


Biological Assessment of

# Marineland of Florida
# Reverse Osmosis Water Treatment Plant

Flagler County

NPDES #FL0043532

Sampled December 1995

June 1996

**Biology Section**
**Division of Administrative and Technical Services**

Comprehensive Quality Assurance Plan No. 870346G

# Department of Environmental Protection
## Results of Fifth Year Inspections

Discharger: Marineland of Florida R/O Plant
County: Flagler
NPDES Number: FL0043532
NPDES Permit Expiration Date: 30 September 1996

### Toxics Sampling Inspection (XSI)

Date Sampled: 4 December 1995

Results: No organic priority pollutants were detected in the effluent sample. No metals were found in the effluent above detection limits.

### Compliance Biomonitoring Inspection (CBI)

Date Sampled: 4 December 1995

Results: The sample of undiluted effluent was acutely toxic to the invertebrate, *Mysidopsis bahia* (with 100% mortality), and to the fish, *Menidia beryllina* (with 40% mortality). This toxicity is in violation of Rules 62-302.500(1)(d), 62-302.530(62), and 62-4.244(3)(a) FAC. The mortality may have been partially caused by a pronounced ionic imbalance.

### Impact Bioassessment Inspection (IBI)

Date Sampled: 4 December 1995

Results: Quantitative measures of benthic macroinvertebrate community health indicated no degradation associated with the discharge. Although a moderate reduction in diversity was seen at test site 2, this could be explained by the abundance of barnacles there. Several pollution sensitive marine taxa, such as the pelecypod, *Dosinia discus*, the cumacean, *Cyclaspis varians*, and the amphipods, *Corophium acherusicum* and *Cerapus* sp., were common to the test and reference sites alike (Farrell 1992). These data suggest that a healthy benthic population was represented at the test sites and the facility's effluent did not appear to have a negative effect on the community. The phytoplankton communities appeared to be typical of oligotrophic conditions, and were not negatively affected by the discharge.

### Water Quality Inspection (WQI)

Date Sampled: 4 December 1995

Results: With the exception of relatively small amounts of ammonia (0.54 mg/L), other bioreactive nutrients were low or undetected in the effluent. Nutrients at all receiving water sites were low or undetected. Algal Growth Potential (AGP) levels were less than the "problem threshold" of 10 mg dry wt/L at all three receiving water stations. AGP ranged from 3.1 mg dry wt/L at the test site 1 to 4.8 mg dry wt/L at the reference site.

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 Marineland of Florida Reverse Osmosis Water Treatment Plant is located in Flagler County, south of the St. Johns County line (see maps in Appendix). Reject water from this facility receives aeration as it is released into a *Spartina* marsh adjacent to the Class III Atlantic Intracoastal Waterway. Although the design flow is 0.100 MGD, the discharge is intermittent, with an actual mean flow during the past year of approximately 0.052 MGD. The facility was not discharging during the two weeks preceding this survey, and was activated roughly 24 hours before our study to enable sampling.

Permit limits are as follows: flow (0.100 MGD), pH (6.5-8.5 SU), chlorides (not increased by more than 10% above background, with normal daily and seasonal fluctuations maintained), dissolved oxygen (minimum of 5.0 mg/L), iron (maximum of 1 mg/L), if receiving waters are fresh, specific conductance may not be greater than 1275 µmhos/cm or 50% above background, and acute toxicity (no more than 20% mortality in full strength effluent). Additionally, the facility is required to monitor hydrogen sulfide.

No prior violations of permit limits have been noted.

*Major characteristics of community structure of control and test sites.*

| | Reference Site | Test Site 1 | Test Site 2 |
|---|---|---|---|
| **Macroinvertebrate Ponar** | | | |
| Number of Taxa | 23 | 23 | 29 |
| Shannon-Weaver Diversity | 3.68 | 3.58 | 2.59 |
| # Polychaete taxa | 4 | 4 | 8 |
| % Polychaeta | 2.8 | 4.8 | 3.6 |
| % Amphipoda | 16.0 | 14.9 | 22.2 |
| % Gastropoda | 8.0 | 8.7 | 0.9 |
| % Decapoda | 0.5 | 1.0 | 0.7 |
| % Isopoda | 3.8 | 2.8 | 0.8 |
| % Thoracica | 0 | 0 | 33.8 |
| % Pelecypoda | 62.0 | 63.7 | 37.2 |
| % Predator/Carnivores | 4.5 | 3.1 | 0.7 |
| % Above-Surface Deposit Feeders | 12.5 | 10.5 | 3.3 |
| % Below Surface Deposit Feeders | 0.5 | 0 | 0.1 |
| % Scavengers | 5.2 | 6.9 | 1.2 |
| % Suspension Feeders | 72.6 | 74.0 | 93.9 |
| % Browser/Grazers | 4.7 | 5.5 | 0.8 |
| **Phytoplankton Algae** | | | |
| Number of Taxa | 18 | 27 | 22 |
| Shannon-Weaver Diversity | 3.88 | 3.91 | 3.96 |
| Chlorophyll a (µg/L) | 5.4 | 6.2 | 0.5 U |
| Algal Density (#/mL) | 50 | 98 | 110 |
| % Blue-green | 6 | 3.1 | 4 |
| % Green | 10 | 4.1 | 10 |
| % Diatoms | 82 | 91.8 | 84.5 |
| **Algal Growth Potential (mg dry wt/l)** | 4.8 | 3.1 | 4.3 |

## 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 approximately 2 miles south of the discharge in the Intracoastal Waterway, adjacent to Washington Oaks State Gardens) and two test sites (also in the Intracoastal Waterway, near the mouth of Pellicer Creek, bracketing the discharge) (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 *Menidia beryllina* and *Mysidopsis bahia* 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, and pesticide 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 both reference and test sites. Invertebrates were collected via three Ponar grabs per site (Ross 1990). Phytoplankton was sampled at reference and test sites via subsurface

grabs. Chlorophyll *a* was also determined for phytoplankton communities (Ross 1990). Algal Growth Potential tests, using *Dunaliella tertiolecta*, followed EPA (1974).

## Explanation of Measurements of Community Health

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

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

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

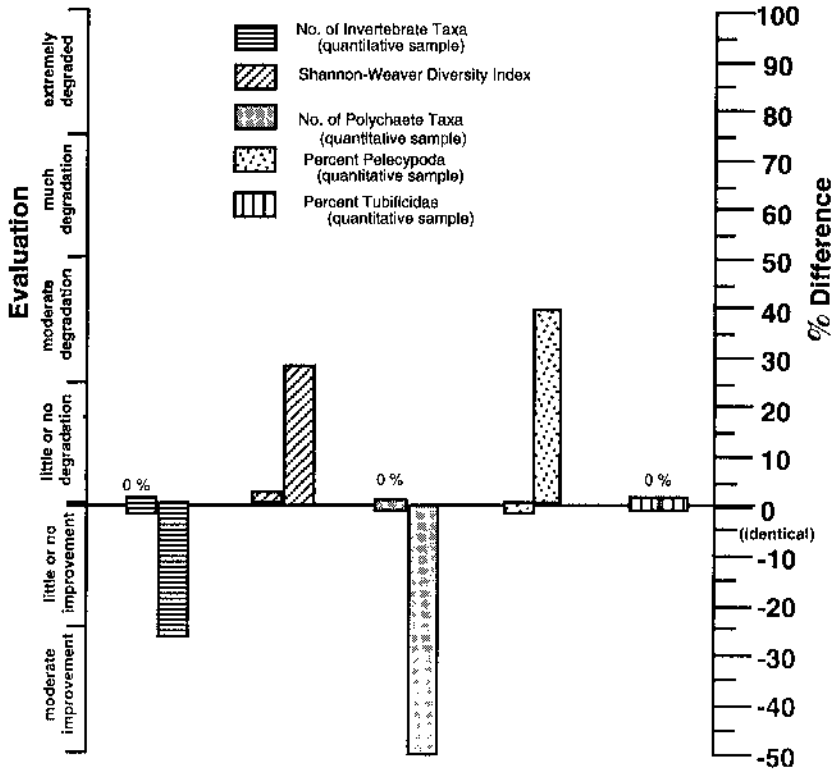
Numbers of pollution sensitive taxa: Some organisms become rare or absent as the intensity or duration of disturbance increases. For example, the Florida Index assigns points to stream-dwelling macroinvertebrates based on their sensitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy. Species sensitivity data from other sources, such as Hulbert (1990), Hudson *et al.* (1990), Lenat (1993), Farrell (1992), Chang *et al.* (1992), and Whitmore (1989), are used as appropriate.

