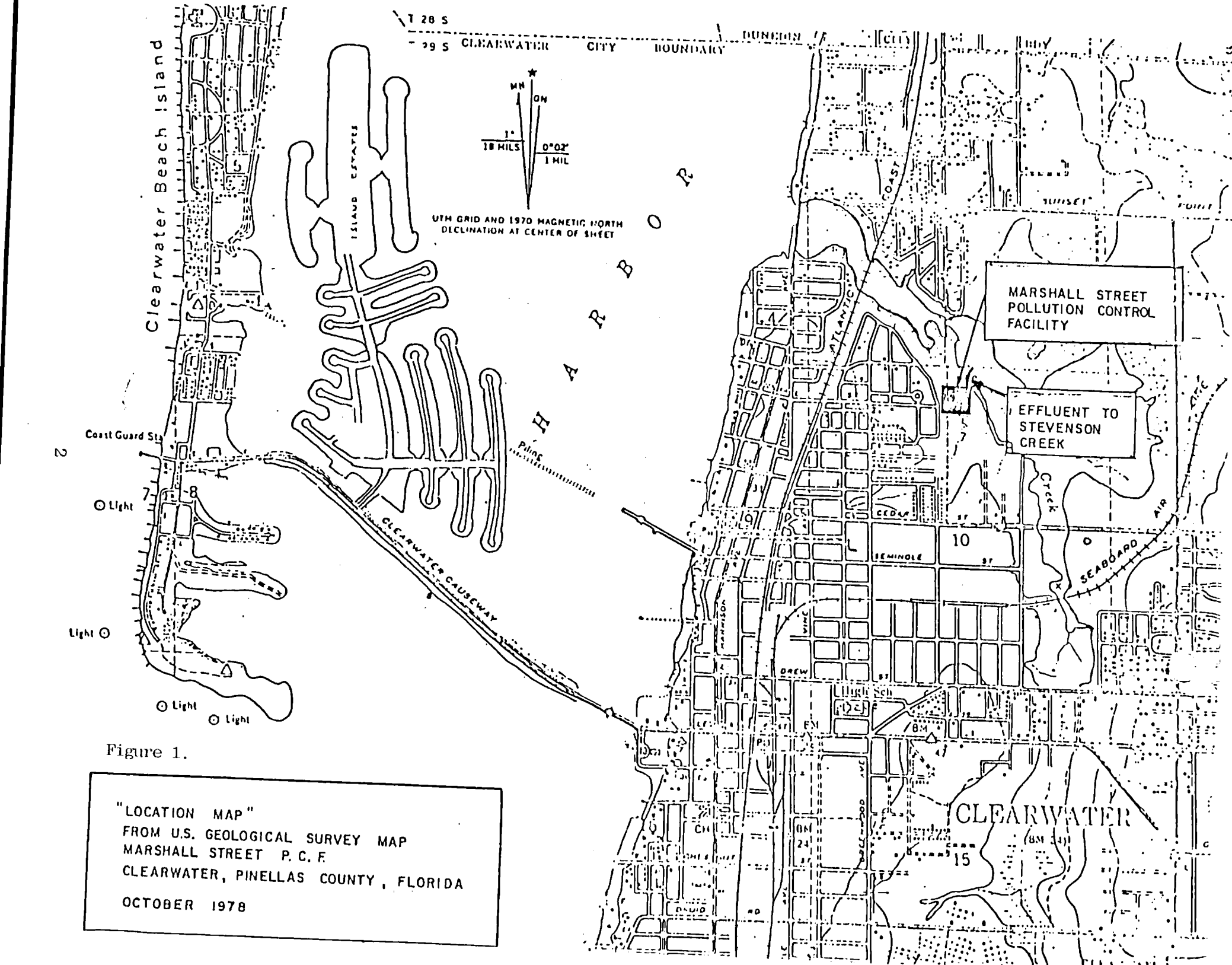


Figure 1.

"LOCATION MAP"
FROM U.S. GEOLOGICAL SURVEY MAP
MARSHALL STREET P. C. F.
CLEARWATER, PINELLAS COUNTY, FLORIDA
OCTOBER 1978

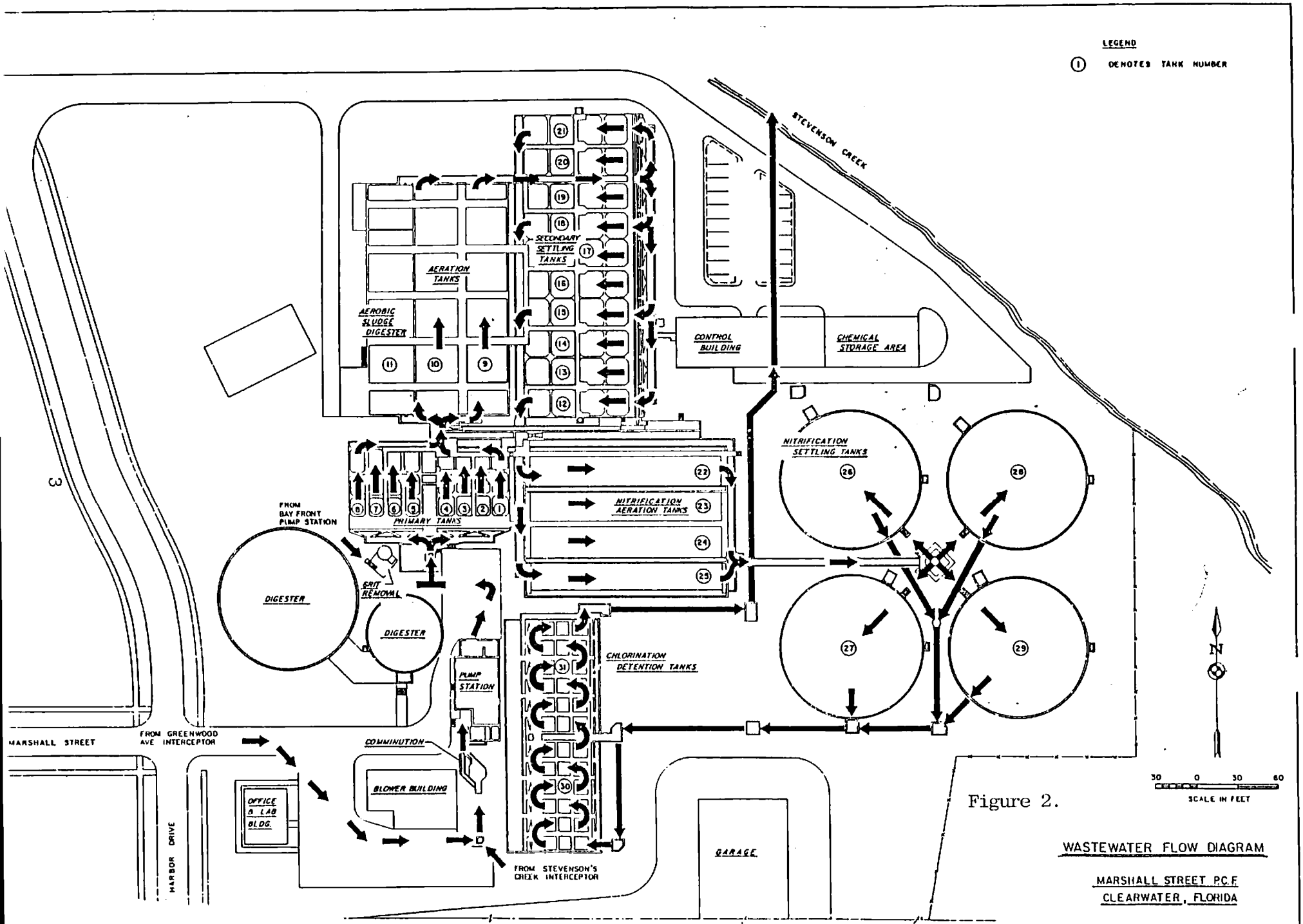


Figure 2.

WASTEWATER FLOW DIAGRAM

MARSHALL STREET P.C.F.
CLEARWATER, FLORIDA

Methods and Materials

Test methods used to conduct these static bioassays are extensively described by Peltier and Weber (1985) and the FDER Biology Section (1985). The organisms selected for this study include a species recommended by Peltier and Weber (1985) and the FDER Biology Section (1985). Additionally, the Biology Section maintains cultures of several species of organisms indigenous to the State of Florida. One of these indigenous species was also selected for testing. Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

The Microtox® assay was run according to the manufacturer's protocol described in the Microtox® System Operating Manual (Beckman 1982).

1. 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, in June, 1987. This culture has been maintained since its arrival in 2 1/2 gallon all-glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, once daily on weekends, and are kept at a constant temperature of 22 ±2 °C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms, and then refilling with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Ceriodaphnia dubia (water flea)—A breeding culture of *Ceriodaphnia dubia* was obtained from the EPA laboratory in Athens, Georgia, in June, 1985. The culture is maintained in 2-1/2 gallon all-glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow®, Cerophyl® and Fleischmann's® yeast twice daily, once daily on weekends, and are kept at a constant temperature of 26 ±2 °C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms, and then refilling with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Notropis leedsi (bannerfin shiner)—Approximately 40 adult bannerfin shiners were obtained from an indigenous population in the upper Suwannee River during October, 1981. The breeding stock is maintained in 125 gallon all-glass aquaria equipped with a flow-through water exchange system. Water for this system is unchlorinated and is pumped from the DER deep well. The bannerfin shiners are reared at 22 ±2 °C under a 16:8 hour light-dark cycle and are fed Aquarian® flake food and frozen *Artemia* (brine shrimp) twice daily, and once daily on weekends. Breeding and egg hatching are encouraged at 25 °C. The eggs are laid between stacked red ceramic tiles separated by a 3mm bead of silicone. Most of the eggs adhere to the tiles and are easily removed to heated, aerated hatching tanks. The narrow space between the tiles eliminates egg predation by adult fish. New hatching tanks are started regularly to segregate fry into even age groups. Newly hatched fry are fed a liquefied blend of Purina Trout Chow® and Cerophyl® twice daily. After one week, feeding is augmented with newly hatched *Artemia* nauplii and finely crushed Aquarian® flake food. The fish used were 17 days old when the test commenced.

Photobacterium phosphoreum, a luminescent marine bacterium, is maintained as a freeze-dried culture, purchased from Microbics Corporation. Lot number M-606 was used in this assay. Immediately prior to the assay, the culture is rehydrated with 1.0 ml of specially purified water (Microtox Reconstitution Solution).

2. Standard Reference Toxicity Assays

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biology Section conducts monthly standard reference toxicant bioassays using sodium lauryl sulfate as the reference toxicant.

3. Test Methods

Methods used to perform acute toxicity bioassays are described by Peltier and Weber (1985) and the FDER Biology Section (1985). Some of the methods described below are more specific than those of Peltier and Weber. These will be noted in more detail.

Sampling Methods and Test Dates

Six separate 48 hour acute toxicity bioassays and two Microtox® assays was performed on a sample from the City of Clearwater, Marshall Street Sewage Treatment Plant facility outfall #001. The tests were performed from 1400 hrs on 12 July, 1988 to 1330 hrs on 14 July, 1988.

Separate samples were obtained for chemical and biological testing. Samples for metal analyses were preserved with HNO_3. Samples for organic chemical analyses and for the bioassays were unpreserved. The samples were collected by Mr. David Demmi of the FDER district office in Tampa, at 1055 hours on 11 July, 1988, using standard wastewater sampling procedures. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

Test Temperature

Upon arrival of the iced (4 °C) bioassay samples in the Tallahassee laboratory, the containers were placed in warm water and the temperature of the samples allowed to rise to 20 ± 2 °C. Although this temperature may be different than the temperature of the sample during collection, it is the temperature range to which the test organisms are acclimatized and is the range recommended in the above referenced bioassay protocols. This avoids stressful effects caused by exposure to unusually cold or warm samples.

Total Residual Chlorine

Since many reclaimed waters are chlorinated, especially those originating from sewage treatment facilities, it is often desirable to differentiate between the toxicity resulting from chlorine and the toxicity associated with other components of the reclaimed water. To accomplish this, the Biology Section performed concurrent bioassays on a sample of chlorinated reclaimed water in which the chlorine had been neutralized. Dechlorination was accomplished by adding a calculated amount of 0.025N sodium thiosulfate. The total residual chlorine concentrations of the tested sample of reclaimed water are given on the bioassay data forms. A comparison of the results of these tests will distinguish between the toxicity due solely to residual chlorine and the toxicity inherently contained in the reclaimed water.