Community structure: Substantial shifts in the proportions of major groups of organisms, compared to reference conditions, may indicate degradation. In marine systems, an increase in the % tubificid oligochaetes, a decrease in the % pelecypods, and a decrease in the number of polychaete taxa are all considered indicators of disturbance (Engel *et al.* 1994).

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

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

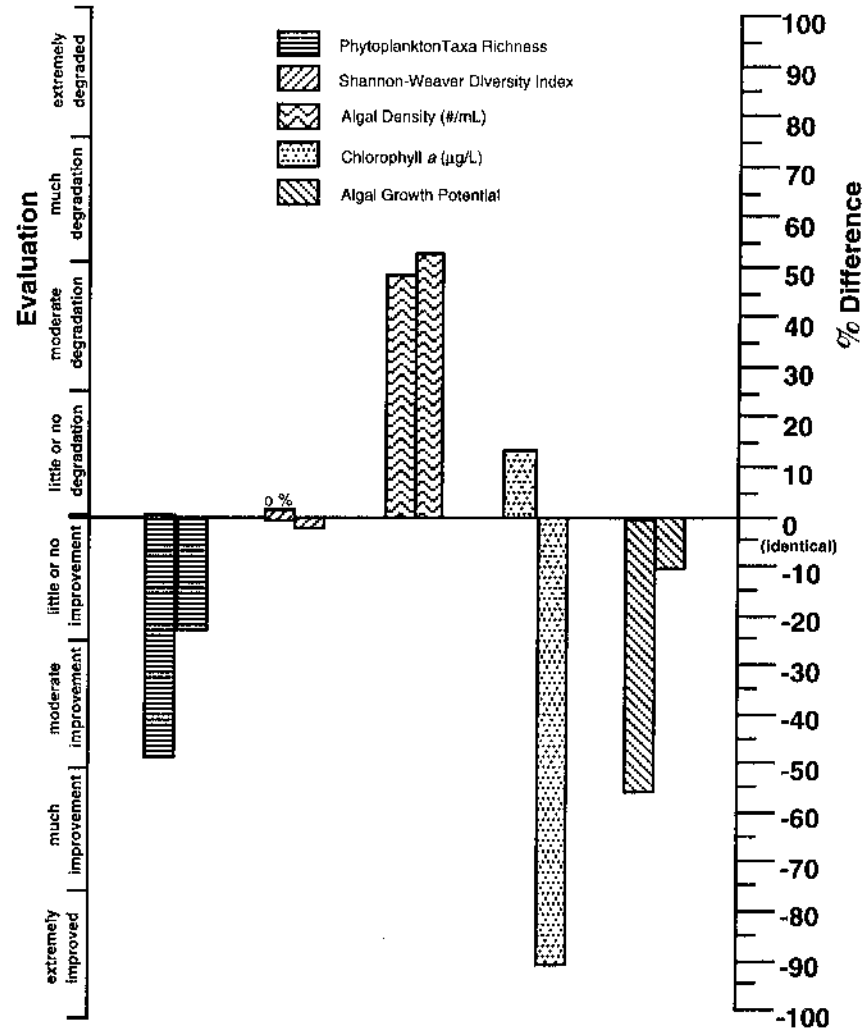
For graphical purposes, the percent differences between the reference and test sites involving the number of taxa, the diversity index, the % filter-feeders, the number of polychaete taxa, and the % pelecypods are measured as the reference site minus test site divided by the reference site. The percent differences between sites involving the % tubificids, algal density, chlorophyll *a*, and algal growth potential are measured as the test site mi-




***Effect of discharge on the benthic macroinvertebrate community.***

nus reference site divided by the reference site.

The following personnel were involved in this investigation: Ruth Bouman, Amy Kalmbacher, and Daniel Hull (DEP Northeast District) and Lyn Burton-Hupp, Marshall Faircloth, Russel Frydenborg, Joy Jackson, Kathleen Lurding, Tina Mikulski, Elizabeth Miller, Joe North, Urania Quintana, Lisa Tamburello, David Whiting, Vicki Whiting, 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.




***Effect of discharge on the algal community.***

## Results and Discussion

The study sites were situated in a channelized portion of the Matanzas River (the Atlantic Intracoastal Waterway), which is a high salinity, coast-parallel lagoon (see maps in Appendix). Habitat quality was similar at all three sites, with 81 points at the reference site and 79 points at both test sites. Surrounding land was predominantly natural (maritime hammock, *Spartina* marsh, and mangrove forest) with some residential and commercial areas. The reference and test sites were similar with respect to most physical/chemical parameters, such as salinity (32.1 to 32.3 ppt), pH (7.8 to 8.0 SU), temperature (19.1 to 19.9 °C), and dissolved oxygen (ranging from 8.1 mg/L to 8.4 mg/L). Secchi depth ranged from 0.8 m to 1.0 m. Substrate at all three sites consisted of a combination of sand, shell, and mud (Appendix).

No organic priority pollutants were detected in the effluent sample. No metals were found in the effluent above detection limits.

The sample of undiluted effluent was acutely toxic to the invertebrate, *Mysidopsis bahia,* (with 100% mortality), and to the fish, *Menidia beryllina* (with 40% mortality). This toxicity is in violation of Rules 62-302.500(1)(d), 62-302.530(62), and 62-4.244(3)(a) FAC. The department has noted that a pronounced ionic imbalance has contributed to acute toxicity at several reverse osmosis facilities that employ membrane technology throughout the state.

With the exception of relatively small amounts of ammonia (0.54 mg/L), other bioreactive nutrients were low or undetected in the effluent. Nutrients at all receiving water sites were low or undetected (see table of Typical Water Quality Values in Appendix).

Algal Growth Potential (AGP) levels were less than the "problem threshold" of 10 mg dry wt/L (Ron Raschke, USEPA, personal communication) at all three receiving water stations. AGP ranged from 3.1 mg dry wt/L at the test site 1 to 4.8 mg dry wt/L at the reference site.

Quantitative measures of benthic macroinvertebrate community health indicated no degradation associated with the discharge. The Figure on p 2. indicates the degree of difference between the invertebrate populations of the reference 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 reference.

Taxa richness at the reference site (which had 23 taxa) was equal to or less than the test sites (with 23 taxa at test site 1 and 29 taxa at test site 2). Shannon-Weaver diversity ranged from 3.7 at the reference site, to 3.6 at test site 1, to 2.6 at test site 2. The moderate reduction in diversity at test site 2 corresponded with high numbers of barnacles at that site (*Balanus* sp. made up 33.8% of the total population). *Balanus* sp. is often abundant where substrate requirements for its success are optimal, and its presence at test site 2 is not cause for concern. Pelecypods, shown by Engle *et al.* (1994) to be pollution sensitive, were the most abundant group at all three sites, ranging from 63.7% at test site 1 to 37.2% at test site 2. The proportionate reduction in pelecypods at test site 2 corresponds to the increase in barnacles there. Amphipods were well represented at all sites, ranging from 14.9% of the population at test site 1 to 22.2% at test site 2. Polychaetes also were present (with 4 taxa represented at the reference site and at test site 1, and 8 polychaete taxa found at test site 2). Tubificid worms, which are often abundant in polluted situations, were absent at all three sites.