Method

Freshwater for diluting the water samples being tested was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study is given in Table 1.

Two replicates of the control and each test concentration were used in bioassays with the water flea, *Daphnia pulex* and four replicates of each with the water flea, *Ceriodaphnia dubia*. Plastic vials of 30 ml capacity (for *C. dubia*) and flint glass jars of 250 ml capacity (for *D. pulex*) were used as test chambers, and 15 ml or 100 ml, respectively, of the appropriate test concentration was placed in each chamber. *Ceriodaphnia* were siphoned into a large culture dish and neonates were transferred by glass pipette. Five were loaded per chamber, resulting in 20 per test concentration. *Daphnia* were siphoned into a stainless steel screen chamber placed into a large culture dish to

isolate the proper size and age organisms (neonates). Then the screen chamber along with any retained adults were removed. The neonates remaining were then captured by glass pipette, examined for injury, and loaded 10 per chamber, resulting in 20 per test concentration. The water fleas were not fed during these tests.

Two replicates of each concentration and a control were used for the *Notropis leedsi* (bannerfin shiner) bioassay. The fish were transferred individually or by twos using a pipette into wide mouth quart jars containing 500 ml each of the appropriate test concentration. Five were loaded per chamber, resulting in 10 per concentration. Fish were not fed during this test.

Test Parameters

Dissolved oxygen (YSI Model 57 oxygen meter), pH (Corning Model 7 pH meter with Orion Ross® combination electrode), temperature (NBS calibrated glass thermometer), and the number of live organisms were recorded for each test concentration at 0 hours, 24 hours, and 48 hours. Total alkalinity and total hardness (measured as $CaCO_3$ using Hach Chemical Company reagents) were recorded at the beginning of the test for the controls and the 100% reclaimed water concentration. The specific conductance (YSI Model 33 S-C-T meter) of each test concentration was recorded at the beginning and end of the test. All instruments were calibrated before use according to manufacturer's recommendations. Ammonia concentrations, including the total and unionized fraction (expressed in mg/l as N and as NH_3, respectively), were recorded in the controls and the 100% reclaimed water test concentration at the beginning of the test. Total ammonia concentrations were determined using an Orion specific ion probe and an Orion Ionalyzer®. The unionized fraction was then calculated based on the total ammonia concentration and the pH, temperature, and salinity of the sample. These values were recorded on the bioassay data forms and are presented in Tables 2 and 3.

Microtox® Test

Upon receipt at the DER laboratory, a 20 ml subsample was collected for Microtox® analysis. The sample was adjusted to 2% salinity with reagent grade dry sodium chloride to maintain the osmotic balance of the test bacterium during the assay. Four two-fold dilutions were made of the test sample resulting in a test range of 99%, 49.5%, 24.75%, 12.38%, and 0%. An incubation temperature of 15 °C was maintained throughout the assay. Ten µl of bacterial suspension was added to each of the 1.0 ml test dilutions. Light output (luminescence) was read after 5 and 15 minutes incubation, using the Microtox® analyzer and recorded on a Perkin-Elmer strip chart recorder. In the presence of a toxicant, the luminescence of the test organisms will decrease. In the presence of a stimulant, the luminescence will increase. Toxicity is calculated as a function of the light lost in the test sample, normalized to the control, and is reported as the effective concentration at which a 50% reduction, of light output is determined in 15 minutes (EC_{50}). Results are given in Table 4.

Results and Discussion

The sample of chlorinated discharge from the City of Clearwater, Marshall Street STP was acutely toxic to the bioassay test organisms, *Ceriodaphnia dubia* and *Notropis leedsi*, producing LC_{50}'s of less than 100%. The chlorinated sample was also toxic to the bioassay test organism, *Daphnia pulex*, resulting in 25% death; however, an LC_{50} could not be calculated. This sample was toxic to the Microtox® assay organism, *Photobacterium phosphoreum*, producing an EC_{50} of 33.92% sample.

The tests performed on the dechlorinated portion of the sample showed that the sample was acutely toxic to the bioassay organism, *C. dubia* and the Microtox® assay organism, *P. phosphoreum*, producing, respectively, an LC_{50} of 50.0% and an EC_{50} of 49.55%. Laboratory analyses indicated that the concentration of total residual chlorine in the chlorinated sample (0.5 mg/l Hach; 0.7 mg/l Iodometric) was sufficient to contribute to the observed test organism mortality in the chlorinated tests. Other analyses indicated that there was no ammonia in the sample. The cause of the toxicity in the dechlorinated discharge from the Marshall Street facility was not determined.

Additional chemical analyses of the sample detected g-BHC (Lindane 0.03 µg/l) and several components sensitive to electron capture (ECD) and nitrogen/phosphorus (NPD) detection in the pesticide extractable portion of the organics analyses. The metal, zinc (11 µg/l), was also detected in the sample. Neither the g-BHC (Lindane) concentration (EPA, 19xx) nor the zinc concentration (EPA 1976) in the sample were sufficient to cause the observed toxicity; however, the g-BHC (Lindane) in combination with the unnamed organic components of the sample may have contributed to the toxicity.

In conclusion, the sample of discharge from the City of Clearwater Marshall Street STP was acutely toxic on 11 July, 1988.

Biology Section Recommendations

The Biology Section recommends additional toxicity testing of the discharge from this facility as the first step in a Toxicity Reduction Evaluation. Should additional toxicity tests show that the discharge from the facility is again toxic, then the facility should be required to continue the Toxicity Reduction Evaluation with the goal of meeting state water quality standards.

Table 1. Concentration Series and Volumes Used for These Static Bioassays.

Ceriodaphnia dubia (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	15.0 ml	0.0 ml	15 ml
10.0%	13.5 ml	1.5 ml	15 ml
30.0%	10.5 ml	4.5 ml	15 ml
50.0%	7.5 ml	7.5 ml	15 ml
70.0%	4.5 ml	10.5 ml	15 ml
85.0%	2.25 ml	12.75 ml	15 ml
100.0%	0.0 ml	15.0 ml	15 ml

Daphnia pulex (water flea)

Concentration	Dilution Water	Sample	Total Volume
Control	100 ml	0 ml	100 ml
100.0%	0 ml	100 ml	100 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Sample	Total Volume
Control	500 ml	0 ml	500 ml
10.0%	450 ml	50 ml	500 ml
30.0%	350 ml	150 ml	500 ml
50.0%	250 ml	250 ml	500 ml
70.0%	150 ml	350 ml	500 ml
85.0%	75 ml	425 ml	500 ml
100.0%	0 ml	500 ml	500 ml

Table 2. Data recorded during the 48 hour static definitive bioassay of dechlorinated sample from the Marshall Street STP, Clearwater, Pinellas County, NPDES #FL0021857, on 12 to 14 July, 1988.

Facility: Marshall St. STP — NPDES # FL0021857 — Facility Type: Municipal
Location: 1605 Harbor Dr., Clearwater — Contact/District: D. Demmi / SW
County: Pinellas — Test type: definitive
Sample Collection Date: 7/11/88 Time: 1055 — # tests: 6 — Receiving Water: Stevenson's Creek
Test Beginning Date: 7/12/88 Time: 1400 — Chlorination Type: dechlorinated
Test Ending Date: 7/14/88 Time: 1330 — Page 1 of 2

Total Residual Cl2	mg/l	Method
Field:	0.7	plant meter
Lab:	0.5	Hach
Lab:	0.7	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.00	0.00
100% Sample:	0.00	0.00

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	122	125
Cond. Control Water (daphnids):	130	125
100% Sample:	155	225

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Organism: *Ceriodaphnia dubia* Life stage: neonate
LC50: - Binomial: 50.0% Moving Average: 57.1% Probit: 54.0%

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	9.0	-	9.1	8.0	-	8.0	19.1	-	19.8	-	-
Control	5	5	5	9.0	-	9.1	8.0	-	8.0	-	-	-	-	-
Control	5	4	4	9.0	-	9.0	8.0	-	8.0	-	-	-	-	-
Control	5	5	5	9.0	-	9.0	8.0	-	8.0	-	-	-	210	232
10%	5	5	5	8.9	-	8.9	8.0	-	8.0	18.9	-	19.7	-	-
10%	5	5	5	8.9	-	8.9	8.0	-	8.0	-	-	-	-	-
10%	5	5	5	8.9	-	8.9	8.0	-	8.0	-	-	-	-	-
10%	5	5	5	8.9	-	8.9	8.0	-	8.0	-	-	-	275	265
30%	5	5	5	8.9	-	8.9	7.9	-	8.0	18.7	-	19.7	-	-
30%	5	5	5	8.9	-	8.9	7.9	-	8.0	-	-	-	-	-
30%	5	5	5	8.9	-	8.9	7.9	-	8.0	-	-	-	-	-
30%	5	4	4	8.9	-	8.9	7.9	-	8.0	-	-	-	390	375
50%	5	5	2	8.8	-	8.9	7.7	-	8.1	19.2	-	19.7	-	-
50%	5	5	2	8.8	-	8.9	7.7	-	8.1	-	-	-	-	-
50%	5	5	3	8.8	-	8.9	7.7	-	8.1	-	-	-	-	-
50%	5	5	3	8.8	-	8.9	7.7	-	8.2	-	-	-	560	594
70%	5	5	3	8.7	-	9.0	7.6	-	8.1	19.4	-	19.7	-	-
70%	5	4	2	8.7	-	9.0	7.6	-	8.1	-	-	-	-	-
70%	5	5	2	8.8	-	9.0	7.6	-	8.1	-	-	-	-	-
70%	5	5	2	8.8	-	9.0	7.6	-	8.1	-	-	-	710	753
85%	5	1	0	8.8	-	9.0	7.6	-	8.1	19.5	-	19.7	-	-
85%	5	3	0	8.8	-	9.0	7.6	-	8.1	-	-	-	-	-
85%	5	4	0	8.8	-	9.0	7.6	-	8.1	-	-	-	-	-
85%	5	5	1	8.8	-	9.0	7.6	-	8.1	-	-	-	800	875
100%	5	4	0	8.8	-	9.0	7.5	-	8.1	19.5	-	19.7	-	-
100%	5	3	0	8.8	-	9.0	7.5	-	8.1	-	-	-	-	-
100%	5	3	0	8.8	-	8.9	7.5	-	8.1	-	-	-	-	-
100%	5	2	0	8.8	-	8.9	7.5	-	8.1	-	-	-	930	983

Organism: *Daphnia pulex* Life stage: neonate
LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	10	10	10	9.0	-	9.0	8.2	-	8.1	19.6	-	19.7	-	-
Control	10	10	9	9.0	-	9.0	8.2	-	8.1	-	-	-	210	225
100.0%	10	10	10	9.0	-	9.0	7.3	-	8.1	19.7	-	19.4	-	-
100.0%	10	10	10	9.0	-	9.0	7.3	-	8.1	-	-	-	880	890

Table 2. Continued

Facility:	Marshall St. STP		NPDES #	FL0021857	Facility Type: Municipal
Location:	1605 Harbor Dr. , Clearwater		Contact/District:	D. Demmi/SW	
County:	Pinellas		Test type:	static screening	
Sample Collection Date:	7/11/88	Time: 1055	# tests:	6	Receiving Water: Stevenson's Creek
Test Beginning Date:	7/12/88	Time: 1400	Chlorination Type:	dechlorinated	
Test Ending Date:	7/14/88	Time: 1330			Page 2 of 2

Total Residual Cl2	mg/l	Method
Field:	0.7	plant meter
Lab:	0.5	Hach
Lab:	0.7	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.00	0.00
100% Sample:	0.00	0.00

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	122	125
Cond. Control Water (daphnids):	130	125
100% Sample:	155	225

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Organism: ***Notropis leedsi*** Age: 17 days
LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	8.5	8.6	8.5	7.6	7.7	7.9	21.0	20.1	19.7	-	-
Control	5	5	5	8.5	8.9	8.5	7.6	7.7	7.9	-	-	-	215	222
10%	5	5	5	8.6	8.9	8.6	7.6	7.7	7.9	20.7	19.8	19.5	-	-
10%	5	5	5	8.6	8.9	8.6	7.6	7.7	7.9	-	-	-	300	294
30%	5	5	5	8.8	9.0	8.7	7.5	7.7	7.9	20.6	19.6	19.3	-	-
30%	5	5	5	8.8	9.0	8.7	7.5	7.7	7.9	-	-	-	445	434
50%	5	5	5	8.8	9.0	8.6	7.4	7.7	7.9	20.4	19.5	19.3	-	-
50%	5	5	5	8.8	8.8	8.6	7.4	7.7	7.9	-	-	-	600	589
70%	5	5	5	8.4	8.9	8.6	7.3	7.7	7.9	20.3	19.4	19.2	-	-
70%	5	5	5	8.4	8.9	8.6	7.3	7.7	7.9	-	-	-	760	744
85%	5	5	5	8.2	8.9	8.6	7.3	7.7	7.9	20.2	19.4	19.1	-	-
85%	5	5	5	8.2	8.8	8.6	7.3	7.7	7.9	-	-	-	870	850
100%	0*	0*	0*	8.2	9.1	9.0	7.2	7.7	7.9	20.1	19.5	19.0	-	-
100%	5	5	5	8.2	8.9	8.6	7.2	7.7	7.9	-	-	-	975	968

* not loaded through error

Table 3. Data recorded during the 48 hour static screening bioassay of a chlorinated sample from the Marshall Street STP, Clearwater, Pinellas County, NPDES #FL0021857, on 12 to 14 July, 1988.