Several pollution sensitive marine taxa, such as the pelecypod, *Dosinia discus*, the cumacean, *Cyclaspis varians*, and the amphipods, *Corophium acherusicum* and *Cerapus* sp., were common to the test and reference sites alike (Farrell 1992). These data suggest a healthy benthic population was represented at the test sites and the facility's effluent did not appear to have a negative effect on the community.

The Figure on p. 3 represents changes in the phytoplankton algal community. As was noted with the macroinvertebrates, larger differences (that is, higher percentages) correspond with greater degrees of degradation. A total of 18 phytoplankton taxa were found at the reference site, 27 were recovered from test site 1, while 22 taxa were found at test site 2. Diversity ranged from 3.9 to 4.0 at all three sites. Chlorophyll *a* was low to average throughout the study area (5.4 µg/L at the reference site, 6.2 µg/L at test site 1, and 0.5 µg/L at test site 2). Diatoms dominated all three sites (they were greater than or equal to 82% of the total population), followed by chlorophytes and cyanophytes. The phytoplankton communities appeared to be typical of oligotrophic conditions, and were not negatively affected by the discharge.

## Conclusions

No organic priority pollutants were detected in the effluent sample. No metals were found in the effluent above detection limits.

The sample of undiluted effluent was acutely toxic to the invertebrate, *Mysidopsis bahia* (with 100% mortality), and to the fish, *Menidia beryllina* (with 40% mortality). This toxicity is in violation of Rules 62-302.500(1)(d), 62-302.530(62), and 62-4.244(3)(a) FAC.

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The phytoplankton communities appeared to be typical of oligotrophic conditions, and were not negatively affected by the discharge.

## Literature Cited

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**Chemistry Summary Table for Marineland of Florida R/O Plant**

| | Effluent | Reference Site | Test Site 1 | Test Site 2 |
|---|---|---|---|---|
| **Organic Constituents (ug/L)** | | | | |
| None detected | | | | |
| **Metals (ug/L)** | | | | |
| Aluminum | 100 U | | | |
| Arsenic | 10 U | | | |
| Cadmium | 0.80 U | | | |
| Copper | 3 U | | | |
| Chromium | 10 U | | | |
| Iron | 10 U | | | |
| Lead | 10 U | | | |
| Mercury | 0.10 U | | | |
| Nickel | 4 U | | | |
| Selenium | 30 U | | | |
| Silver | 0.50 U | | | |
| Zinc | 10 U | | | |
| **Nutrients (mg/L)** | | | | |
| Ortho-phosphate | 0.020 U | 0.020 U | 0.020 U | 0.020 U |
| Total phosphorus | 0.015 U | 0.075 | 0.052 | 0.045 A |
| Ammonia | 0.54 A | 0.023 I | 0.020 U | 0.022 I |
| Nitrate+Nitrite | 0.20 U | 0.020 U | 0.020 U | 0.020 U |
| TKN | 0.60 A | 0.33 | 0.35 | 0.35 A |
| **General Phys-Chem Parameters** | | | | |
| Habitat Assessment | | 81 | 79 | 79 |
| D. O. (mg/L) | 6.5 | 8.2 | 8.4 | 8.1 |
| pH (SU) | 6.4 | 8.0 | 8.0 | 7.8 |
| Specific Conductance (µmhos/cm) | 13,000 | 49,000 | 49,300 | 49,300 |
| Salinity (ppt) | 7.5 | 32.1 | 32.3 | 32.3 |
| Temperature (°C) | 24.2 | 19.9 | 19.3 | 19.1 |
| Total Suspended Solids (mg/L) | < 1 | 37 | 18 | 14 |
| Biological Oxygen Demand, 5 day (mg/L) | < 2 | < 2 | < 2 | < 2 |
| Algal Growth Potential (mg dry wt/L) | 17.8 | 4.8 | 3.1 | 4.3 |
| **Toxicity** | | | | |
| Bioassay Fish | 40 % Mortality | | | |
| Bioassay Invertebrate | 100 % Mortality | | | |
| **Microbiological Communities (org/100 mL)** | | | | |
| Fecal Coliform | 1 KQ | 9 AQ | 8 KQ | 10 Q |
| Total Coliform | 1 KQ | 35 AQ | 20 Q | 30 Q |

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

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

K- Actual value is known to be less than value given

Q- Sample held beyond normal holding time

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

# Typical Values for Selected Parameters in Florida Waters

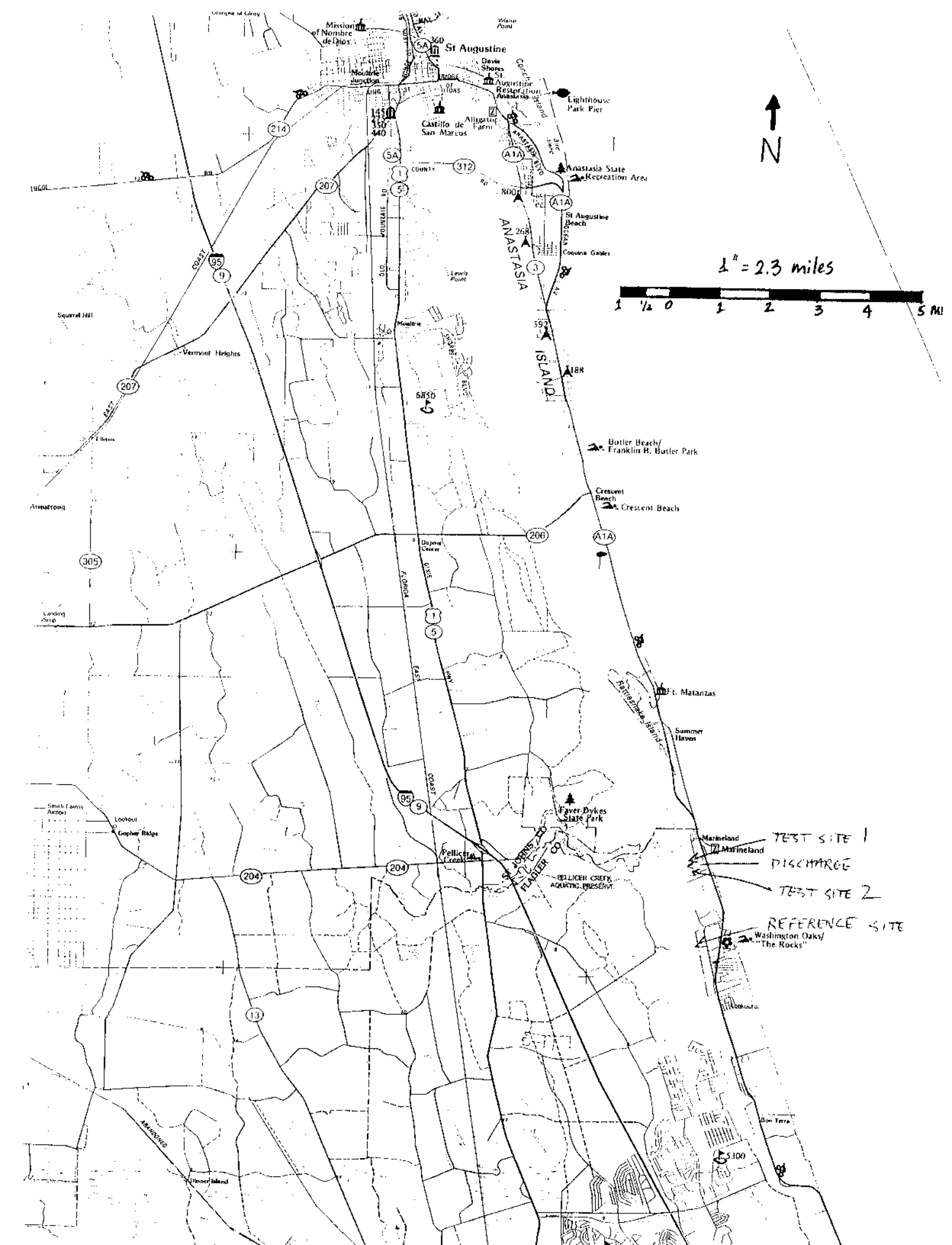
Adapted from Joe Hand, FDER, personal communication, 1991
(data was collected between 1980 and 1989)