Facility:	Marshall St. STP		NPDES #	FL0021857	Facility Type: municipal
Location:	1605 Harbor Dr. , Clearwater		Contact/District:	D. Demmi / SW	
County:	Pinellas		Test type:	Static Screen	
Sample Collection Date:	7/11/88	Time: 1055	# tests:	6	Receiving Water: Stevenson's Creek
Test Beginning Date:	7/12/88	Time: 1400	Chlorination Type:	Chlorinated	
Test Ending Date:	7/14/88	Time: 1330			Page 1 of 2

Total Residual Cl2	mg/l	Method
Field:	0.7	plant meter
Lab:	0.5	Hach
Lab:	0.7	Iodometric

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	0.00	0.00
Cond. Control Water (daphnids):	0.00	0.00
100% Sample:	0.00	0.00

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	122	125
Cond. Control Water (daphnids):	130	125
100% Sample:	155	225

Salinity (ppt)	
Control Water:	0
100% Sample:	0

Organism: ***Ceriodaphnia dubia*** Life stage: neonate
LC50: <100%

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	8.9	-	8.9	8.1	-	8.0	19.5	-	20.0	-	-
Control	5	5	5	8.9	-	8.9	8.1	-	8.0	-	-	-	-	-
Control	5	5	5	8.9	-	8.9	8.1	-	8.0	-	-	-	-	-
Control	5	5	5	9.0	-	8.9	8.1	-	8.0	-	-	-	215	212
100%	5	1	0	8.5	-	9.0	7.5	-	8.1	19.6	-	19.7	-	-
100%	5	0	0	8.5	-	9.0	7.5	-	8.1	-	-	-	-	-
100%	5	0	0	8.5	-	9.0	7.5	-	8.1	-	-	-	-	-
100%	5	0	0	8.5	-	9.0	7.5	-	8.1	-	-	-	900	942

Organism: ***Daphnia pulex*** Life stage: neonate
LC50: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	10	10	8.9	-	9.0	8.2	-	8.0	19.7	-	18.9	-	-
Control	5	10	10	8.9	-	9.0	8.2	-	8.0	-	-	-	215	220
100%	5	10	8	8.3	-	9.1	7.2	-	8.0	20.1	-	19.1	-	-
100%	5	10	6	8.3	-	9.1	7.2	-	8.0	-	-	-	940	930

Organism: ***Notropis leedsi*** Age: 17 days
LC50: <100%

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	8.4	8.8	7.9	7.6	7.8	7.9	20.6	19.5	19.2	-	-
Control	5	5	5	8.4	8.9	7.9	7.6	7.8	7.9	-	-	-	225	216
100%	5	0	0	7.9	9.0	7.8	7.2	7.6	7.8	21.1	19.5	19.1	-	-
100%	5	0	0	7.9	9.0	7.8	7.2	7.6	7.8	-	-	-	950	944

Table 4. Microtox test results, Clearwater Marshall St. STP discharge, Pinellas County, NPDES #FL0021857, on 12 July, 1988.

Microtox Test Culture Lot # M-606

% Sample	Final Reclaimed Water			
	Chlorinated		Dechlorinated	
	5-min	15-min	5-min	15-min
0	99	67	84	54
0	88	58	86	55
0	108	71	73	46
12.38	83	51	73	44
12.38	90	54	75	45
12.38	94	56	73	44
24.75	82	46	65	35
24.75	82	46	67	34
24.75	89	49	69	38
49.5	56	24	57	27
49.5	52	21	54	26
49.5	56	23	52	25
99	24	7	37	15
99	22	7	36	15
99	26	8	39	16

EC_{50} Chlorinated (15 minute, 15 °C) = 33.92% sample
EC_{50} Dechlorinated (15 minute, 15 °C) =49.55% sample

EC_{50} (15 minute, 15 °C) is calculated using the Data Reduction Computer Program developed by Microbics Corporation for the Sharp Model EL-5100 (Microbics) Systems Operating Manual, 1982.

Table 5. LC_{50} Data for Bioassay.

Organism	Method of Data Analysis	48 Hour LC_{50} (95% Confidence Intervals)
Chlorinated discharge		
Ceriodaphnia dubia	Binomial	a, (<100%)[b]
	Moving Average	a
	Probit	a
Daphnia pulex	Binomial	a
	Moving Average	a
	Probit	a
Notropis leedsi	Binomial	a, (<100%)[b]
	Moving Average	a
	Probit	a
Dechlorinated discharge		
Ceriodaphnia dubia	Binomial	50.00% (30.0%-85.0%)
	Moving Average	57.08% (46.8%-80.5%)
	Probit	54.39% (47.2%-60.9%)
Daphnia pulex		no toxicity
Notropis leedsi		no toxicity

[a] Due to an insufficient number of dead organisms, or to the irregular distribution of mortality, an LC_{50} value cannot be calculated using this method of statistical analysis.

[b] The LC_{50} is < 100% since all the organisms died in the lowest test concentration (100%).

Table 6. Chemical constituents present in the discharge water from the Marshall Street Wastewater Treatment Plant, NPDES #FL0021857, on 12 July, 1988.

	Organics	
Pesticide extractables	g-BHC	0.03 µg/l Several unidentified components sensitive to ECD and NPD
	Metals	
	Zinc	11 µg/l

Literature Cited

Beckman Instruments, Inc. 1982. Microtox system operating manual.

Florida Department of Environmental Regulation. 1985. Quality assurance manual for performing acute toxicity tests (Second Edition). Biology Section, Tallahassee.

Peltier, W. and C. I. Weber. 1985. Methods for measuring the acute toxicity of effluents to aquatic organisms (Third Edition). Environmental Research Laboratory. Athens, Georgia. EPA-600/4-85-012. 217 p.

U.S. Environmental Protection Agency. 1976. Quality criteria for water. U.S. EPA, Washington, D.C. 256 p.

_____. [undated]. Hexachlorocyclohexane: Ambient Water Quality Criteria. Criteria and Standards Division. Office of Water Planning and Standards. U.S. EPA. Washington, D.C. 106 p.

Discussion of the Toxicity Criteria

The toxicity standards of Chapters 17-3 and 17-4, F.A.C., are complex. Because of this complexity, they will be briefly reviewed here so that these test results may be more readily compared with the standards. For legal purposes, however, the language of the Florida Administrative Code should be consulted directly. Applicable portions of the F.A.C. are: 17-3.021(1), 17-3.021(4), 17-3.051(1)(d), 17-3.061(3)(p), 17-3.402(1), 17-4.244(4), and 17-4.244(6).

The particular restrictions applied to a given discharger depend upon the type of discharge, the type of water body which is impacted, and the type of mixing zone, if any, which has been permitted. The most stringent toxicity limitations which apply to the various combinations of these factors are listed below, specified in terms of the most dilute concentration of effluent which is allowed to kill 50% of the test organisms in 96 hours. Note that any listed concentration greater than 100% is extrapolated from toxicity curves determined from testing various effluent concentrations of 100% or less. Violations of the toxicity standards occur in the following conditions.

I. Discharges to Surface Water

   A. With no mixing zone, or with only a dredge and fill mixing zone the discharge may not exhibit an $LC_{50} < 2000\%$ at the point of discharge.

   B. With a non-dredge and fill mixing zone the discharge may not exhibit an $LC_{50} < 100\%$ at the point of discharge and may not exhibit an $LC_{50} < 2000\%$ at the edge of the mixing zone.

   C. With a non-dredge and fill mixing zone, and either discharging to the open ocean through multiport diffusers or meeting the provisions of 17-4.244(4)(b) the LC_{50} at the point of discharge cannot exceed 30% sample concentration.

II. Discharges to ground water may not exceed an LC_{50} of 300% at the point of contact with surface waters

A violation of these provisions occurs if toxicity is found at a more dilute concentrations of the sampled discharge than allowed above.

Clearwater STP
Marshall St.

Test No.: 1 - 6
Test Type: Static Renewal, Screening, Conventional
Other: deCl2

7-11-88 1055
7-12-88 1400
7-14-88 1330

Test Organism: C. dubia
Life Stage: neonate

Treatment	Test Chamber	Number of Organisms 0	24	48	72	96
Control	1/2	5/5	5/5	5/5		
Control	3/4	5/5	4/5	4/5		
10%	5/6	5/5	5/5	5/5		
10%	7/8	5/5	5/5	5/5		
30%	9/10	5/5	5/5	5/5		
30%	11/12	5/5	5/4	5/4		
50%	13/14	5/5	5/5	2/2		
50%	15/16	5/5	5/5	3/3		
70%	17/18	5/5	5/4	3/2		
70%	19/20	5/6	5/5	2/2		
85%	21/22	5/5	1/3	0/0		
85%	23/24	5/5	4/5	0/1		
100%	25/26	5/5	4/3	0/0		
100%	27/28	5/5	3/2	0/0		
Initial of Investigator		KHL	JMF	JMF		

Treatment	Test Chamber	Dissolved Oxygen (mg/l) 0	24	48	72	96
Control	1/2	9.0/9.0	9.1/9.1			
Control	3/4	9.0/9.0	9.0/9.0			
10%	5/6	8.9/8.9	8.9/8.9			
10%	7/8	8.9/8.9	8.9/8.9			
30%	9/10	8.9/8.9	8.9/8.9			
30%	11/12	8.9/8.9	8.9/8.9			
50%	13/14	8.8/8.8	8.9/8.9			
50%	15/16	8.8/8.8	8.9/8.9			
70%	17/18	8.7/8.7	9.0/9.0			
70%	19/20	8.8/8.8	9.0/9.0			
85%	21/22	8.8/8.8	9.0/9.0			
85%	23/24	8.8/8.8	9.0/9.0			
100%	25/26	8.8/8.8	9.0/9.0			
100%	27/28	8.8/8.8	8.9/8.9			
Initial of Investigator		JMF	JMF			

Treatment	Test Chamber	pH 0	24	48	72	96
Control	1/2	8.0/8.0	8.0/8.0			
Control	3/4	8.0/8.0	8.0/8.0			
10%	5/6	8.0/8.0	8.0/8.0			
10%	7/8	8.0/8.0	8.0/8.0			
30%	9/10	7.9/7.9	8.0/8.0			
30%	11/12	7.9/7.9	8.0/8.0			
50%	13/14	7.7/7.7	8.1/8.1			
50%	15/16	7.7/7.7	8.1/8.2			
70%	17/18	7.6/7.6	8.1/8.1			
70%	19/20	7.6/7.6	8.1/8.1			
85%	21/22	7.6/7.6	8.1/8.1			
85%	23/24	7.6/7.6	8.1/8.1			
100%	25/26	7.5/7.5	8.1/8.1			
100%	27/28	7.5/7.5	8.1/8.1			
Initial of Investigator		SHW	JMF			

Treatment	Test Chamber	Temperature °C 0	24	48	72	96
Control	1/2	19.4/19.8				
Control	3/4					
10%	5/6	18.9/19.7				
10%	7/8					
30%	9/10	18.7/19.7				
30%	11/12					
50%	13/14	19.2/19.7				
50%	15/16					
70%	17/18	19.4/19.7				
70%	19/20					
85%	21/22	19.5/19.7				
85%	23/24					
100%	25/26	19.5/19.7				
100%	27/28					
Initial of Investigator		SHW	RBF			

Treatment	Test Chamber	Conductivity 0	24	48	72	96
Control	1/2					
Control	3/4	810		832		
10%	5/6					
10%	7/8	270		265		
30%	9/10					
30%	11/12	390		375		
50%	13/14					
50%	15/16	560		554		
70%	17/18					
70%	19/20	710		753		
85%	21/22					
85%	23/24	800		817		
100%	25/26					
100%	27/28	930		983		
Initial of Investigator		SHW		RBF		