## 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

| | Refer-ence Site | Test Site 1 | Test Site 2 |
|---|---|---|---|
| **Macroinvertebrate Ponar** | | | |
| Number of Taxa | 23 | 23 | 29 |
| Shannon-Weaver Diversity | 3.68 | 3.58 | 2.59 |
| # Polychaete taxa | 4 | 4 | 8 |
| % Polychaeta | 2.8 | 4.8 | 3.6 |
| % Amphipoda | 16.0 | 14.9 | 22.2 |
| % Gastropoda | 8.0 | 8.7 | 0.9 |
| % Decapoda | 0.5 | 1.0 | 0.7 |
| % Isopoda | 3.8 | 2.8 | 0.8 |
| % Thoracica | 0 | 0 | 33.8 |
| % Pelecypoda | 62.0 | 63.7 | 37.2 |
| % Predator/Carnivores | 4.5 | 3.1 | 0.7 |
| % Above-Surface Deposit Feeders | 12.5 | 10.5 | 3.3 |
| % Below Surface Deposit Feeders | 0.5 | 0 | 0.1 |
| % Scavengers | 5.2 | 6.9 | 1.2 |
| % Suspension Feeders | 72.6 | 74.0 | 93.9 |
| % Browser/Grazers | 4.7 | 5.5 | 0.8 |
| **Phytoplankton Algae** | | | |
| Number of Taxa | 18 | 27 | 22 |
| Shannon-Weaver Diversity | 3.88 | 3.91 | 3.96 |
| Chlorophyll a (µg/L) | 5.4 | 6.2 | 0.5 U |
| Algal Density (#/mL) | 50 | 98 | 110 |
| % Blue-green | 6 | 3.1 | 4 |
| % Green | 10 | 4.1 | 10 |
| % Diatoms | 82 | 91.8 | 84.5 |
| **Algal Growth Potential (mg dry wt/l)** | 4.8 | 3.1 | 4.3 |


N
1" = 2.3 miles
1 ½ 0 1 2 3 4 5 MI
St Augustine
Mission of Nombre de Dios
Castillo de San Marcos
Lighthouse Park Pier
Anastasia State Recreation Area
St Augustine Beach
ANASTASIA ISLAND
Butler Beach/ Franklin B. Butler Park
Crescent Beach
Ft. Matanzas
Summer Haven
Faver-Dykes State Park
Marineland
Washington Oaks/ "The Rocks"
PELLICER CREEK AQUATIC PRESERVE
TEST SITE 1
DISCHARGE
TEST SITE 2
REFERENCE SITE


NORTHEAST DISTRICT
RECEIVED
MAY 13 1991
DER-JACKSONVILLE
Light
INTRACOASTAL WATERWAY
RIVER
T 9 S
T 10 S
Marineland
ST JOHNS CO
FLAGLER CO
CREEK
PELLICER
Hammock Point
Bridge
MATANZAS
Sand
Rock
37
38
39
42
13
8

***State of Florida***
***Department of Environmental Protection***
***Facility Summary***

| | |
|---|---|
| **Facility Name:** Marineland of Florida | **Prepared By:** Daniel Hull **Date:** 12/11/95 |

| | | |
|---|---|---|
| **Location:** (See Attached Map) | **County:** 18 - Flagler | **District:** Northeast |

| | | |
|---|---|---|
| **Federal Permit No.:** FL0043532<br>**Expiration Date:** 9/30/96 | **State GMS #:** 3118P04353<br>**State Expiration Date:** 6/23/97 | **Facility Type:** Industrial |

**Function of Facility:**
The facility operates a reverse osmosis water treatment system.

**Description of treatment process:**

| | |
|---|---|
| **Receiving Waters:** Atlantic Intracoastal Waterway | Classification: Class III |
| Design Flow: 0.100 MGD | Actual Mean Flow: past year ~ 0.052 |

**Discharge is:** Continuous Intermittent Seasonal Rainfall Dependent Other

**Facility Mixing Zone Details:**
No Mixing Zone.

**List effluent limits:**

| PARAMETER | LIMIT (unit) | Describe special permit conditions and permit modifications |
|---|---|---|
| Flow | 0.100 (MGD) | The adjacent parameters are based from FAC 62-302, Surface Water Quality Standards. |
| D.O. | Min 5.0 (mg/l) | |
| Specific Cond. | FAC 62-302 | |
| Chlorides | FAC 62-302.310(3) | |
| pH | 6.0 - 8.5 | |
| Iron | 1.0 (mg/l) | |
| Hydrogen Sulfide | | |
| Acute Toxicity | No >20% die | |

**Description of permitted outfall:**
The permitted outfall is a standpipe that allows for splashing prior to mixing in the Atlantic Intracoastal Waterway.

**List permit violations (MOR data) and plant upsets that occurred at the plant within the past year:**

A review of MOR submitted data indicate no parameter limit violations, this included the parameters which are dependent on background characteristics.

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

No previous impact bioassessments and/or previous enforcement cases were available in the current file at the Northeast District.

**Discuss MOR trends to prior data; is the trend improving or declining:** The trend appears to remain consistent.

**Additional Information:**
No further information to list.

# STATE OF FLORIDA
## DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 5)

| SUBMITTING AGENCY CODE: 8031 / SUBMITTING AGENCY NAME: FDEP NED | STORET STATION NUMBER: 27010144 | DATE (M/D/Y): 12-4-95 | TIME: 1310 | RECEIVING BODY OF WATER: ICW Flagler Cty |
|---|---|---|---|---|

| REMARKS: | LOCATION: Oceanland R/D Pkwy ICW | FIELD ID/NAME: Pottsworm Cm 100+102 Matanzas Sub |
|---|---|---|

RIPARIAN ZONE/INSTREAM FEATURES

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

| Forest/Natural | Silviculture | Field/Pasture | Agricultural | Residential | Commercial | Industrial | Other (Specify) |
|---|---|---|---|---|---|---|---|
| 90 | | | | 10 | | | |

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

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

Width of riparian vegetation (m) on least buffered side: 718 m

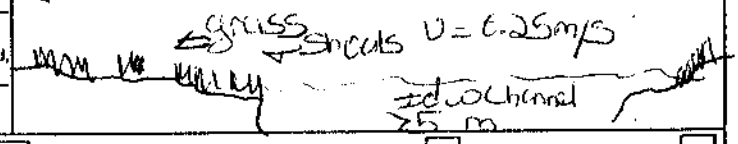
***List & map dominant vegetation on back***

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

Artificially Impounded ☐ yes

High Water Mark (m above ~~bed~~ surface): 1 m

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect (draw cross-section & provide at least 3 velocity & depth values)




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

SEDIMENT/SUBSTRATE

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

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

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

| Substrate Types | % coverage | # times sampled | method | Substrate Types | % coverage | # times sampled | method |
|---|---|---|---|---|---|---|---|
| Woody Debris (Snags) | | | | Sand | 30 | 3x3 | Dive |
| Leaf Packs or Mats | | | | Mud/Muck/Silt | 40 | 3x3 | Dive |
| Aquatic Vegetation | | | | Other: | | | |
| Rock or Shell Rubble | 30 | 3x3 | grab | Other: | | | |
| Shorezone (Roots/Veg.) | | | | *Draw aerial view sketch of habitats found in 100 m section* | | | |

| WATER QUALITY | Depth (m): | Temp. (°C): | pH (SU): | D.O. (mg/l): | Cond. (µmho/cm) or Salinity (ppt): | | | Secchi (m): |
|---|---|---|---|---|---|---|---|---|
| Top | 0.3 | 19.91 | 8.02 | 8.18 | 49,000 | | | 0.8 |
| Mid-depth | | | | | | | | |
| Bottom | | | | | | | | |

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

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

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

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

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

Weather Conditions/Notes: Mild, Sunny
light breeze
This sample taken off of Washington Oaks State Park.

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

| SAMPLING TEAM: | SIGNATURE: | DATE: |
|---|---|---|
| Bauman / Palmbach | Ruth Bauman | 12-4-95 |

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

| SUBMITTING AGENCY CODE: 203 SUBMITTING AGENCY NAME: FDEP/NED | STORET STATION NUMBER: 27010144 | DATE (M/D/Y): 12-4-95 | RECEIVING BODY OF WATER: I.C.W. Flagler Cty. |
|---|---|---|---|

| REMARKS: | LOCATION: | FIELD ID/NAME: |
|---|---|---|
| | Marineland R/C Plant IC.W. | Reference Site |

| Habitat Parameter<br>score | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| **Littoral Alterations**<br>10 | None—Unaltered shoreline.<br>**9-10 points** | Mostly natural shoreline, but with occasional riprap.<br>**6-8 points** | Shoreline consisting mostly of riprap and vertical seawalls.<br>**3-5 points** | Shoreline consisting almost entirely of vertical seawalls.<br>**0-2 points** |
| **Community Types Observed**<br>37 | At least four communities observed from the following list: mangrove swamp, marsh, oyster bar, grass bed, reef, saltern, natural beach, or tidal creek.<br>**38-50 points** | Two or three communities observed from those listed.<br>**26-37 points** | One community observed from those listed.<br>**13-25 points** | No communities observed from those listed.<br>**0-12 points** |
| **Tidal Fluctuation**<br>5 | >0.75 m.<br>**4-5 points** | 0.5 - 0.75 m.<br>**3 points** | 0.25 - 0.5 m.<br>**2 points** | <0.25 m.<br>**0-1 point** |
| **Freshwater Discharges/ Alterations**<br>9 | Only natural runoff..<br>**9-10 points** | Mostly natural runoff, but with a few, small stormwater sources.<br>**6-8 points** | Considerable stormwater discharge from local roads, parking lots, etc.<br>**3-5 points** | Extensive manmade discharges, especially from canals draining large tracts of land.<br>**0-2 points** |
| **Flow and Wave Action**<br>9 | Light to moderate wave action present except under the harshest weather conditions. Flow unrestricted by manmade structures.<br>**9-10 points** | — | — | Heavy wave action sometimes present even during average weather conditions, or flow restricted by manmade structures so that velocities are very high.<br>**0-2 points** |
| **Sediment Type**<br>11 | Combination of sand, gravel, and shell.<br>**12-15 points** | Primarily sand, with small areas of mud.<br>**8-11 points** | Mixture of sand and mud, or well-aerated mud only.<br>**4-7 points** | Anaerobic mud.<br>**0-3 points** |

**TOTAL SCORE** 81

COMMENTS: Sample taken off Washington Oaks

| ANALYSIS DATE: | ANALYST: | SIGNATURE: |
|---|---|---|
| 12-4-95 | Ruth Bauma | Ruth Bauma |

# STATE OF FLORIDA
## DEPARTMENT OF ENVIRONMENTAL PROTECTION

## PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 5)

| SUBMITTING AGENCY CODE: 6031 / SUBMITTING AGENCY NAME: FDEP NED | STORET STATION NUMBER: 27010142 | DATE (M/D/Y): 12-4-95 | TIME: 1210 | RECEIVING BODY OF WATER: Ico Flagler Cty. |
|---|---|---|---|---|
| REMARKS: | LOCATION: Meredith RV Plant ICW North of POD | FIELD ID/NAME: SITE #1 | | |

### RIPARIAN ZONE/INSTREAM FEATURES

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

| Forest/Natural | Silviculture | Field/Pasture | Agricultural | Residential | Commercial | Industrial | Other (Specify) |
|---|---|---|---|---|---|---|---|
| 75 | | | | | 25 | | |

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

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

Width of riparian vegetation (m) on least buffered side: >100 m

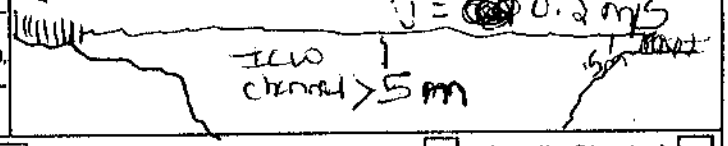
***List & map dominant vegetation on back***

Artificially Channelized ☐ no ☐ ☑ ☐ Artificially Impounded ☐ yes

recent, severe · some recovery · mostly recovered, more sinuous

High Water Mark (m above surface): [illegible] m

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect (draw cross-section & provide at least 3 velocity & depth values)




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

### SEDIMENT/SUBSTRATE

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

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

Sediment Deposition: Sludge: ☐ Sand smothering: none / slight / moderate / severe Silt smothering: none / slight / moderate / severe Other: Shell Slight

| Substrate Types | % coverage | # times sampled | method | Substrate Types | % coverage | # times sampled | method |
|---|---|---|---|---|---|---|---|
| Woody Debris (Snags) | | | | Sand | 40 | 3x3 | poss |
| Leaf Packs or Mats | | | | Mud/Muck/Silt | 40 | 3x3 | poss |
| Aquatic Vegetation | | | | Other: | | | |
| Rock or Shell Rubble | 20 | 3x3 | poss | Other: | | | |
| Shorezone (Roots/Veg.) | | | | *Draw aerial view sketch of habitats found in 100 m section* | | | |

| WATER QUALITY | Depth (m): | Temp. (°C): | pH (SU): | D.O. (mg/l): | Cond. (µmho/cm) or Salinity (ppt): | | | Secchi (m): |
|---|---|---|---|---|---|---|---|---|
| Top | 0.3 | 19.32 | 8.03 | 8.41 | 49.300 | | | 0.8L |
| Mid-depth | | | | | | | | |
| Bottom | | | | | | | | |

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

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

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

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

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

Weather Conditions/Notes: mild (mid 70s) Sunny, light breeze

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

| SAMPLING TEAM: | SIGNATURE: | DATE: |
|---|---|---|
| Baumann / Holmbacher | Ruth Baumann | 12-4-95 |

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

| SUBMITTING AGENCY CODE: 8C31 / SUBMITTING AGENCY NAME: DEP NED | STORET STATION NUMBER: 2701042 | DATE (M/D/Y): 12-4-95 | RECEIVING BODY OF WATER: ICW Flagler Cty |
|---|---|---|---|

| REMARKS: | LOCATION: | FIELD ID/NAME: |
|---|---|---|
| | Intracoastal W/O Platted | Site #1 North of POD |

| Habitat Parameter / score | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| **Littoral Alterations** 7 | None—Unaltered shoreline. **9-10 points** | Mostly natural shoreline, but with occasional riprap. **6-8 points** | Shoreline consisting mostly of riprap and vertical seawalls. **3-5 points** | Shoreline consisting almost entirely of vertical seawalls. **0-2 points** |
| **Community Types Observed** 40 | At least four communities observed from the following list: mangrove swamp, marsh, oyster bar, grass bed, reef, saltern, natural beach, or tidal creek. **38-50 points** | Two or three communities observed from those listed. **26-37 points** | One community observed from those listed. **13-25 points** | No communities observed from those listed. **0-12 points** |
| **Tidal Fluctuation** 5 | >0.75 m. **4-5 points** | 0.5 - 0.75 m. **3 points** | 0.25 - 0.5 m. **2 points** | <0.25 m. **0-1 point** |
| **Freshwater Discharges/ Alterations** 7 | Only natural runoff.. **9-10 points** | Mostly natural runoff, but with a few, small stormwater sources. **6-8 points** | Considerable stormwater discharge from local roads, parking lots, etc. **3-5 points** | Extensive manmade discharges, especially from canals draining large tracts of land. **0-2 points** |
| **Flow and Wave Action** 9 | Light to moderate wave action present except under the harshest weather conditions. Flow unrestricted by manmade structures. **9-10 points** | — | — | Heavy wave action sometimes present even during average weather conditions, or flow restricted by manmade structures so that velocities are very high. **0-2 points** |
| **Sediment Type** 11 | Combination of sand, gravel, and shell. **12-15 points** | Primarily sand, with small areas of mud. **8-11 points** | Mixture of sand and mud, or well-aerated mud only. **4-7 points** | Anaerobic mud. **0-3 points** |

**TOTAL SCORE** 79

COMMENTS:

| ANALYSIS DATE: | ANALYST: | SIGNATURE: |
|---|---|---|
| 12-4-95 | Ruth Bauman | Ruth Bauman |

# STATE OF FLORIDA
## DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (Version 5)

| SUBMITTING AGENCY CODE: 6031 / SUBMITTING AGENCY NAME: FDEP NED | STORET STATION NUMBER: 27010143 | DATE (M/D/Y): 12-4-95 | TIME: 1110 | RECEIVING BODY OF WATER: ICW Flagler Cty |
|---|---|---|---|---|

| REMARKS: | LOCATION: Matanzas R/D plant ICW | FIELD ID/NAME: Site South #2 POP |
|---|---|---|

RIPARIAN ZONE/INSTREAM FEATURES

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

| Forest/Natural | Silviculture | Field/Pasture | Agricultural | Residential | Commercial | Industrial | Other (Specify) |
|---|---|---|---|---|---|---|---|
| 75 | | | | | 25 | | |

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

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

Width of riparian vegetation (m) on least buffered side: 718m

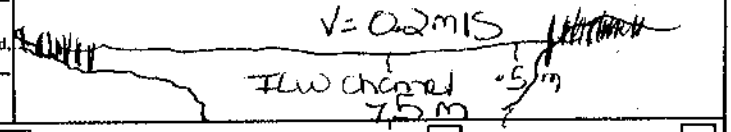
***List & map dominant vegetation on back***

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

Artificially Impounded ☐ yes

High Water Mark (m above surface): ____

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect (draw cross-section & provide at least 3 velocity & depth values)




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

SEDIMENT/SUBSTRATE

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

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

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

| Substrate Types | % coverage | # times sampled | method | Substrate Types | % coverage | # times sampled | method |
|---|---|---|---|---|---|---|---|
| Woody Debris (Snags) | | | | Sand | 40 | 3x3 | Ponar |
| Leaf Packs or Mats | | | | Mud/Muck/Silt | 40 | 3x3 | Ponar |
| Aquatic Vegetation | | | | Other: | | | |
| Rock or Shell Rubble | 20 | 3x3 | Ponar | Other: | | | |
| Shorezone (Roots/Veg.) | | | | *Draw aerial view sketch of habitats found in 100 m section* | | | |

| WATER QUALITY | Depth (m): | Temp. (°C): | pH (SU): | D.O. (mg/l): | Cond. (µmho/cm) or Salinity (ppt): | | | Secchi (m): |
|---|---|---|---|---|---|---|---|---|
| Top | 0.3 | 14.05 | 7.77 | 8.10 | 49,300 | | | 1.0L |
| Mid-depth | | | | | | | | |
| Bottom | | | | | | | | |

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

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

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

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

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

Weather Conditions/Notes: mild, sunny light breeze

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

| SAMPLING TEAM: | SIGNATURE: | DATE: |
|---|---|---|
| Bauman / Balmbacher | Ruth Bauman | 12-4-95 |

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

| SUBMITTING AGENCY CODE: 0031 SUBMITTING AGENCY NAME: FDEP NED | STORET STATION NUMBER: 27010143 | DATE (M/D/Y): 12-4-95 | RECEIVING BODY OF WATER: ICW Flagler Cty |
|---|---|---|---|

| REMARKS: | LOCATION: Marineland R/C Plant ICW | FIELD ID/NAME: Test Site #2 South of PAD |
|---|---|---|

| Habitat Parameter (score) | Excellent | Good | Fair | Poor |
|---|---|---|---|---|
| **Littoral Alterations** 7 | None—Unaltered shoreline. **9-10 points** | Mostly natural shoreline, but with occasional riprap. **6-8 points** | Shoreline consisting mostly of riprap and vertical seawalls. **3-5 points** | Shoreline consisting almost entirely of vertical seawalls. **0-2 points** |
| **Community Types Observed** 40 | At least four communities observed from the following list: mangrove swamp, marsh, oyster bar, grass bed, reef, saltern, natural beach, or tidal creek. **38-50 points** | Two or three communities observed from those listed. **26-37 points** | One community observed from those listed. **13-25 points** | No communities observed from those listed. **0-12 points** |
| **Tidal Fluctuation** 5 | >0.75 m. **4-5 points** | 0.5 - 0.75 m. **3 points** | 0.25 - 0.5 m. **2 points** | <0.25 m. **0-1 point** |
| **Freshwater Discharges/ Alterations** 7 | Only natural runoff.. **9-10 points** | Mostly natural runoff, but with a few, small stormwater sources. **6-8 points** | Considerable stormwater discharge from local roads, parking lots, etc. **3-5 points** | Extensive manmade discharges, especially from canals draining large tracts of land. **0-2 points** |
| **Flow and Wave Action** 9 | Light to moderate wave action present except under the harshest weather conditions. Flow unrestricted by manmade structures. **9-10 points** | — | — | Heavy wave action sometimes present even during average weather conditions, o flow restricted by manmade structures so that velocities are very high. **0-2 points** |
| **Sediment Type** 11 | Combination of sand, gravel, and shell. **12-15 points** | Primarily sand, with small areas of mud. **8-11 points** | Mixture of sand and mud, or well-aerated mud only. **4-7 points** | Anaerobic mud. **0-3 points** |

**TOTAL SCORE** 79

COMMENTS:

| ANALYSIS DATE: | ANALYST: | SIGNATURE: |
|---|---|---|
| 12-04-95 | Ruth Bamco | Ruth Bamco |

# FDEP Biology Section — Acute Bioassay Bench Sheet

**Sample Source:** Manneland R/O
**County:**
**Contact / District:** Ruth Bowman / Northeast
**NPDES Permit #:** FL00 43532
**LIMS Sample #:** 124011 (Sample log 12/15/95) **LIMS Job #:** 95-DEC-05-25

**Sample Collection:** Date 12-4-95 Time 1440
**Test Beginning:** Date 12-5-95 Time 1300
**Test Ending:** Date 12-6-95 Time 1300
**Organism Batch #:** 336 **Diluent Batch #:** NSW
**Organism Age:** 3 days old
***Test Organism:*** Mysidopsis bahia

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

**Test Number:** 1 of 2

**Remarks:**
Test Terminated @ 24 hrs
100% mortality in 100% sample.

**Instrument Calibrations:**

| | pH | Temperature °C | D.O. mg/L | Conductivity µmhos/cm |
|---|---|---|---|---|
| meter # | 7851 | 90H018262 | 90H018262 | G9005749 |
| 0 hr | 7.0 @ 7.0<br>9.0 @ 9.0 | 23.5 @ 23.6 | 8.4 @ 23.5 °C | 140.8 @ 141.3<br>1394 @ 1412 @ 23.5 °C |
| 24 hr | 7.0 @ 7.0<br>9.0 @ 9.0 | 23.1 @ 23.2 | 8.3 @ 24.4 °C | 139.1 @ 141.3<br>1389 @ 1412 @ 23.5 °C |
| 48 hr | 7.0 @ 7.0<br>9.0 @ 9.0 | 22.8 @ 22.9 | 8.3 @ 24.5 °C | 9700 @ 9180<br>140.8 @ 141.3<br>1395 @ 1412 @ 23.4 °C |

| Conc. | Chamber # | Number Live 0 hr | Number Live 24 h | Number Live 48 h | pH 0 hr | pH 24 h | pH 48 h | Temperature (°C) 0 hr | Temperature (°C) 24 h | Temperature (°C) 48 h | D.O. (mg/L) 0 hr | D.O. (mg/L) 24 h | D.O. (mg/L) 48 h | UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm) 0 hr | 24 hr | 48 h |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CTL A | 30 | 5 | 5 | | 8.3 | 7.8 | | 23.7 | 23.3 | | 7.1 | 6.9 | | 12.8 | 12.8 | |
| CTL B | 209 | 5 | 5 | | 8.3 | 7.7 | | 23.7 | 23.3 | | 7.2 | 6.9 | | 12.8 | 12.8 | |
| CTL C | 317 | 5 | 4 10 | | 8.3 | 7.7 | | 23.7 | 23.2 | | 7.2 | 6.9 | | 12.8 | 12.8 | |
| CTL D | 414 | 5 | 5 | | 8.3 | 7.7 | | 23.7 | 23.3 | | 7.2 | 7.0 | | 12.8 | 12.8 | |
| 100% A | 307 | 5 | 0 SD | | 6.7 | 7.5 | | 24.6 | 23.3 | | 7.6 | 7.0 | | 13.0 | 12.7 | |
| 100% B | 304 | 5 | 0 SD | | 6.7 | 7.5 | | 24.6 | 23.2 | | 7.6 | 7.0 | | 13.0 | 12.7 | |
| 100% C | 45 | 5 | 0 SD | | 6.7 | 7.5 | | 24.7 | 23.2 | | 7.7 | 7.0 | | 13.1 | 12.7 | |
| 100% D | 476 | 5 | 0 SD | | 6.7 | 7.5 | | 24.8 | 23.3 | | 7.6 | 7.1 | | 13.1 | 12.8 | |
| Measured/Loaded by: | | TM | TM | | TM | TM | | TM | JM | | TM | TM | | TM | TM | |
| Recorded by: | | TM | TM | | JN | JN | | JN | JN | | JN | JN | | JN | JN | |

Investigators' Signatures
Jayne Martin
Tina M. Kulaski
Marshall Landreth
(Damien Burke for Ruth)

**Water Quality Parameters**

| | Salt Water at 7.5‰ Well Water | 20% Min Water | Sample | Method | Measured by |
|---|---|---|---|---|---|
| Field Total Residual Cl2 (mg/L): | | | — | — | |
| Lab Total Residual Cl2 (mg/L): | <0.03 | — | <0.03 | DR-100 | TM |
| Alkalinity (mg/L as $CaCO_3$): | 30 | — | 80 | Hach | TM |
| Hardness (mg/L as $CaCO_3$): | — | — | — | Hach | TM |
| Total ammonia (mg/L as N): | <0.017 | — | <0.017 | Orion | JN |

Ammonia Meter #: 02126 Ammonia Meter Slope: -59.4 Ammonia Blanks: <0.017 Control Salinity: 75 ppt Sample Salinity: 7.51 ppt

# FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Marine Ind R/O
County:
Contact / District: Ruth Bowman / Northeast
NPDES Permit #: FL00 43532
LIMS Sample #: 124011 LIMS Job #: 95-DEC-05-25
sample log 12/05/95

Sample Collection: Date 12-4-95 Time 1440
Test Beginning: Date 12-5-95 Time 1300
Test Ending: Date 12-7-95 Time 1300
Organism Batch #: 1010 Diluent Batch #: NSW
Organism Age: 11 days old
*Test Organism:* Mysidia bevylinia

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

Test Number: 2 of 2

Remarks:

| Instrument Calibrations: | pH | Temperature °C | D.O. mg/L | Conductivity µmhos/cm |
|---|---|---|---|---|
| meter # | 7851 | 90H018262 | 90H018262 | G9005749 |
| 0 hr | 7.0 @ 7.0<br>9.0 @ 9.0 | 23.5 @ 23.6 | 8.4 @ 23.5 °C | 140.8 @ 141.3<br>1394 @ 1412 @ 23.5 °C |
| 24 hr | 7.0 @ 7.0<br>9.0 @ 9.0 | 23.1 @ 23.2 | 8.3 @ 24.4 °C | 139.1 @ 141.3<br>1389 @ 1412 @ 23.5 °C |
| 48 hr | 7.0 @ 7.0<br>9.0 @ 9.0 | 22.8 @ 22.9 | 8.3 @ 24.5 °C | 9700 @ 10180<br>140.8 @ 141.3<br>1395 @ 1412 @ 23.4 °C |

| Conc. | Chamber # | Number Live 0 hr | Number Live 24 h | Number Live 48 h | pH 0 hr | pH 24 h | pH 48 h | Temperature (°C) 0 hr | Temperature (°C) 24 h | Temperature (°C) 48 h | D.O. (mg/L) 0 hr | D.O. (mg/L) 24 h | D.O. (mg/L) 48 h | UNCORRECTED Cond. (mmhos/cm) / Cond. (µmhos/cm) 0 hr | UNCORRECTED Cond. (mmhos/cm) / Cond. (µmhos/cm) 24 h | UNCORRECTED Cond. (mmhos/cm) / Cond. (µmhos/cm) 48 h | pH * |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CTL A | 24 | 5 | 5 | 5 | 8.3 | 7.7 | 7.7 | 23.8 | 23.3 | 23.3 | 7.2 | 7.4 | 7.4 | 12.8 | 12.7 | 12.9 | 7.8 |
| CTL B | 10 | 5 | 5 | 5 | 8.3 | 7.7 | 7.7 | 23.7 | 23.2 | 23.3 | 7.2 | 7.4 | 7.5 | 12.8 | 12.7 | 12.9 | 7.8 |
| CTL C | 148 | 5 | 5 | 5 | 8.3 | 7.7 | 7.8 | 23.7 | 23.3 | 23.3 | 7.2 | 7.5 | 7.6 | 12.8 | 12.8 | 12.9 | 7.8 |
| CTL D | 1506 | 5 | 5 | 5 | 8.3 | 7.7 | [illegible] | 23.7 | 23.3 | 23.3 | 7.2 | 7.5 | 7.7 | 12.8 | 12.8 | 12.9 | 7.8 |
| 100% A | 75 | 5 | 3 (2D) | 3 | 6.7 | 7.5 | 8.0 | 24.9 | 23.4 | 23.4 | 7.5 | 7.6 | 7.7 | 13.1 | 12.8 | 12.9 | 7.6 |
| 100% B | 87 | 5 | 3 (2D) | 3 | 6.7 | 7.5 | 8.0 | 24.9 | 23.4 | 23.3 | 7.5 | 7.5 | 7.7 | 13.1 | 12.8 | 12.8 | 7.6 |
| 100% C | 132 | 5 | 3 (2D) | 3 | 6.7 | 7.5 | 8.0 | 24.9 | 23.4 | 23.3 | 7.5 | 7.6 | 7.7 | 13.1 | 12.8 | 12.9 | 7.6 |
| 100% D | 30A | 5 | 3 (2D) | 3 | 6.8 | 7.5 | 8.0 | 24.9 | 23.5 | 23.3 | 7.5 | 7.6 | 7.8 | 13.1 | 12.9 | 12.9 | 7.6 |
| Measured/Loaded by: | | TM | TM | [illegible] | JN | TM | JN | TM | TM | JN | TM | TM | JN | TM | TM | JN | |
| Recorded by: | | TM | TM | [illegible] | JN | JN | DB | JN | JN | DB | JN | JN | DB | JN | JN | DB | |

* JN 12-6-95 wrong organism

ADS wrong number - DB 1/8

Investigators' Signatures

Joseph Morth
Tina McKendry
Marshall Faircloth
(Damien Burke sitter)

reviewer

form updated 5/05/95

**Water Quality Parameters**

| | Salt Water at 7.5‰ / Well Water | 20% Min Water | Sample | Method | Measured by |
|---|---|---|---|---|---|
| Field Total Residual Cl2 (mg/L): | | | — | — | — |
| Lab Total Residual Cl2 (mg/L): | <0.03 | — | <0.03 | DR-102 | TM |
| Alkalinity (mg/L as $CaCO_3$): | 30 | — | 80 | Hach | TM |
| Hardness (mg/L as $CaCO_3$): | — | — | — | Hach | TM |
| Total ammonia (mg/L as N): | <0.017 | — | <0.017 | Orion | JN |

Ammonia Meter #98136 Ammonia Meter Slope: -59.4 Ammonia Blank: <0.017 Control Salinity: 7.5 ppt Sample Salinity: 7.51 ppt

Phytoplankton taxa list and densities (#/mL) for Marineland of Florida R/O Plant, collected via subsurface grabs on December 5, 1995.

| | Reference Site | Test Site 1 | Test Site 2 |
|---|---|---|---|
| **Cyanophyceae** | | | |
| *Aphanocapsa* sp. | - | 1 | - |
| *Chroococcus* sp. | 2 | - | - |
| *Gomphosphaeria* sp. | - | 1 | - |
| *Johannesbaptistia* sp. | - | 1 | - |
| *Oscillatoria* sp. | 1 | - | - |
| **Bacillariophyceae** | | | |
| *Achnanthes* sp. | - | 1 | 4 |
| *Amphora* sp. | 2 | 1 | - |
| *Asterionella* sp. | 2 | 2 | 2 |
| *Biddulphia* sp. | - | 2 | - |
| *Chaetoceros* sp. | 6 | 6 | 1 |
| *Coscinodiscus* sp. | 5 | 5 | 8 |
| *Cyclotella* sp. | 3 | 1 | 4 |
| *Detonula* sp. | - | 1 | - |
| *Diploneis* sp. | - | 1 | - |
| *Ditylum* sp. | 1 | - | - |
| *Entomoneis* sp. | 1 | 1 | - |
| *Gyrosigma* sp. | - | 1 | - |
| *Hemiaulus* sp. | - | 3 | 4 |
| *Leptocylindrus* sp. | 4 | 19 | 1 |
| *Melosira* sp. | 1 | 2 | - |
| *Navicula* sp. | 6 | 2 | 3 |
| *Nitzschia constricta* | 1 | 1 | - |
| *Nitzschia longissima* | 2 | 6 | 4 |
| *Nitzschia pungens* | - | - | 6 |
| *Nitzschia* sp. | - | 4 | 9 |
| *Rhaphoneis* sp. | 2 | 1 | - |
| *Rhizosolenia* sp. | 1 | 1 | 5 |
| *Skeletonema* sp. | - | 17 | 9 |
| *Synedra* sp. | - | - | 3 |
| *Thalassiosira* sp. | - | - | 9 |
| *Thalassiothrix* sp. | - | 4 | - |
| Pennales | 4 | 8 | 21 |
| **Chlorophyceae** | | | |
| *Chlorella* sp. | - | 1 | 1 |
| *Closterium* sp. | - | 3 | 2 |
| *Cosmarium* sp. | - | - | 1 |
| *Dunaliella* sp. | 5 | - | 6 |
| *Pediastrum* sp. | - | - | 1 |
| **Cryptophycea** | | | |
| *Chroomonas* sp. | - | - | 4 |
| *Cryptomonas* sp. | - | 1 | - |
| *Pyramimonas* sp. | - | - | 1 |
| *Tetraselmis* sp. | 1 | - | - |
| **Dinophyceae** | | | |
| *Peridinium* sp. | - | - | 1 |

Benthic macroinvertebrate taxa list for Marineland of Florida R/O Plant, collected via 3 Ponar grabs on December 5, 1995.

| | Reference Site | Test Site 1 | Test Site 2 |
|---|---|---|---|
| **Nemertea** | 2 | - | - |
| **Polychaeta** | | | |
| *Diopatra cuprea* | 1 | 2 | - |
| *Laeonereis culveri* | - | - | 1 |
| *Lumbrineris tenuis* | - | 2 | - |
| *Nereis succinea* | 3 | - | 2 |
| *Pectinaria gouldi* | 1 | - | - |
| *Prionospio* sp. | - | 1 | 7 |
| *Sthenelais* sp. | 1 | 1 | - |
| *Streblospio benedicti* | - | - | 2 |
| Nereidae | - | - | 1 |
| Onuphidae | - | - | 2 |
| Orbiniidae | - | - | 1 |
| Polynoidae | - | - | 1 |
| Sigalionidae | - | 2 | 1 |
| Spionidae | - | 6 | 7 |
| **Gastropoda** | | | |
| *Anachis obesa* | 3 | 1 | - |
| *Bailya parva* | - | - | 1 |
| *Odostomia* | 5 | 4 | - |
| *Retusa* sp. | 9 | 14 | 6 |
| Naticidae | - | 1 | - |
| Pyramidellidae | - | 1 | - |
| Retusidae | - | 4 | - |
| **Pelecypoda** | - | 1 | - |
| *Abra aequalis* | 20 | 10 | 14 |
| *Anadara transversa* | - | - | 1 |
| *Dosinia discus* | 16 | 16 | 4 |
| *Lyonsia floridana* | - | - | 4 |
| *Macoma* sp. | - | 2 | - |
| *Mactra fragilis* | 3 | - | - |
| *Mercenaria* sp. | 45 | 15 | 13 |
| *Mulinia* sp. | 1 | - | - |
| *Nucula crenulata* | 4 | 12 | 1 |
| *Tellina* sp. | - | 1 | - |
| *Tellina versicolor* | 36 | 76 | 209 |
| Mactridae | - | 51 | 31 |
| Mytilidae | 7 | - | - |
| **Thoracica** | | | |
| *Balanus* sp. | - | - | 252 |
| **Cumacea** | - | 2 | - |
| *Cyclaspis* sp. | 1 | 1 | - |
| *Cyclaspis varians* | 6 | 3 | 3 |

| | | | |
|---|---|---|---|
| **Tanidacea** | | | |
| *Hargeria rapax* | 1 | - | 2 |
| **Isopoda** | | | |
| *Edotea montosa* | 8 | 8 | 6 |
| **Amphipoda** | | | |
| *Cerapus* sp. | 12 | 21 | 3 |
| *Corophium* sp. | - | - | 12 |
| *Corophium acherusicum* | 22 | 19 | 128 |
| *Melita nitida* | - | - | |
| Ampeliscidae | - | 3 | - |
| Corophiidae | - | - | 20 |
| Oedicerotidae | - | - | 1 |
| **Decapoda** | | | |
| *Libinia* sp. | - | - | 1 |
| *Pinnixa* sp. | 1 | 3 | - |
| *Rhithropanopeus harrisii* | - | - | 4 |
| **Echinodermata** | | | |
| *Amphioplus* sp. | - | 3 | - |
| Amphiuridae | - | 1 | 3 |
| Ophiuroidea | 5 | 2 | - |

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

| Transaction Code | NPDES NUMBER | YR/MO/DA | Insp Type | Inspector | Fac Type |
|---|---|---|---|---|---|
| 1 N 2 5 | 3 FL0043532 11 | 12 950126 17 | 18 X | 19 S | 20 2 |

Remarks

21 66

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

| Transaction Code | NPDES NUMBER | YR/MO/DA | Insp Type | Inspector | Fac Type |
|---|---|---|---|---|---|
| 1 N 2 5 | 3 FL0043532 11 | 12 950126 17 | 18 R | 19 S | 20 2 |

Remarks

21 66