Salinity/Hardness (mg/l as $CaCO_3$)

Control Water: 134/125
100% Sample: ~~130/125~~
Other: 155/225
Measured by: JMF

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0

Control Water: 0
100% Sample: 0
Other:

Hour 0

Control Water:
100% Sample:
Other:
Measured by: JMF

Signatures:
Steven H Wolfe
K H Harding
Jim Fairbrother

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours	7 at 7; 9 at 9	9.0 at 21°C	1279 at 20.5° at 1281
24 Hours	7 at 7; 9 at 9	8.8 at 22°C	
48 Hours	7 at 7; 9 at 9	9.1 at 20.5°C	1275 at 20.5 at 1201
72 Hours			
96 Hours			

Total Residual Chlorine:
Field data: 0.7 Method: meter
Lab: 0.5 Method: Hach DR
Lab: 0.7 Method: 1000. Reviewed by:

De-chlorinated: Date:
Measurements by: JMF, RBF

Remarks:
Slope = -57.3

Industry/Toxicant Clearwater STP
Address
Contact/District
Effluent Serial Number
NPDES Permit Number

BIOASSAY DATA FORM

Test Number: 2 of 6
Test Type: (Static) Renewal, (Screening) Conventional
Other: deCl2

Sample Collection: Date 7-11-88 Time 1055
Test Beginning: Date 7-12-88 Time 1700
Test Ending: Date 7-14-88 Time 1330
Test Organism D. pulex
Age/Life Stage neonate

Conc. or %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	59	10	10	10			9.0		9.0			8.2	8.1				19.6	19.7				~~SHW~~				
Control	1	10	10	9			9.0		9.0			8.2	8.1									~~210~~ 225		225		
100%	27	10	10	10			9.0		9.0			7.3	8.1				19.7	19.4								
100%	17	10	10	10			9.0		9.0			7.3	8.1									880		890		
Initial of Investigator		JHF	JMF	JMF			JMF		JMF			SHW					SHW	RBF				SHW		RBF		

Alkalinity/Hardness (mg/l as $CaCO_3$)
Control Water:
100% Sample:
Other:
Measured by:

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0
Control Water:
100% Sample:
Other:
Hour
Control Water:
100% Sample:
Other:
Measured by:

Signatures:
Steven H Wolfe
RA Lurding
E.M Faulkner

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks:

Total Residual Chlorine:
Field data: Method:
Lab: Method:
Lab: Method: Reviewed by:
Dechlorinated: Date:
Measurements by:

Clearwater STP

3-6

deCl2

7-11-88 1055
7-12-88 1400
7-14-88 1330
N. Leedsi
17days

%	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	2	5	5	5			8.5	8.6	8.5			7.6	7.7	7.9			21.0	20.1	19.7							
Control	99	5	5	5			8.5	8.9	8.5			7.6	7.7	7.9								215		224		
10%	21	5	5	5			8.6	8.9	8.6			7.6	7.7	7.9			20.7	19.8	19.5							
10%	54	5	5	5			8.6	8.9	8.6			7.6	7.7	7.9								300		294		
30%	6	5	5	5			8.8	9.0	8.7			7.5	7.7	7.9			20.6	19.6	19.3							
30%	5	5	5	5			8.8	9.0	8.7			7.5	7.7	7.9								445		434		
50%	47	5	5	5			8.8	9.0	8.6			7.4	7.7	7.9			20.4	19.5	19.3							
50%	52	5	5	5			8.8	8.8	8.6			7.4	7.7	7.9								600		589		
70%	113	5	5	5			8.4	8.9	8.6			7.3	7.7	7.9			20.3	19.4	19.2							
70%	49	5	5	5			8.4	8.9	8.6			7.3	7.7	7.9								760		744		
85%	86	5	5	5			8.2	8.9	8.6			7.3	7.7	7.9			20.2	19.4	19.1							
85%	23	5	5	5			8.2	8.8	8.6			7.3	7.7	7.9								870		850		
100%	43	5	-	-			8.2	9.1	9.0			7.2	7.7	7.9			20.1	19.5	19.0							
100%	38	5	5	5			8.2	8.9	8.6			7.2	7.7	7.9								975		968		
Initial of Investigator		SHW	SHW	SHW			JMF	SHW	JMF			SHW	SHW	JMF			SHW	SHW	RBF			SHW		RBF		

Alkalinity/Hardness (mg/l as CaCO3)

	A	A
Control Water:	122	125
100% Sample:	155	221
Other:		

Measured by: MF

Ammonia unionized/total (mg/l as NH_3/N)

Hour 0

Control Water: 0
100% Sample: 0
Other:

Hour 0

Control Water:
100% Sample:
Other:
Measured by: MF

Signatures:
Steven H Wolfe
KM Lurding
J. M. Faubert

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Total Residual Chlorine:

Field data: _____ Method: _____
Lab: _____ Method: _____
Lab: _____ Method: _____ Reviewed by: _____

De-chlorinated: Date: _____
Measurements by: _____

Remarks:

* Loading error

MICROTOX™ Data Reduction Sheet

SOURCE: Clearwater STP

GRAPH CALC EC 50 (15 MIN, 15 °C) = 49.55 %SAMPLE mg/L

SAMPLE DATA:

SAMPLE TYPE (EFFLUENT, LEACHATE, ETC.): effluent de Cl2

DATE ASSAYED: 7-12-88 TIME: 10:15

VISUAL COLOR: none CORRECTION REQUIRED: YES (NO)

VISUAL TURBIDITY: none SEPARATION REQUIRED: YES (NO)

INITIAL pH: pH ADJUSTED TO: WITH:

OSMOTICALLY ADJUSTED WITH: MOAS (DRY NaCl) OTHER

PRIMARY DILUTION OF SAMPLE:

OPERATOR: Leslie Williams REAGENT VIAL LOT NO. M-606

REMARKS:

MICROTOX™ 99% TEST

SAMPLE CUVETTE	% SAMPLE	READINGS 5 MIN	READINGS 15 MIN	Γ5	Γ15	NOTES
A1	0	84	54	X	X	
B1		86	65			
C1		73	46			
A2	12.38	73	44	.100	.165	
B2		75	45			
C2		73	44			
A3	24.75	65	35	.209	.449	
B3		67	34			
C3		69	38			
A4	49.5	57	27	.491	.987	
B4		54	26			
C4		52	25			
A5	99	37	15	1.170	2.370	
B5		36	15			
C5		39	16			
EC_{50} (MIN, °C)				56.88	49.55	

REVIEWED BY:
DATE:

Industry/Toxicant Clearwater STP
Address
Contact/District
Effluent Serial Number
NPDES Permit Number

BIOASSAY DATA FORM

Test Number: 4 of 6
Test Type: Static Renewal, Screening Conventional
Other: Cl2

Sample Collection: Date 7-11-88 Time 1055
Test Beginning: Date 7-12-88 Time 1400
Test Ending: Date 7-14-88 Time 1330
Test Organism C. dubia
Age/Life Stage neonate

Conc. or %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	29	10	5	5			8.9	8.9				8.1		8.0			19.5	20.0								
Control	30	10	5	5			8.9	8.9				8.1		8.0												
Control	31	10	5	5			8.9	8.9				8.1		8.0												
Control	32	10	5	5		SW	8.9	8.9				8.1		8.0								215		212		
100%	33	10	1	0		SW 7.5	9.0	9.0				7.5		8.1			19.6	19.7								
100%	34	5	0	0		SW 8.5	9.0	9.0				7.5		8.1												
100%	35	5	0	0		SW 8.5	9.0	9.0				7.5		8.1												
100%	36	5	0	0			8.5	9.0				7.5		8.1								900		942		
Initial of Investigator		JMF	JMF	JMF			JMF		JMF			SHW		JMF			SHW	RBF				SHW		RBF		

Alkalinity/Hardness (mg/l as $CaCO_3$)

Control Water:
100% Sample:
Other:
Measured by:

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0

Control Water:
100% Sample:
Other:

Hour

Control Water:
100% Sample:
Other:
Measured by:

Signatures:
Steve H Wolfe
Kathy Harding
Lisa Faibisch

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks:

Total Residual Chlorine:

Field data: Method:
Lab: Method:
Lab: Method: Reviewed by:

Dechlorinated:
Neutralized by:
Date:

Clearwater STP

7-11-88 1055
7-12-88 1400
7-13-88 1330

Test Number: 5 6
Other: Cl2
Test Organism: D. pulex
Life Stage: neonate

Dilution %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen 48 (mg/l) 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96	Alkalinity/Hardness (mg/l as CaCO3) 0	24	48	72	96
Control	12	10	10	10			8.9	9.0				8.2		8.0			14.7	18.9								
Control	119	10	10	10			8.9	9.0				8.2		8.0								215		220		
100%	65	10	10	8			8.3	9.1				7.3		8.0			20.1	19.1								
100%	18	10	10	6			8.3	9.1				7.3		8.0								940		930		
Initial of Investigator		JMF	JMF	JMF			JMF	RBF				SHW		JMF			SHW	RBF				SHW		RBF		

Control Water:
100% Sample:
Other:
Measured by:

Ammonia unionized/total (mg/l as NH3/N)
Hour 0

Control Water:
100% Sample:
Other:

Hour

Control Water:
100% Sample:
Other:
Measured by:

Signatures:
Steven H Wolfe
KM Winding
Jim Taubold

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks:

Total Residual Chlorine:

Field data: Method:
Lab: Method:
Lab: Method: Reviewed by:

De-chlorinated: Date:
Measurements by:

Industry/Toxicant: Clearwater STP
Address:
Contact/District:
Effluent Serial Number:
NPDES Permit Number:

BIOASSAY DATA FORM

Test Number: 6 of 6
Test Type: Static Renewal, Screening Conventional
Other: Cl_2

Sample Collection: Date 7-11-88 Time 1055
Test Beginning: Date 7-12-88 Time 1400
Test Ending: Date 7-14-88 Time 1330
Test Organism: N. seticus
Age/Life Stage: 17 days

Conc. or %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	7	5	5	5			8.4	8.8	8.7			7.6	7.8	7.9			20.6	19.5	21.2							
Control	67	5	5	5			8.4	8.9	8.7			7.6	7.8	7.9								229		216		
100%	33	5	0	0			7.9	9.0	8.8			7.2	7.6	7.8			21.1	19.5	19.1							
100%	120	5	0	0			7.9	9.0	8.7			7.2	7.6	7.8								959		944		
Initial of Investigator		SHW	SHW	SHW			JMF	SHW	RBF			SHW	SHW	JMF			SHW	SHW	RBF			SHW		RBF		

Alkalinity/Hardness (mg/l as $CaCO_3$)

Control Water:
100% Sample:
Other:
Measured by:

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0

Control Water:
100% Sample:
Other:

Hour

Control Water:
100% Sample:
Other:
Measured by:

Signatures:
Steven H Wolfe
KM Lurding

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours			
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks:

Total Residual Chlorine:

Field data: Method:
Lab: Method:
Lab: Method: Reviewed by:

Dechlorinated:
Measurements by:
Date:

MICROTOX™ Data Reduction Sheet

SOURCE: Clearwater STP

GRAPH CALC EC 50 (15 MIN, 15 °C) = 33.9 (%SAMPLE) mg/l

SAMPLE DATA:

SAMPLE TYPE (EFFLUENT, LEACHATE, ETC.): effluent - Cl_2

DATE ASSAYED: 7-12-88 TIME: 9:45Am

VISUAL COLOR: none CORRECTION REQUIRED: YES (NO)

VISUAL TURBIDITY: none SEPARATION REQUIRED: YES (NO)

INITIAL pH: pH ADJUSTED TO: WITH:

OSMOTICALLY ADJUSTED WITH: MOAS (DRY NaCl) OTHER

PRIMARY DILUTION OF SAMPLE:

OPERATOR: Lesli Williams REAGENT VIAL LOT NO. M-606

REMARKS:

MICROTOX™ 99% TEST

SAMPLE CUVETTE	% SAMPLE	READINGS 5 MIN	READINGS 15 MIN	Γ5	Γ15	NOTES
A1	0	99	67			
B1		88	58			
C1		108	71			
A2	12.38	83	51	.105	.217	
B2		90	54			
C2		94	56			
A3	24.75	82	46	.166	.390	
B3		82	46			
C3		89	49			
A4	49.5	56	24	.799	1.882	
B4		52	21			
C4		56	23			
A5	99	24	7	3.097	7.909	
B5		22	7			
C5		26	8			
EC_{50} (MIN, °C)				54.65	33.92	

REVIEWED BY:
DATE: