

Biological Assessment of

Jupiter Reverse Osmosis Water Treatment Plant

Palm Beach County

NPDES #FL0042358

Sampled September 1995

January 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: Jupiter RO Water Treatment Plant
County: Palm Beach
NPDES Number: FL0042358
State Permit Expiration Date: 30 September 1995

Toxics Sampling Inspection (XSI)

Date Sampled: 6 September 1995

Results: The copper concentrations in the bottom layer of the C-18 canal ranged from 12 µg/L to 15 µg/L, violating Class II marine water quality standards. The effluent copper level (7 µg/L) also exceeded the copper standard. Copper was mostly undetected in the surface layer except at station 1, where it was 7.6 µg/L. Since the reference site (station 5) had similar or slightly higher copper concentrations than the areas potentially affected by the discharge (stations 1, 3, and 7), this suggests additional copper sources besides the Jupiter RO effluent. Other metals were not present in deleterious concentrations.

Compliance Biomonitoring Inspection (CBI) – Not sampled

Impact Bioassessment Inspection (IBI)

Date Sampled: 6 September 1995

Results: Quantitative measures of benthic macroinvertebrate community health indicated that the facility was having no adverse effects on the receiving water biota. The benthos in C-18 were primarily influenced by the salinity regime, as evidenced by the mix of marine and freshwater taxa at the study stations. Macroinvertebrate taxa richness and Shannon-Weaver diversity were similar between the reference and test sites. The discharge did not appear to be having any negative effect on algal communities, which were also highly influenced by the salinity and flow regime.

Water Quality Inspection (WQI)

Date Sampled: 6 September 1995 and 12 September 1995

Results: The specific conductance of the effluent was 15,600 µmhos/cm, equivalent to approximately 9.6 ppt salinity. The bottom dissolved oxygen at all canal stations was very close to the minimum Class II water quality standard for marine waters. Class III standards were not met in Simms Creek (surface was 2.5 mg/L) and Jones Creek (surface was 3.1 mg/L and bottom was 3.5 mg/L). Ammonia values in the bottom layer of C-18 were higher than those found in 80% of other Florida estuaries, ranging from 0.14 mg/L to 0.18 mg/L. Conversely, the C-18 surface layer and the Loxahatchee estuary were low in ammonia. Although the effluent had 2.7 mg/L of ammonia, there was only a slight increase at station 7 (bottom was 0.18 mg/L) compared with the canal reference area (bottom layer at station 5 was 0.16 mg/L). The source of ammonia at station 5 is currently unknown. Other nutrients were not present in problem amounts. Algal growth potential at all stations was less than the 10 mg dry wt/L "problem threshold" for marine waters.

Introduction

The Jupiter Reverse Osmosis Water Treatment Plant is located in Palm Beach County (see maps in Appendix). This water treatment facility is permitted to treat 8 MGD of brackish Floridan Aquifer water to produce 6 MGD of drinking water. An average of 2 MGD of reject water is discharged into the Class II C-18 canal, a tributary of the Southwest Fork of the Loxahatchee River estuary. Prior to discharge, reject water is pH adjusted and aerated.

Although the NPDES permit has expired, the facility is required to monitor the following on a monthly basis: Temperature, pH, dissolved oxygen, hydrogen sulfide, fluoride, unionized ammonia, total residual chlorine, specific conductance, copper, and radium$^{226+228}$. The facility has been granted a 1000 foot mixing zone on both sides of the discharge pipe for fluoride and radium$^{226+228}$ on the east side of the point of discharge. They are required to maintain Class II water quality standards for fluoride and radium$^{226+228}$ outside the mixing zone, as well as all other standards at the sampling point prior to discharge.

The effluent has been acutely toxic to *Mysidopsis bahia* in tests performed in August, 1992, and October, 1994.

Major characteristics of community structure of control and test sites.

	Reference Site	Test Site 1	Test Site 2
Macroinvertebrate Ponar			
Number of Taxa	11	14.5	14
Shannon-Weaver Diversity	2.4	2.1	2.4
% Polychaeta	36.6	2.3	24.3
% Diptera	2.1	4.7	4.5
% Gastropoda	1.4	11.7	4.5
% Tanaidacea	29.0	0.6	0
% Thoracica	0	1.8	0
% Isopoda	0.7	1.2	0.6
% Amphipoda	22.1	69.6	62.7
% Pelecypoda	4.1	2.3	2.8
% Oligochaeta	0.7	2.9	0
% Predator/Carnivores	3.1	2.3	0.9
% Above-Surface Deposit Feeders	17.9	2.1	13.3
% Below Surface Deposit Feeders	2.8	4.1	1.7
% Scavengers	11.4	34.5	26.6
% Browser/Grazers	11.4	34.5	26.6
% Shredders	0	0.6	1.7
% Scrapers	1.7	12.0	4.5
% Suspension Feeders	51.7	7.0	23.7
% Unknown FFG	0	1.2	1.1
Phytoplankton Algae			**Test Site 3**
Number of Taxa	32	28.5	30
Shannon-Weaver Diversity	3.0	2.8	2.2
Chlorophyll a (µg/L)	6.1	4.8	5.3
Algal Density (#/mL)	2,370	3,558	2,827
% Blue-green	3.6	2.8	1.6
% Green	10.8	8.5	6.3
% Diatoms	85.3	88.7	91.6
Algal Growth Potential (mg dry wt/l)	3.7	4.8	4.8

Methods

The focus of this investigation was to determine the discharger's effects on the receiving waters. Due to the hydrologic complexity and dynamic nature of this estuarine system, more stations than are normally sampled during a 5th year inspection were established (see maps in Appendix). A comparison of biological community health was made between a reference site (actually, 2 stations located in C-18 near the confluence with the Southwest Fork of the Loxahatchee River estuary), two near-field test sites (each consisting of 2 stations) bracketing the discharge (see map in Appendix), and a far-field test site (located near S-46). Other stations in Simms Creek, Jones Creek, and the SW Fork of the Loxahatchee River were sampled for various physical and chemical parameters. Habitat assessments were not performed during this study, but the biological stations were located in a disturbed canal system, subject to extreme fluctuations in salinity, depending upon the amount of fresh water discharged from the S-46 control structure. Supplemental physical/chem-

ical data were also collected at the stations shown on the maps. The effluent and selected receiving water stations were analyzed for metals and nutrients. Methods used for all chemical analyses are on file at the Tallahassee DEP Chemistry Laboratory.

Benthic macroinvertebrate communities were evaluated at the reference site (stations 5 and 6), test site 1 (stations 1 and 3) and test site 2 (stations 2 and 4). Invertebrates were collected via three Ponar grabs per station (Ross 1990). Because benthic samples from stations 2 and 4 (a total of 6 replicates) were inadvertently marked as station 4, it was decided to combine the replicates from the reference stations, as well as those from the test site 1 stations (so 6 benthic drops were collected per site). Phytoplankton was sampled (top and bottom of the water column) at the reference site, test site 1, and at a far-field site (test site 3) by subsurface grabs. Chlorophyll *a* was also collected for phytoplankton communities. Algal Growth Potential tests, using *Dunaliella tertiolecta* for the marine receiving water sites, followed EPA (1974).

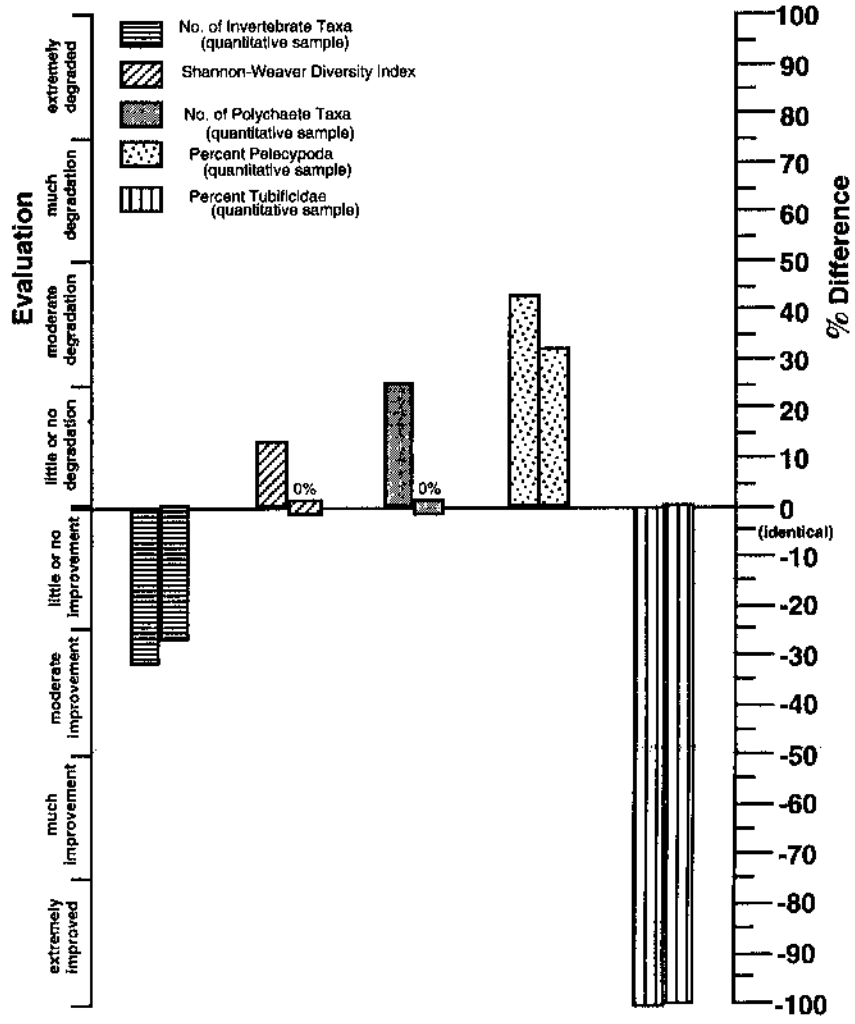
Explanation of Measurements of Community Health

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



Effect of discharge on the benthic macroinvertebrate community.

The left bar for each parameter shows differences between the reference site and test site 1. The right bar shows differences between the reference site and test site 2.

(1992), Chang *et al.* (1992), and Whitmore (1989), are used as appropriate.

Ephemeroptera/Plecoptera/Trichoptera Index: This index is the sum of the number of EPT taxa present. Higher EPT values are associated with healthier systems.

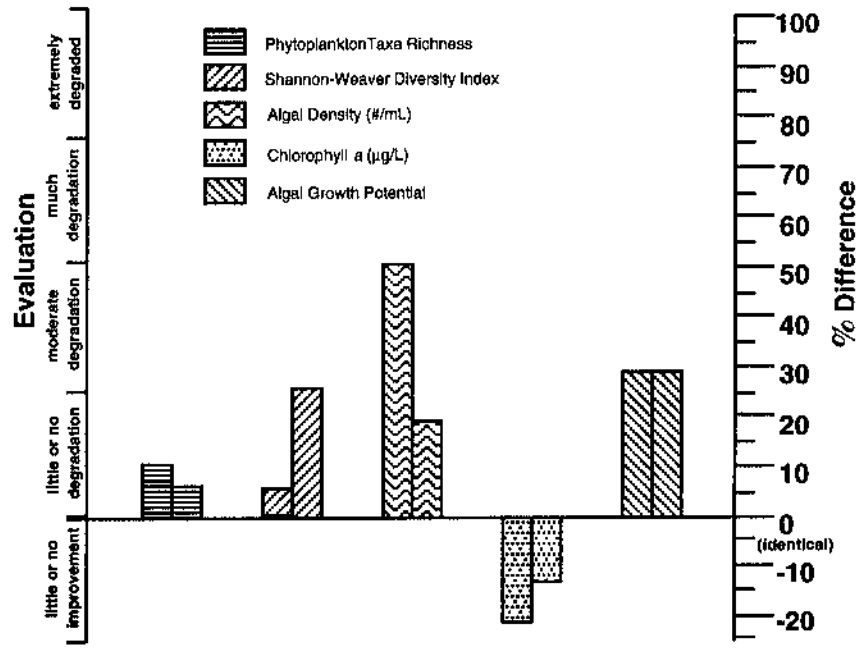
Community structure: Substantial shifts in the proportions of major groups of organisms, compared to reference conditions, may indicate degradation. In marine systems, an increase in the % tubificid oligochaetes, a decrease in the % pelecypods, and a decrease in the number of polychaete taxa are all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

The Stream Condition Index (SCI) is a composite macroinvertebrate metric (EA Engineering 1994). The SCI assigns points to a variety of parameters, depending on how closely each parameter approaches an expected reference condition (see SCI calculation table in Appendix).

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 minus reference site divided by the reference site.



Effect of discharge on the algal community.

The left bar for each parameter shows differences between the reference site and test site 1. The right bar shows differences between the reference site and test site 2.

Results and Discussion

The study area was situated in C-18, a disturbed canal system. The area is subject to extreme fluctuations of salinity, depending upon the amount of water discharged through a control structure (S-46), located approximately 1000 m southeast of the discharge. During the month prior to sampling, the S-46 was discharging continuously, with flows ranging from 74 cfs to 1,847 cfs (see Appendix). A dye study performed by the Division of Water Facilities in December, 1994, revealed a hydrologic phenomenon in the C-18 canal which deserves mention (Greg Knecht, personal communication). During periods of freshwater discharge from S-46, the canal system is highly stratified, and a convective exchange mechanism occurs. As one approaches the

The following personnel were involved in this investigation: Terry Davis and John Moulten (DEP Southeast District) and Lyn Burton, Marshall Faircloth, Russel Frydenborg, Joy Jackson, Christy LeDuc, Kathleen Lurding, Tina Mikulski, Elizabeth Miller, Urania Quintana, Bart Richard, Sonia Razzaque, Lisa Tamburello, David Whiting, Vicki Whiting, 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.

S-46 control structure, highly saline water from the bottom of the salt wedge is drawn up toward the low salinity water at the surface, due to a density-driven horizontal pressure gradient. This establishes a flow pattern in which bottom (highly saline, 30 ppt) water from the Loxahatchee estuary travels towards the control structure in C-18, while the mostly fresh (2 ppt during this study) surface layer flows from the control structure to the estuary (see diagram in Appendix). This phenomenon is important in determining the fate of the effluent, which is theorized to have been flowing upstream in the bottom layer during this study.

The C-18 study sites were similar with respect to many physical/chemical parameters. In general, there were larger vertical differences (between the top and bottom layers at a given station) than there were longitudinal differences (between stations). Salinity was high at the bottom of the water column, ranging from 26.6 ppt at station 7 (near S-46) to 30.4 ppt at station 6 (near the estuarine mouth of C-18) (see salinity graph in Appendix). Conversely, salinity was very low (1.4 to 2.6 ppt) in the surface layer of the canal. Salinity stratification was less evident in Jones Creek (ranging from 11.3 ppt at the top to 13.3 ppt at the bottom) and in the SW Fork of the Loxahatchee (17.5 ppt at the surface and 30 ppt at the bottom). The specific conductance of the effluent was 15,600 µmhos/cm, equivalent to approximately 9.6 ppt salinity.

In the canal, dissolved oxygen was generally higher in the surface layer (usually above 6 mg/L except for station 6) than the bottom layer (where it was near 4 mg/L) (see dissolved oxygen graph in Appendix). The bottom dissolved oxygen at all canal stations was very close to the minimum Class II water quality standard for marine waters. The lowest dissolved oxygen values encountered during this study occurred at Simms Creek (surface was 2.5 mg/L) and Jones Creek (surface was 3.1 mg/L and bottom was 3.5 mg/L), where Class III standards were not met. Dissolved oxygen in the SW Fork of the Loxahatchee was above 5 mg/L at the surface and bottom.

The pH varied from approximately 7.1 SU at the surface of the canal and creek stations to near 7.7 SU in the bottom stations (except for station 10, where the bottom pH was 7.2 SU) (see pH graph in Appendix). Temperature was very similar at all stations and depths, ranging from 29.6 °C to 30.3 °C (see temperature graph in Appendix). Substrate at all sites was composed of a mixture of shell rubble, mud, and sand (Terry Davis, personal communication).

The effluent and water from stations 1, 3, 5, and 7 were analyzed for fluoride and the following metals: aluminum, arsenic, cadmium, calcium, chromium, copper, iron, lead, magnesium, nickel, selenium, silver, strontium, and zinc. With the exception of calcium, copper, strontium, and fluoride, concentrations of the other constituents were either undetected or unremarkable.

Calcium has been implicated as a toxicant when it (alone) is present in concentrations which are 200% above normal for a given salinity. Normal calcium concentrations at a salinity of 35 ppt are around 420 mg/L. Calcium was present in the effluent at 429 mg/L at a salinity of 9.6 ppt, or about 364% higher than expected for that salinity (see calcium graph in Appendix). Calcium in the bottom layer of C-18 ranged from 318 mg/L to 335 mg/L, which is lower than 95% of other Florida estuaries. Not unexpectedly, the surface layer, being composed primarily of Everglades-like marsh water, was lower in calcium (less than 70 mg/L) than was the salt wedge.

Copper was substantially higher in the bottom layer of C-18 than the surface layer. The bottom copper concentrations ranged from 12 µg/L at station 3 to 15 µg/L at stations 1 and 5. These concentrations all represent violations of Class II marine water quality standards (Rule 62-302.530(24) FAC). The effluent copper level (7 µg/L) also exceeded the copper standard. Copper was mostly undetected in the surface layer except at station 1, where it was 7.6 µg/L. Since the reference site (station 5) had similar or slightly higher copper concentrations than the areas potentially affected by the discharge (stations 1, 3, and 7), this suggests additional copper sources besides the Jupiter RO effluent.

Fluoride was higher in the bottom layer (ranging from 0.9 to 0.95 mg/L) than the surface layer (where it was 0.24 mg/L or less) (see fluoride graph in Appendix). Fluoride levels in the salt wedge were lower than those found in approximately 60% of other Florida estuaries. The effluent fluoride level was 2.7 mg/L. While this concentration exceeds the Class II standard of 1.5 mg/L, the facility has a mixing zone for fluoride. Fluoride concentrations complied with Class II standards at the receiving water stations.

As expected, strontium was also higher in the bottom layer (5,760 µg/L at station 1 to 6,690 µg/L at station 7) than in the surface samples (508 µg/L to 699 µg/L) (see

strontium graph in Appendix). The effluent strontium concentration was 39,700 µg/L. Given the flow direction of the salt wedge, it is possible that the slightly higher strontium level at station 7 was related to the discharge. In any case, the strontium levels in the salt wedge were normal for seawater.

Ammonia values in the bottom layer of C-18 were higher than those found in 80% of other Florida estuaries, ranging from 0.14 at station 1 to 0.18 at station 7 (see ammonia graph in Appendix). Conversely, the C-18 surface layer was low in ammonia (less than 0.07 mg/L), as were the top and bottom samples of the Loxahatchee estuary (station 11). Although the effluent was relatively high in ammonia (2.7 mg/L), there was only a slight increase at station 7 (bottom was 0.18 mg/L) over the canal reference area (bottom layer at station 5 was 0.16 mg/L), indicating substantial dilution. The source of ammonia at station 5 is presently unknown.

With the exception of station 10, nitrate-nitrite in the bottom water samples was a typical 0.02 mg/L. The surface nitrate-nitrite values in C-18 were higher than approximately 60% of other estuaries, ranging from 0.03 mg/L to 0.038 mg/L. The highest nitrate-nitrite levels were found in the surface samples in Simms Creek (0.05 mg/L) and Jones Creek (0.043 mg/L). TKN was generally low in the bottom water samples (near 0.7 mg/L) but higher than 90% of other estuaries in the surface layer samples of C-18 (from 1.5 mg/L to 1.6 mg/L). The elevated TKN probably reflects the marsh water input from S-46. TKN was low in both the surface and bottom samples from station 11 in the Loxahatchee estuary. Ortho-phosphate and total phosphorus values were low to fairly normal at all study stations (see graphs in Appendix).

Algal growth potential (AGP) at all stations was less than the 10 mg dry wt/L "problem threshold" for marine waters (Ron Raschke, personal communication), ranging from 0.5 mg dry wt/L at station 7 to 9 mg dry wt/L at station 9 (see AGP graph in Appendix). The effluent AGP was 0.1 mg dry wt/L.

Quantitative measures of benthic macroinvertebrate community health indicated that the facility was having no discernible adverse effects on the receiving water biota. 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 site.

The community composition varied among the three macroinvertebrate study sites, with freshwater influence appearing to play a major role in community distribution. There was a mix of freshwater and marine taxa at all three stations, suggesting a constantly changing salinity regime. This produces conditions that may be unfavorable for the establishment of either a strictly freshwater or marine assemblage. For example, the amphipod, *Grandidierella bonnieroides*, was very abundant at all three invertebrate sampling sites. This taxon is capable of withstanding extremes in salinity, and is often common in low salinity estuaries (despite the high salinity (30 ppt) conditions which were present in the bottom of the canal during this study). All sites were represented by several freshwater taxa. Twelve freshwater taxa were recovered from test site 1, 5 freshwater taxa were found at test site 2, while the reference site had 6 freshwater taxa present. This suggests that organisms inhabiting the marshes west of S-46 are being transported through the control structure due to the high water velocities in C-18. These freshwater taxa were apparently collected in the saline portions of C-18 before they had died or decomposed. Polychaetes (36.6% of the total population) were most abundant at the reference site, followed by tanaiids (29.0%), amphipods (22.1%) and pelecypods (4.1%). Amphipods were most common at test site 1 (69.9% of the total community) and at test site 2, where they made up 62.7% of the population collected. Other abundant organisms at test site 1 included gastropods (11.7%), freshwater dipterans (4.7%), freshwater oligochaetes (2.9%), polychaetes (2.3%), and pelecypods (2.3%). Polychaetes (24.3%), freshwater dipterans (4.5%), gastropods (4.5%), and pelecypods (2.8%) were also represented at test site 2. The tanaid, *Apseudes* sp. was abundant at the reference site, present at test site 1, but absent at test site 2. The pollution tolerant polychaete, *Streblospio benedicti*, was common at the reference site and at test site 2, but was absent from test site 1.

Macroinvertebrate taxa richness (averaged from the two sampling stations per site) was slightly lower at the reference site (with 11 taxa) than at test site 1 (with 14.5 taxa) or test site 2 (with 14 taxa). The reference site and test site 2 had identical Shannon-Weaver diversity values (2.4), while diversity at test site 1 was only slightly less, at 2.1.

There were similar numbers of polychaete taxa at all three sites, from 3 to 4 distinct polychaete taxa.

Pelecypods, including *Mulinia lateralis*, *Musculium* sp. (a freshwater taxon), and individuals of the family Tellinidae, were sparsely represented at all three stations, ranging from 2.3% and 2.8% of the population at test sites 1 and 2, respectively, to 4.1% at the reference site. Tubificid worms were absent at the test sites, while very small numbers of tubificids (0.7% of the total population) were recovered at the reference site. Note that the absolute differences between the reference and test sites with respect to the % Pelecypoda and % Tubificidae parameters are not really as striking as they appear on the graph. A few pollution sensitive taxa, including *Uromunna reynoldsi*, *Rhithropanopeus harrisii*, *Stenelmis* sp. (a freshwater taxon), and *Ablabesmyia rhamphe* grp. (also freshwater), were found at one or both test sites (Farrell 1992). In summary, the discharge was not exerting any negative effects on the receiving water invertebrates, which appeared to be much more affected by the salinity regime. Due to the potential for biological stress at the reference site (from urban runoff and salinity fluctuations), it may be difficult to detect further degradation from other sources.

Phytoplankton was sampled at both the top and the bottom of the water column at stations 1 and 3 (test site 1), stations 5 and 6 (reference site) and station 7 (test site 3). As noted earlier, there was extreme salinity stratification throughout the C-18 canal, which appeared to be an overriding influence on the free water algal community. Taxa richness was higher in the surface layer (composed of freshwater organisms, ranging from 18 taxa at station 7 to 30 taxa at station 3) than it was in the bottom layer (with marine organisms, ranging from 10 to 16 taxa) (see phytoplankton taxa richness graph in Appendix). Shannon-Weaver diversity followed a similar pattern, being considerably higher in the surface layer samples (from 3.1 at station 7 to 4.3 at station 3) than in the salt wedge (from 1.2 at station 1 to 1.8 at station 5) (see phytoplankton diversity graph in Appendix). Chlorophyll *a*, however, was higher in the salt wedge than in the surface layer (see chlorophyll *a* graph in Appendix). Chlorophyll *a* was between 6 µg/L and 9.6 µg/L in the bottom layer. These values are normal to moderately elevated (70th percentile) for a Florida estuary. Chlorophyll *a* in the surface layer was lower, and ranged from 2.8 µg/L to 3.6 µg/L. Diatoms were the dominant group in the salt wedge community, followed by chlorophytes (see phytoplankton community composition graph in Appendix). Chlorophytes and/or diatoms were most abundant in the surface layer samples, with cyanophytes also being common.

The Figure on p. 3 represents changes between sites in the phytoplankton algal community, representing an average across stations and depths sampled per site. As was noted with the macroinvertebrates, larger differences (that is, higher percentages) correspond with greater degrees of degradation. The number of algal taxa ranged from 28.5 at test site 2 to 32 at the reference site. Diversity was mostly similar as well, ranging from 2.2 to 3.0. Algal density was slightly lower at the reference site (with 2,370 organisms/mL) than at the test sites (from 2,827 organisms/mL at test site 2 to 3,558 organisms/mL at test site 1), but these densities are not considered troublesome. Chlorophyll *a* was very similar between sites (from 4.8 µg/L to 6.1 µg/L), as was algal growth potential (between 3.7 mg dry wt/L and 4.8 mg dry wt/L). In summary, the discharge did not appear to be having any negative effect on algal communities, which were influenced much more by the salinity regime.

Conclusions

Extreme salinity stratification and frequent salinity fluctuations are characteristic of the C-18 canal. These factors appear to be of overriding importance to other aspects of the system. During periods of freshwater discharge from S-46, highly saline bottom water flows from the Loxahatchee estuary to the S-46 control structure, where it mixes with the freshwater surface layer, and flows back toward the estuary. The Jupiter RO effluent, during this study, would have been flowing toward S-46.

The bottom dissolved oxygen at all canal stations was very close to the minimum Class II water quality standard for marine waters. The lowest dissolved oxygen values encountered during this study occurred at Simms Creek (surface was 2.5 mg/L) and Jones Creek (surface was 3.1 mg/L and bottom was 3.5 mg/L), where Class III standards were not met. Dissolved oxygen in the SW Fork of the Loxahatchee was above 5 mg/L at the surface and bottom.

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The elevated TKN in C-18 surface samples probably reflects the marsh water input from S-46. TKN was low in both the surface and bottom samples from station 11 in the Loxahatchee estuary. Ortho-phosphate and total phosphorus values were low to fairly normal at all study stations. Moderate nitrate-nitrite enrichment was noted in Simms and Jones Creeks.

Algal growth potential at all stations was less than the 10 mg dry wt/L "problem threshold" for marine waters, ranging from 0.5 mg dry wt/L at station 7 to 9 mg dry wt/L at station 9. The effluent AGP was 0.1 mg dry wt/L.

Quantitative measures of benthic macroinvertebrate community health indicated that the facility was having no adverse effects on the receiving water biota. The benthos in C-18 appeared mostly to be affected by the salinity regime, as evidenced by the mix of marine and freshwater taxa at the study stations. Macroinvertebrate taxa richness and Shannon-Weaver diversity were similar between the reference and test site sites.

The discharge did not appear to be having any negative effect on algal communities, which also were highly influenced by the salinity regime.

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Chemistry Summary Table for Jupiter RO Study	Effluent	1 top	1 bot	3 top	3 bot	5 top	5 bot	6 top	6 bot	7 top	7 bot	9 top	9 bot	10 top	10 bot	11 top	11 bot
Copper (ug/L)	7	7.6	15	5	12	5	15			5	14						
Calcium (mg/L)	429	68.8	355	48.9	319	38.5	336			42.1	318						
Strontium (ug/L)	39700	1060	5760	699	5820	508	5970			574	6690						
Fluoride (mg/L)	2.7	0.24	0.9	0.16	0.89	0.15	0.9			0.15	0.95						
Ammonia (mg/L)	2.7	0.07	0.15	0.06	0.16	0.06	0.16			0.06	0.18	0.12	0.08	0.1	0.1	0.07	0.05
Nitrate-Nitrite (mg/L)	0.04	0.03	0.02	0.04	0.02	0.03	0.02			0.04	0.02	0.05	0.02	0.04	0.04	0.02	0.02
TKN (mg/L)	2.4	1.5	0.63	1.6	0.65	1.5	0.66			1.5	0.72	1.3	0.82	1	0.92	0.85	0.41
Total Phosphorus (mg/L)	0.019	0.05	0.1	0.04	0.1	0.029	0.087			0.05	0.08	0.08	0.13	0.09	0.07	0.06	0.062
Ortho-phosphate (mg/L)	0.02	0.02	0.03	0.02	0.04	0.02	0.04					0.04	0.04	0.05	0.05	0.02	0.02
Chlorophyll a (ug/L)		3.31	5.99	3.64	9.62	2.99	8.66	3.21	9.41	2.78	7.91						
AGP (mg dry wt/L)	0.1	5.3	8.1	1		0.3	7.1			0.5	8.8	9	6	7.4	8.7	5.6	6
Dissolved oxygen (mg/L)		6.5	4.2	6.5	3.9	6.4	3.9	4.5	4	6.6	4.1	2.5	4.4	3.1	3.5	5.3	5.2
pH (SU)		7.1	7.7	7.2	7.7	7.1	7.7	7.2	7.7	7.1	7.6	7.2	7.8	7.1	7.2	7.6	7.9
Salinity (ppt)		2.6	28.8	2.9	29	2.1	29	2.1	30.4	1.4	26.6	6.9	26.3	11.3	13.3	17.5	30
Phytoplankton diversity		3.4	1.2	4.3	1.5	3.8	1.8	4.1	1.5	3.2	1.3						
Phytoplankton taxa		18	10	30	14	24	16	28	13	23	12						
% Diatoms		53.7	98	24.3	92.4	27.9	97.1	23.5	97.3	62.3	95.2						
% Cyanophyta		12	0	32.9	0.7	17.4	0.7	19.1	0.7	14.8	0						
% Chlorophyta		34.3	2	42.9	6.9	53.5	2.2	54.4	2.1	18	4.8						

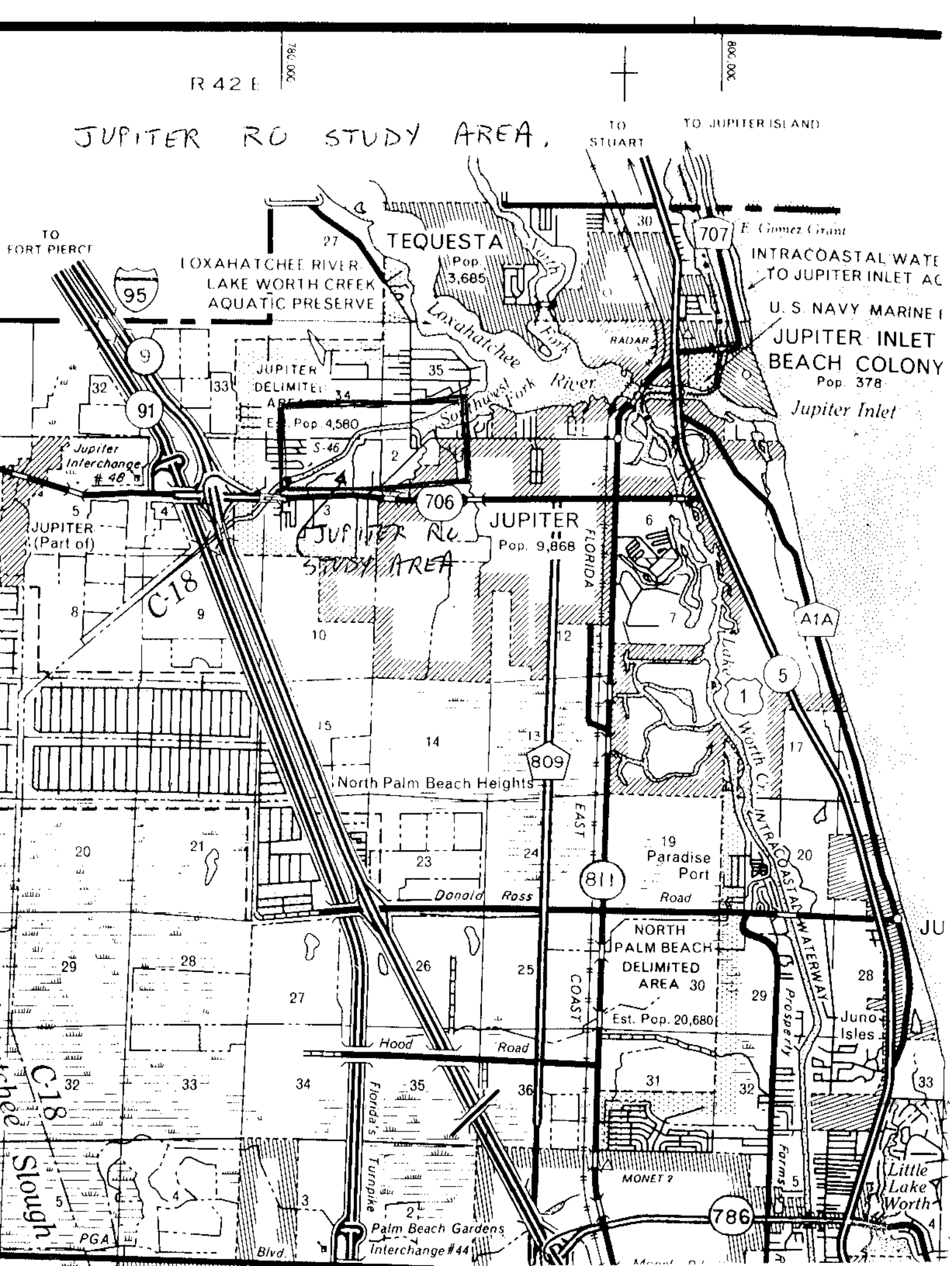
Typical Values for Selected Parameters in Florida Waters

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

Percentile Distribution

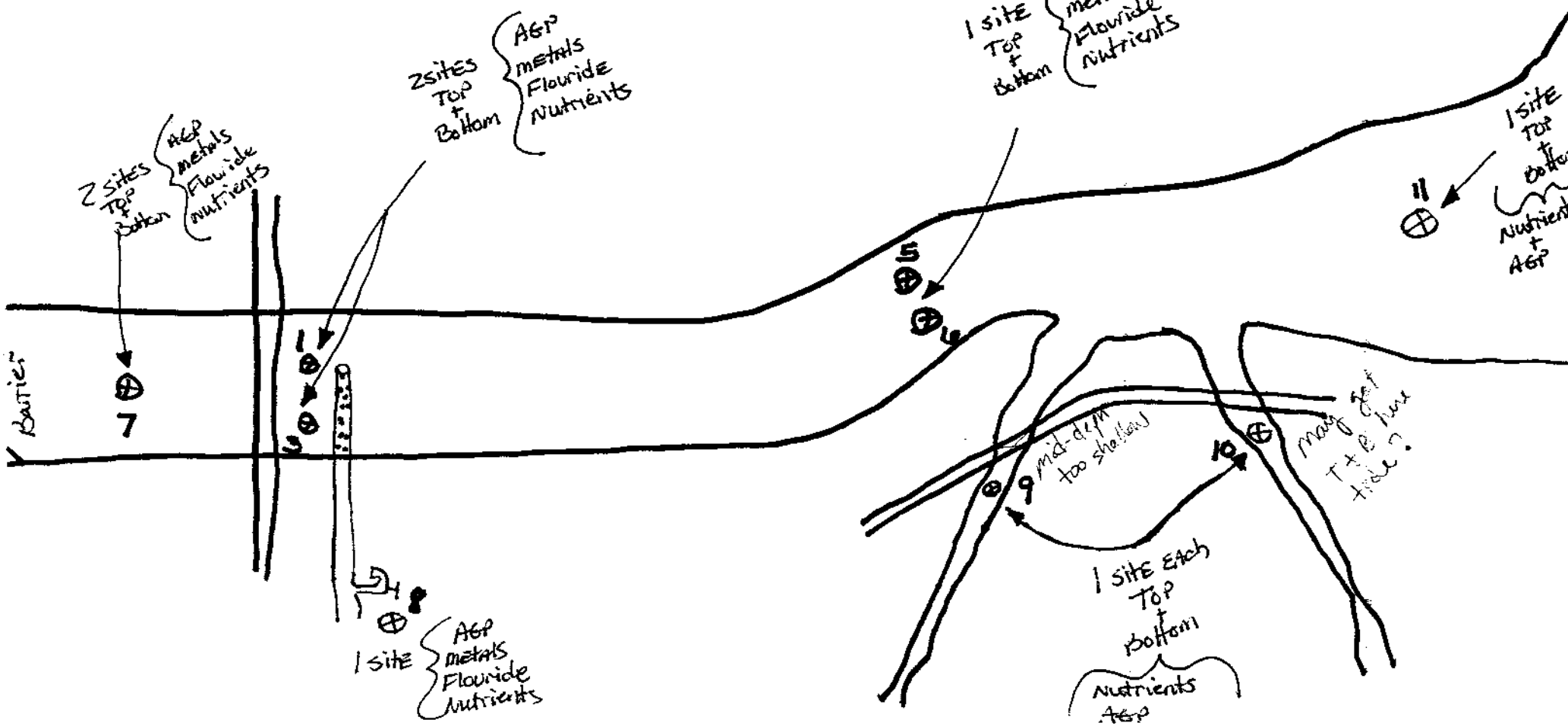
Parameter	5%	10%	20%	30%	40%	50%	60%	70%	80%	90%	95%
STREAMS (1617 stations)											
Phytoplankton Chlorophyll *a*	0.22	0.52	0.94	1.60	3.02	4.63	6.72	9.87	14.68	27.35	48.70
Periphyton Chlorophyll *a*	0.31	0.43	0.77	1.04	2.16	2.94	6.45	10.51	17.00	39.51	60.85
H-D Diversity	0.84	2.12	2.48	2.74	2.88	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


R 42 E
780,000
800,000
JUPITER RD STUDY AREA.
TO STUART
TO JUPITER ISLAND
TO FORT PIERCE
TEQUESTA
Pop. 3,685
LOXAHATCHEE RIVER
LAKE WORTH CREEK
AQUATIC PRESERVE
Loxahatchee River
Northwest Fork
RADAR
E. Gomez Grant
INTRACOASTAL WATE
TO JUPITER INLET AC
U. S. NAVY MARINE I
JUPITER INLET
BEACH COLONY
Pop. 378
Jupiter Inlet
95
91
707
706
809
811
786
A1A
JUPITER DELIMITED AREA
Est. Pop. 4,580
S-46
Jupiter Interchange #48
JUPITER (Part of)
JUPITER
Pop. 9,868
JUPITER RD STUDY AREA
C-18
FLORIDA
Lake Worth Cr.
North Palm Beach Heights
EAST
Donald Ross
Road
19
Paradise Port
INTRACOASTAL WATERWAY
NORTH PALM BEACH DELIMITED AREA 30
Est. Pop. 20,680
COAST
Hood Road
Florida's Turnpike
Prosperity Farms
Juno Isles
MONET ?
Little Lake Worth
Palm Beach Gardens
Interchange #44
PGA Blvd.
C-18 Slough

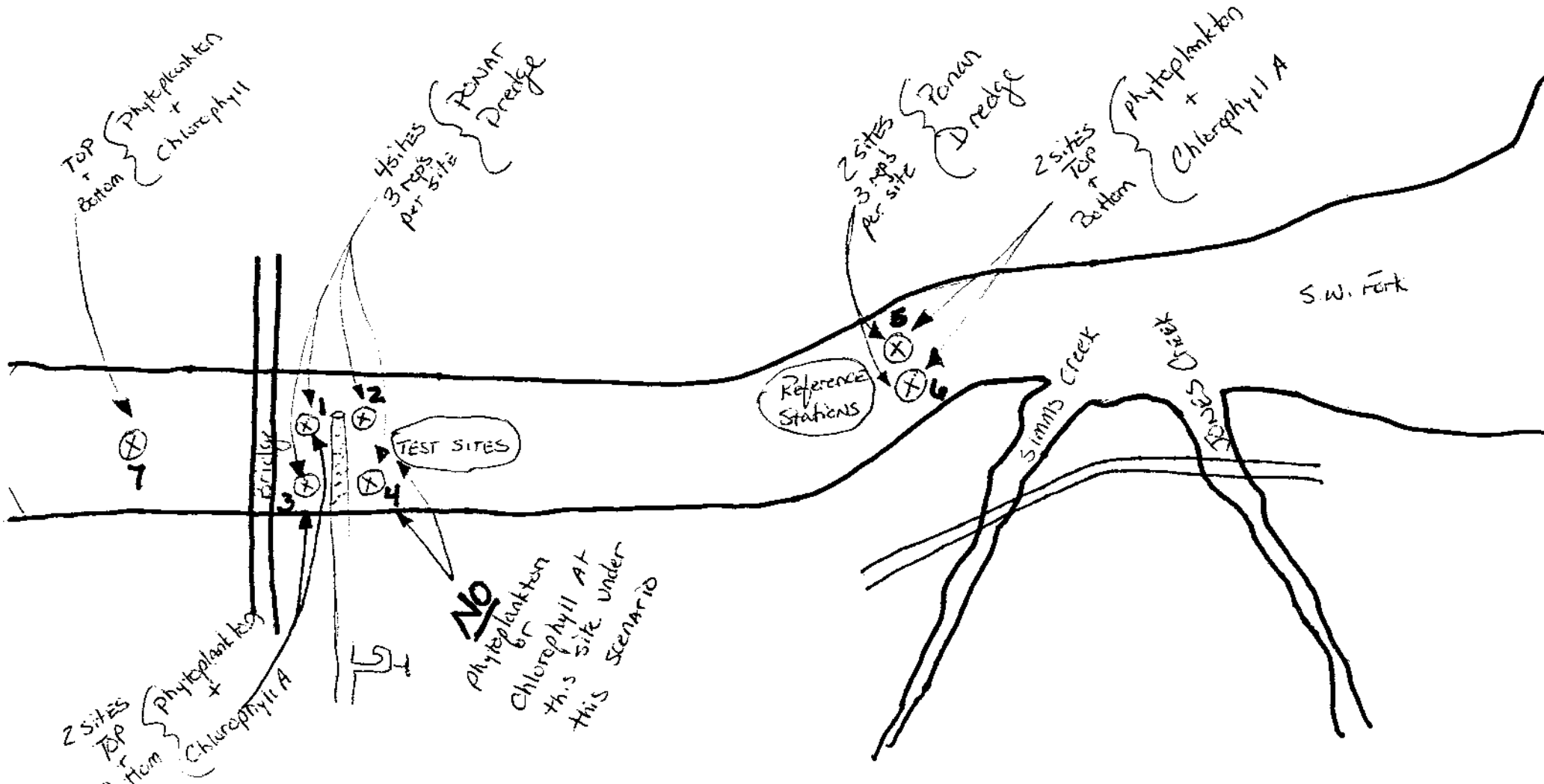
STATION #'s 1- 11

Chemistry Sampling MAP If Freshwater is Being released From the Salinity Barrier



STATION #'s 1-7 (see below)

Benthic Sampling MAP IF Freshwater is being released From the Salinity Barrier



STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

Facility Name: Town of Jupiter Water System		Date Summary Prepared :
Location (attach detailed map):	County: Palm Beach	District: Southeast
Federal Permit # and expiration date: FL0042358, 9/30/95	State GMS # and State expiration date: 5050M02410, 7/13/92. Expired TOP IT50-199998	Facility Type: (Industrial) Municipal Federal Agricultural Other (list):

Function of facility:

Drinking Water Treatment Plant

Description of treatment process:

R/O with pH adjustment to concentrate followed by Aeration for H2O removal.
Treats 8 mgd of Brackish water from Floridan Aquifer producing 6 mgd of drinking water + 2 mgd of Concentrate at 20,000 ppm/TDS

Receiving waters: C-18 CANAL	Classification: I (II) III

Design Flow: 2.0 MGD	Mean Flow:	Flow during survey:

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

therefore, the best time to sample is:

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

Facility has A limited mixing zone For Flouride + Radium 226+228
The mixing zone extends 1000 ft in the C-18 Canal on both sides of the discharge Pipe
The permittee shall maintain the water quality stds for Flouride + Radium outside the mixing zone + All other Class II stds at the sampling point prior to discharge

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

Parameter	Limit (units)
Temperature	Monitor on a Monthly Basis Daily!
pH	
DO	
H_2S	
F	
Unionized NH_3	
TRC	
Specific Conductance	
CV	
226 + 228 (Radium)	

Describe special permit conditions and permit modifications:

Surface water samples shall be collected at a distance of 100' and 1000' on either side of the discharge pipe on a monthly basis and analyzed for Cl, specific Conductance, DO, pH, and Temp.

Samples will be collected at the depth of 1' from the surface and 1' from the bottom of C-18 canal

Bioassays + Benthic samplings shall be done As outlined in the proposal from Hutchison Engineers dated 1/13/92

Bioassays shall be collected every 2 mo.'s along with Chemical samples. Tests will be whole Eff. Static Renewal (continuous aeration)

TP

n 96 hrs w/ renewals done every 24 hrs (from freshly collected samples) using mysid shrimp.
Results shall be submitted to the Dept within 30 days of sampling.

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL REGULATION

FACILITY SUMMARY

_____ (Facility)

Description of permitted outfall(s):

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

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

No WQBEL's have been done on this facility
Abreviated Fifth Year was done on August 3, 1992. Effluent was Acutely Toxic using 96 hr: Acute definitive (96 hr-LC50/70%)
Effluent Results: NH_3 = 1.5 mg/l, un-NH_3 = .08 mg/l, Unidentified organics = 10 ug/l
Abreviated Fifth Year was done on on October 3, 94. Effluent was Acutly Toxic to mysids using 96 hr Acute definitive (48 hr LC50 of 97%) [redacted]. Screen Test using menidia (30%) mortality was also observed
Effluent Results: TRC = .04 mg/l, NH_3 = 5.5 mg/l, Unionized = .21 mg/l, and (F) 9.8 mg/l

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

Additional information:

The NPDES permit has Expired, however the conditions & Compliance schedules will remain in Effect As an Administrative Order. However the A.O. Expired on 9/30/95.

Staff contributing to this review (signature):

(Biologist)

(Inspector)

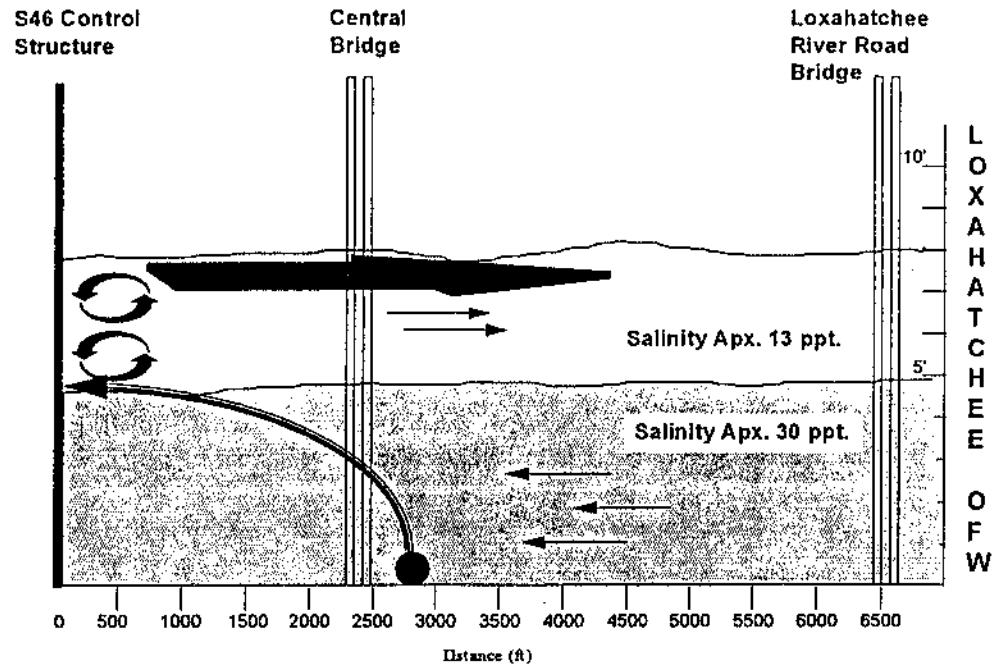
(Engineer)

Michael Tarosi (Tallahassee

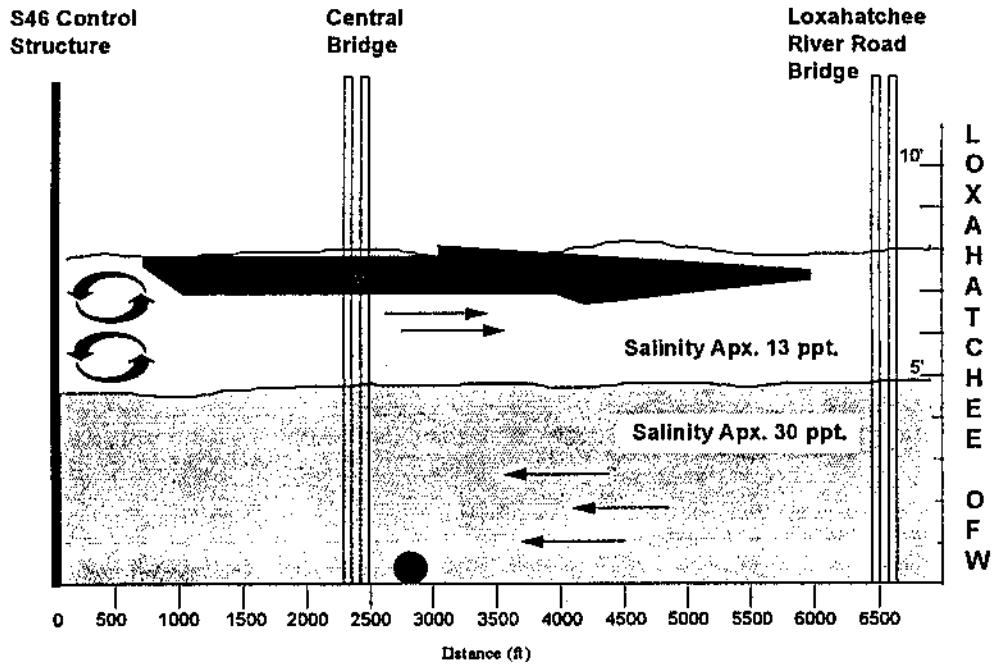
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FATE OF DYE FROM JUPITER RD DISCHARGE.



Time Apx. 15:45 1/19/95



Time Apx. 16:45 1/19/95

JUPITER R/O BIOASSESSMENT – FLOWS FROM C-18 flows CONTROL cfs STRUCTURE (S-46).

STATION: S46_S STATISTIC: MEAN DBKEY: 15734 DATA TYPE: FLOW YEAR: 1995

DAY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
01	190.94E	.07	.06	.00	.00	.00E	281.01E	369.28E	452.05E	.00	448.72	.00
02	138.12E	.00E	.00	.00	.00E	.00	330.22E	260.22E	457.60	.00	424.58E	.00
03	207.48E	.00	.00	.00	6.78	.00	382.41E	1244.82	355.67	.00E	373.25E	.00
04	113.08	.00	.00	.00E	.00	.00	250.89	1409.69	355.97	.00	323.52	.00
05	115.35	.00	.00E	.00E	.00	.00	153.13E	1137.39	315.29E	.00	180.45	.06
06	81.55	.00	.00E	.00	.00	.00	45.65	545.19E	403.74E	44.09	213.16E	.00
07	93.68	.00	.00E	.00	.00	.00	68.10	527.37	638.22	25.93	178.78	.00
08	35.78	.07	49.80	.00	.00	.00E	7.58	432.50E	960.73	210.10	81.49E	.00
09	21.07	.00E	.00E	.00	.00	.00E	.00	352.82	753.96	200.23E	128.50E	.00
10	44.07	.09	.00	.00E	.00	.00	43.21E	318.44	676.80	117.56	114.59	.00
11	.00E	.80	.00	1.91E	.00	.00	.00	313.63E	642.39E	107.78	102.90	.00
12	.00	.00	.00	.87E	.00	.00	37.05E	303.33	532.36E	116.12	30.29	.00P
13	.00	.00	.21	.00E	.00	.00	27.70E	289.54	508.13E	135.49E	46.93P	M
14	118.65	.00	.00E	.00E	.00	.00E	8.94E	199.01E	454.03E	241.22	45.25	M
15	260.25	.00	.00	.00	.00E	.00E	.00E	204.21E	373.27E	598.13	.00E	M
16	205.12	.00	.00E	.00	.03E	.00	.00E	92.68	344.13E	722.12	.00	M
17	137.60	.00	.00	.00	.00	.00	.00E	113.47	299.11E	2645.23	.00	M
18	62.22	.00	.00	.00E	.00	.00E	.03E	74.56E	308.27E	3171.56	.00	M
19	69.36	.00	.00	.00E	20.40	.00E	.00	74.25	228.48E	3038.71	.00	M
20	28.25	.00	.00	.00	.00	.00	.00E	72.99	225.51E	2542.34	.00E	M
21	25.13	.00E	.00	.00	.00	.00	.00	107.99	220.25	2215.91	.00	M
22	.00	.00E	.00E	.00	.00	.00	.00	148.02E	241.91	1889.47	.00E	M
23	.00E	.00E	.00E	.00	.00	.00	.00	522.09E	168.91	1586.35E	.00	M
24	.00E	.00E	.00	.00	.00	.00	.00	1846.83	194.83	1380.51E	.00	M
25	.00	.00	.00	.00	.00	.00	.00E	1503.73	155.27	1257.46E	.00	M
26	.00E	.00	.00	.00	.00	.00	201.79	3300.77	154.32E	1097.77	.00	M
27	.00	.00E	.00	.00	.00	.00	362.83E	813.59	153.41E	1034.50	.00	M
28	.00E	.00	.00	.00	.00E	.00	234.22	661.70E	76.77	929.27	.00	M
29	.00		.00	.00E	.00	.00E	217.31E	363.50E	.00	820.54	.00	M
30	35.89E		.00E	.00	.00	2.63E	170.63	560.00E	.00	563.03	.00	M
31	.00		.00E		.00E		204.90	482.47E		452.99		M
MAX	260.25	0.09	49.80	1.91E	20.40	2.63E	382.41E	1846.83	960.73	3171.56	448.72	0.06
MEAN	60.75	0.01	1.62	0.09	0.88	0.09	98.96	552.45	354.40	878.55	90.00	0.00M
MIN	0.00E	0.00E	0.00	0.00	0.00	0.00E	0.00	72.99	0.00	0.00	0.00E	0.00
SUM	1883.19	0.23	50.07	2.78	27.21	2.63	3067.63	17126.04	10632.12	27235.01	2702.41	0.06M

**** DATA IS PROVISIONAL AFTER ****

DATA TAG LEGEND

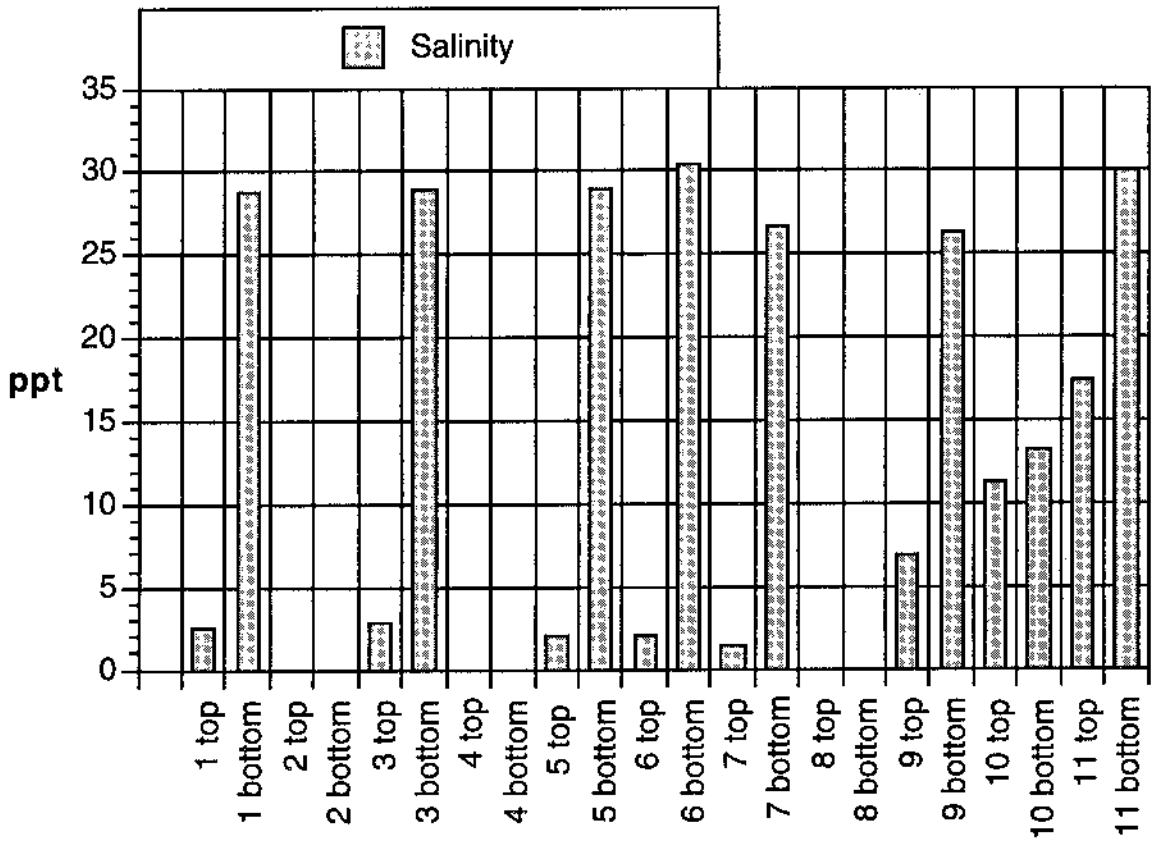
- M – MISSING DATA
- S – ORIGINAL HAD MORE THAN 4 SIGNIFICANT DIGITS
- L – LINE AVERAGE
- ? – QUESTIONABLE
- > – GREATER THAN
- T – TRACE AMOUNT
- G – AMOUNT ACCUMULATED WAS GREATER THAN

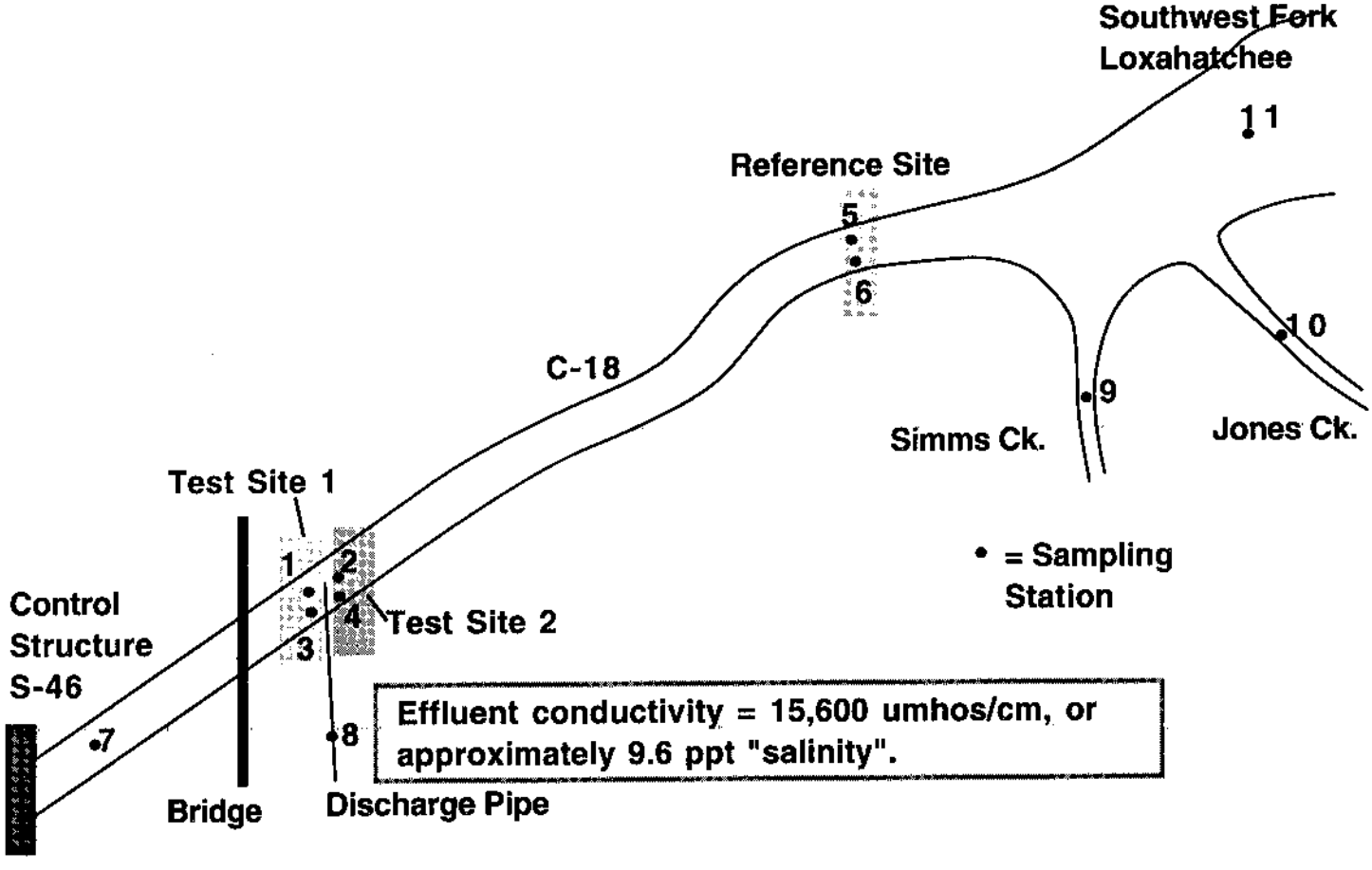
DATA TAG LEGEND

- P – SUMMARY COMPUTED FROM PARTIAL RECORD
- E – ESTIMATED
- < – LESS THAN
- A – INCLUDES PREVIOUS DAYS WITH X
- X – INCLUDED IN NEXT AMOUNT TAGGED A
- R – RAINFALL WAS RECORDED

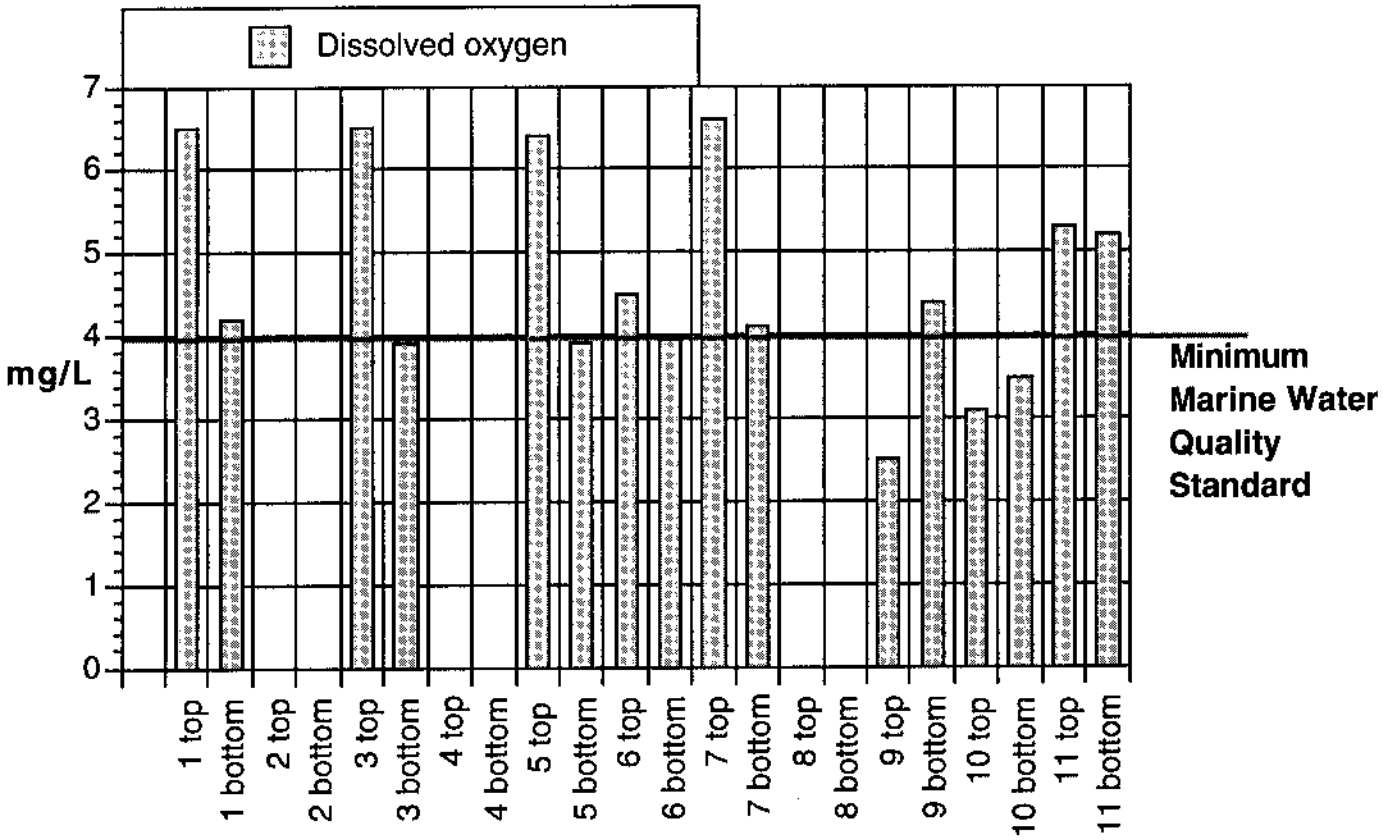
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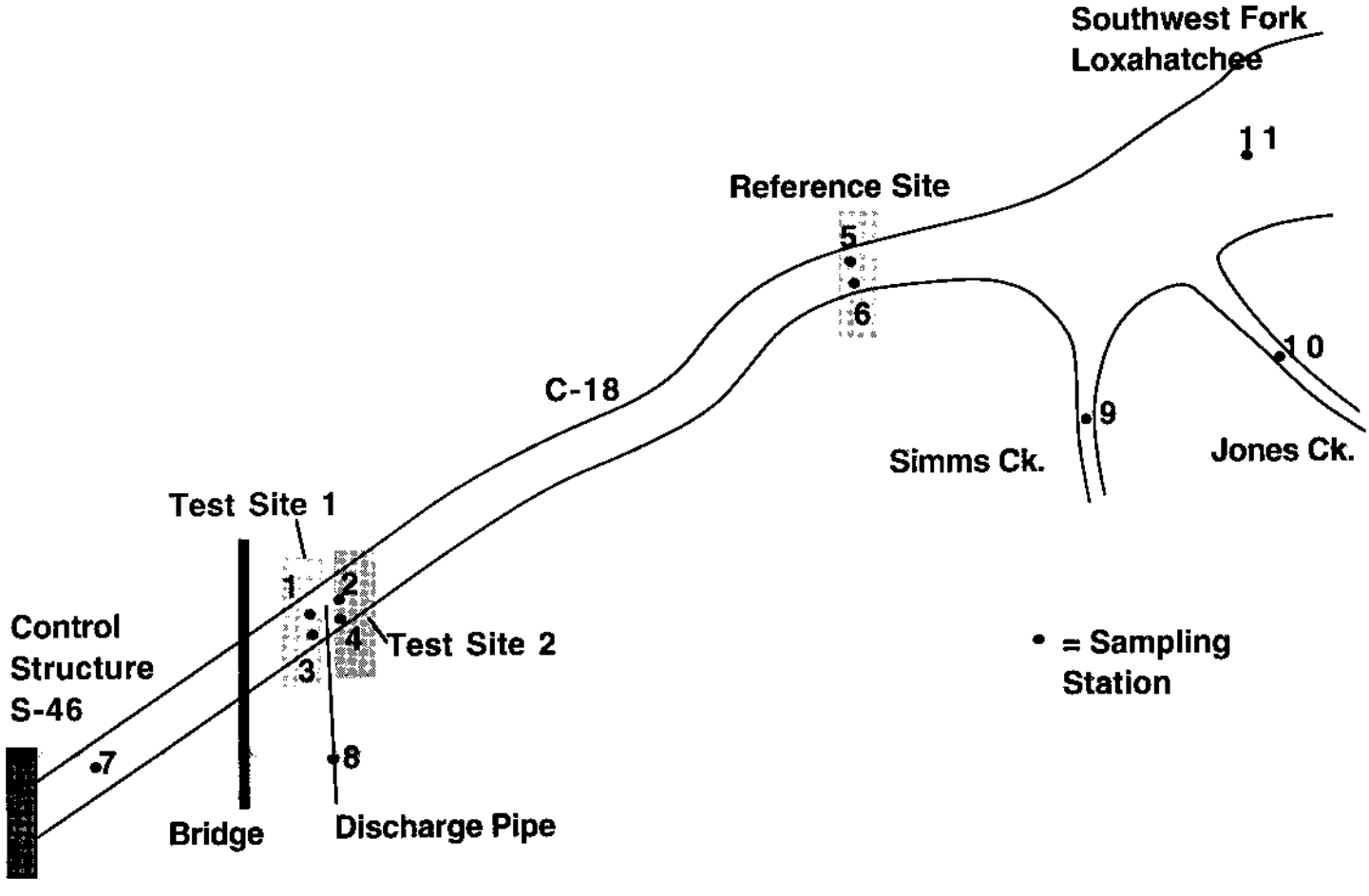
Jupiter RO Bioassessment Study – Salinity data.



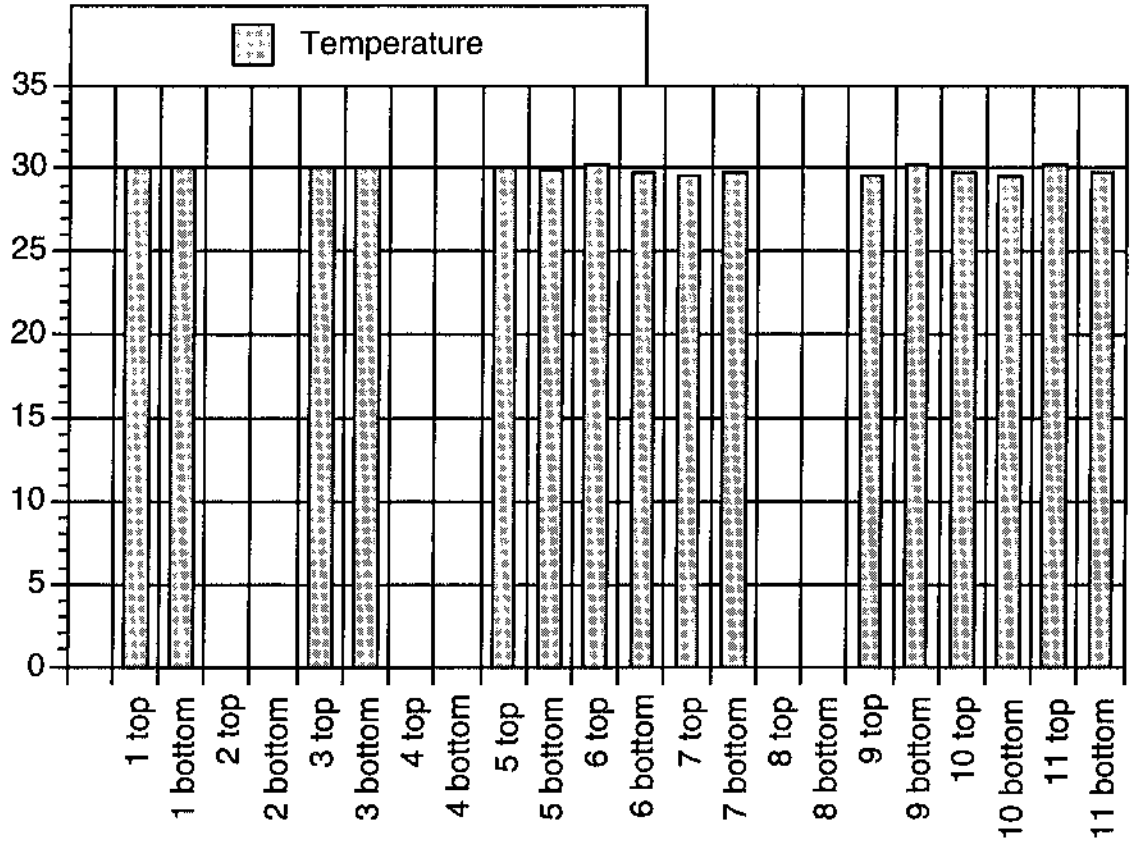


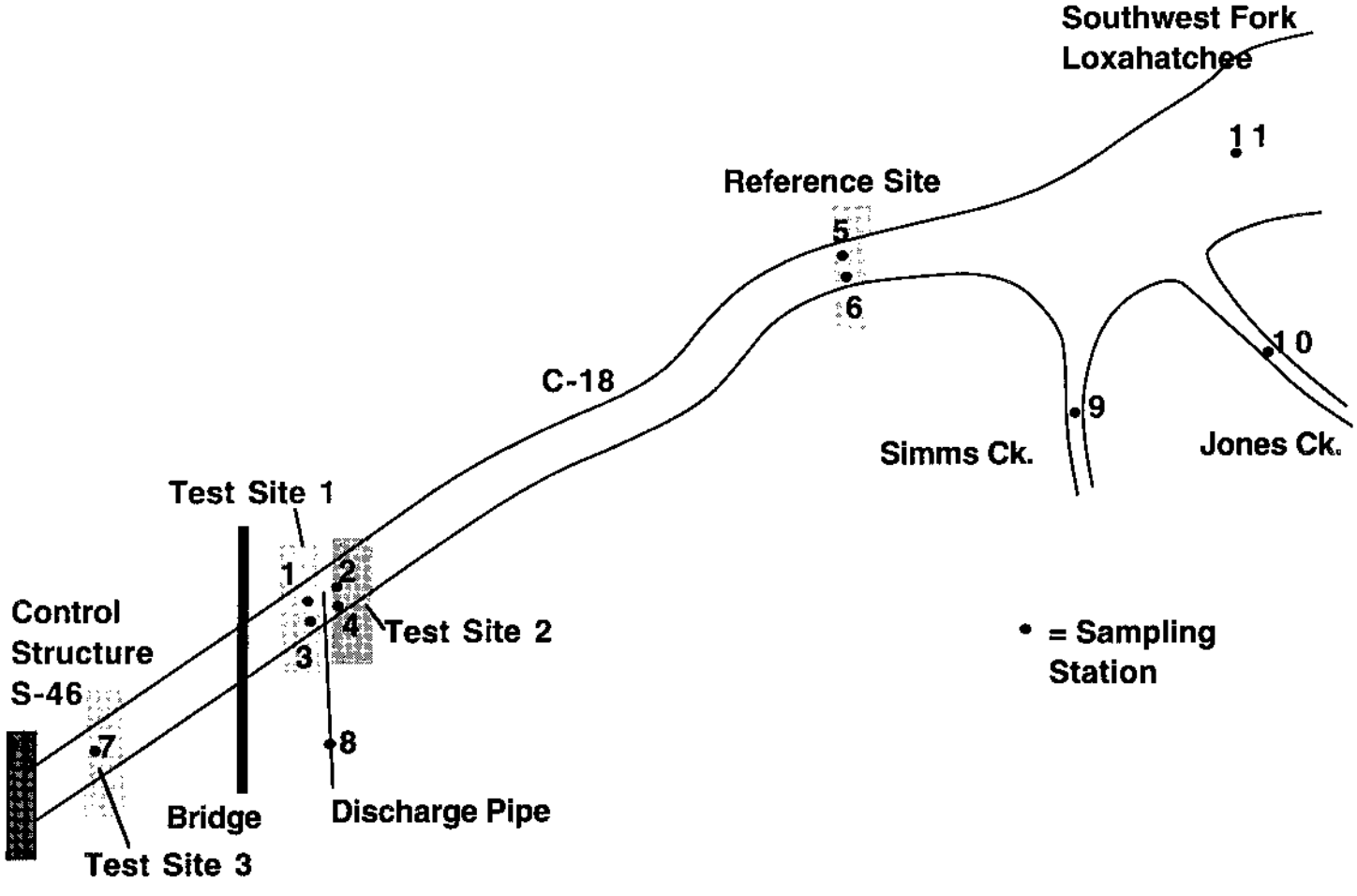
Jupiter RO Bioassessment Study – Dissolved Oxygen Data.



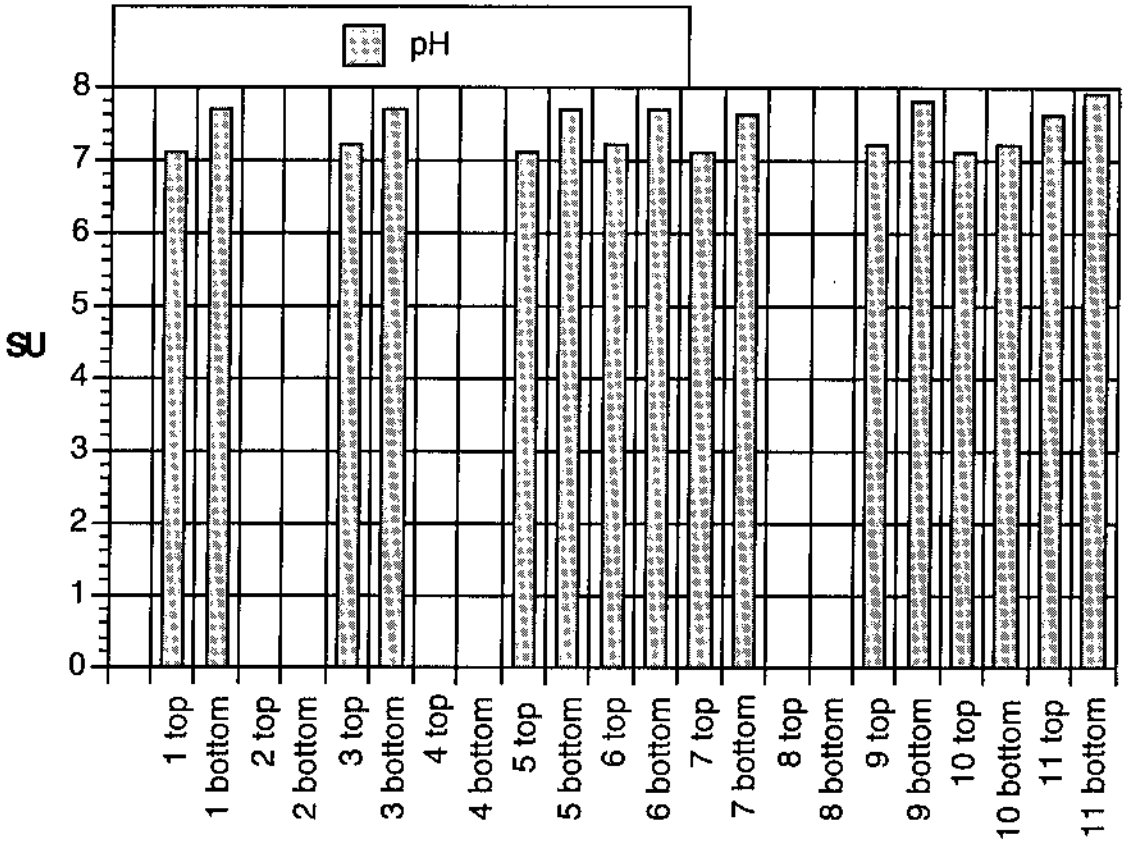


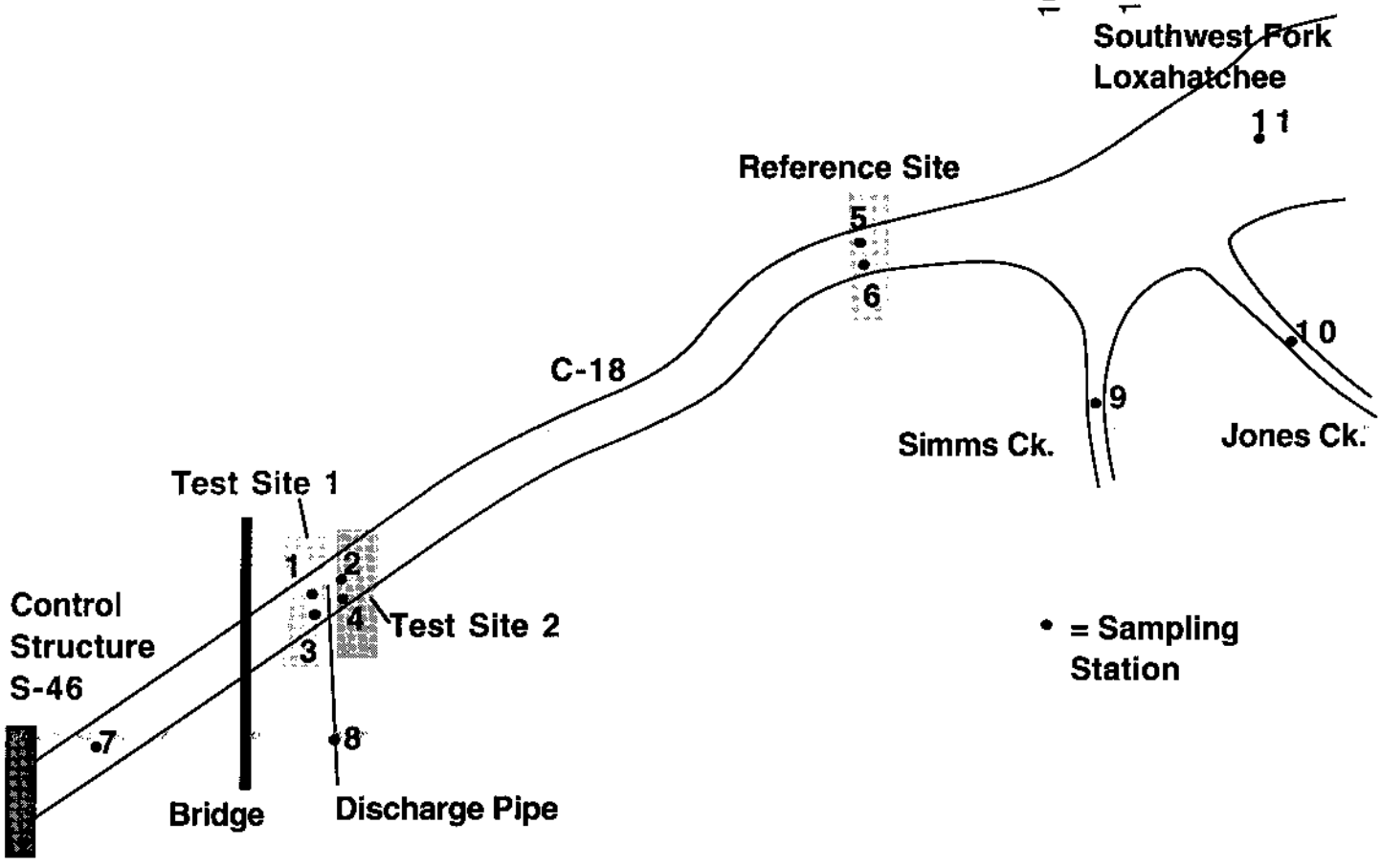
Jupiter RO Bioassessment Study – Temperature data



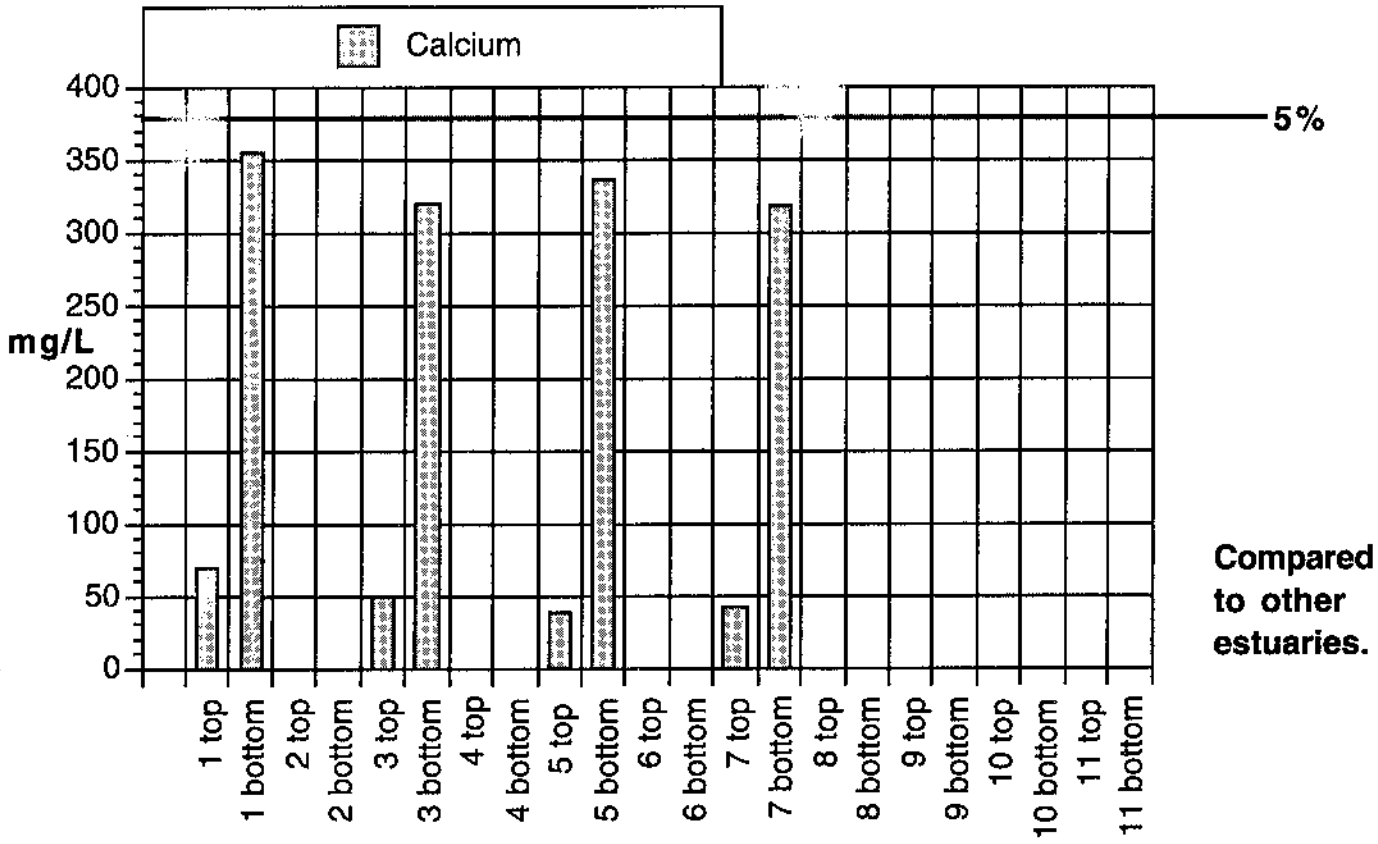


Jupiter RO Bioassessment Study – pH data.

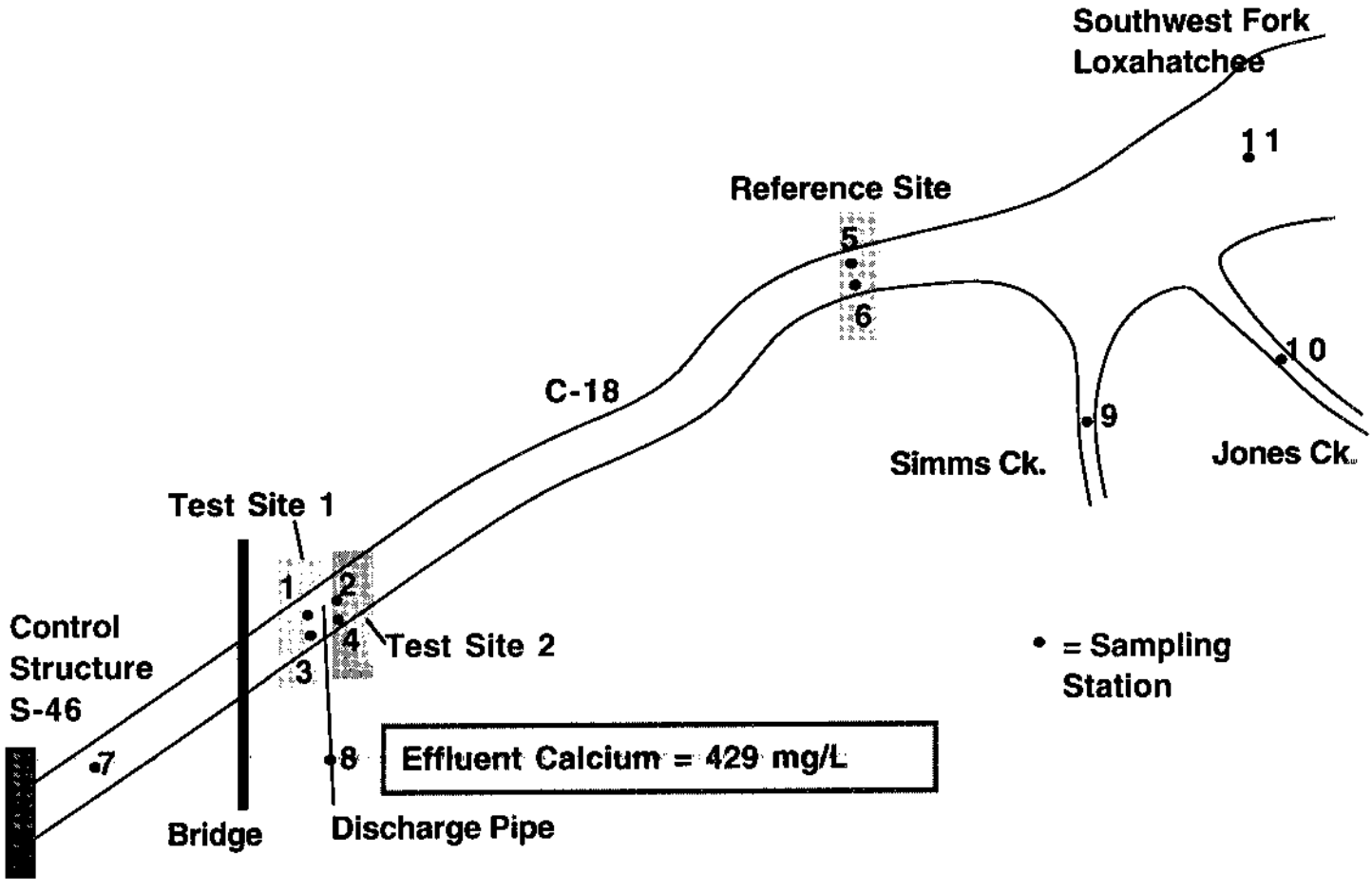




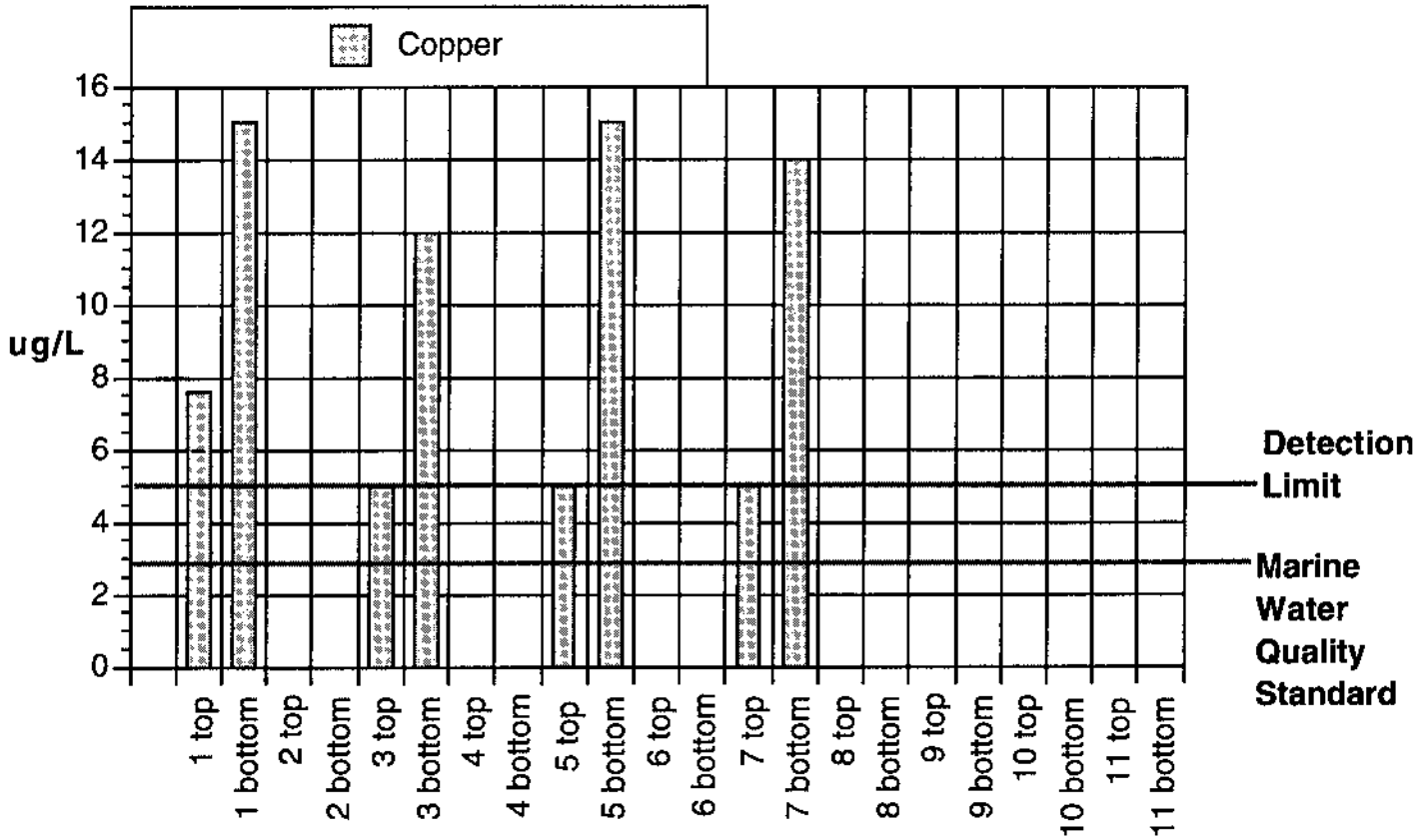
Jupiter RO Bioassessment Study – Calcium Data

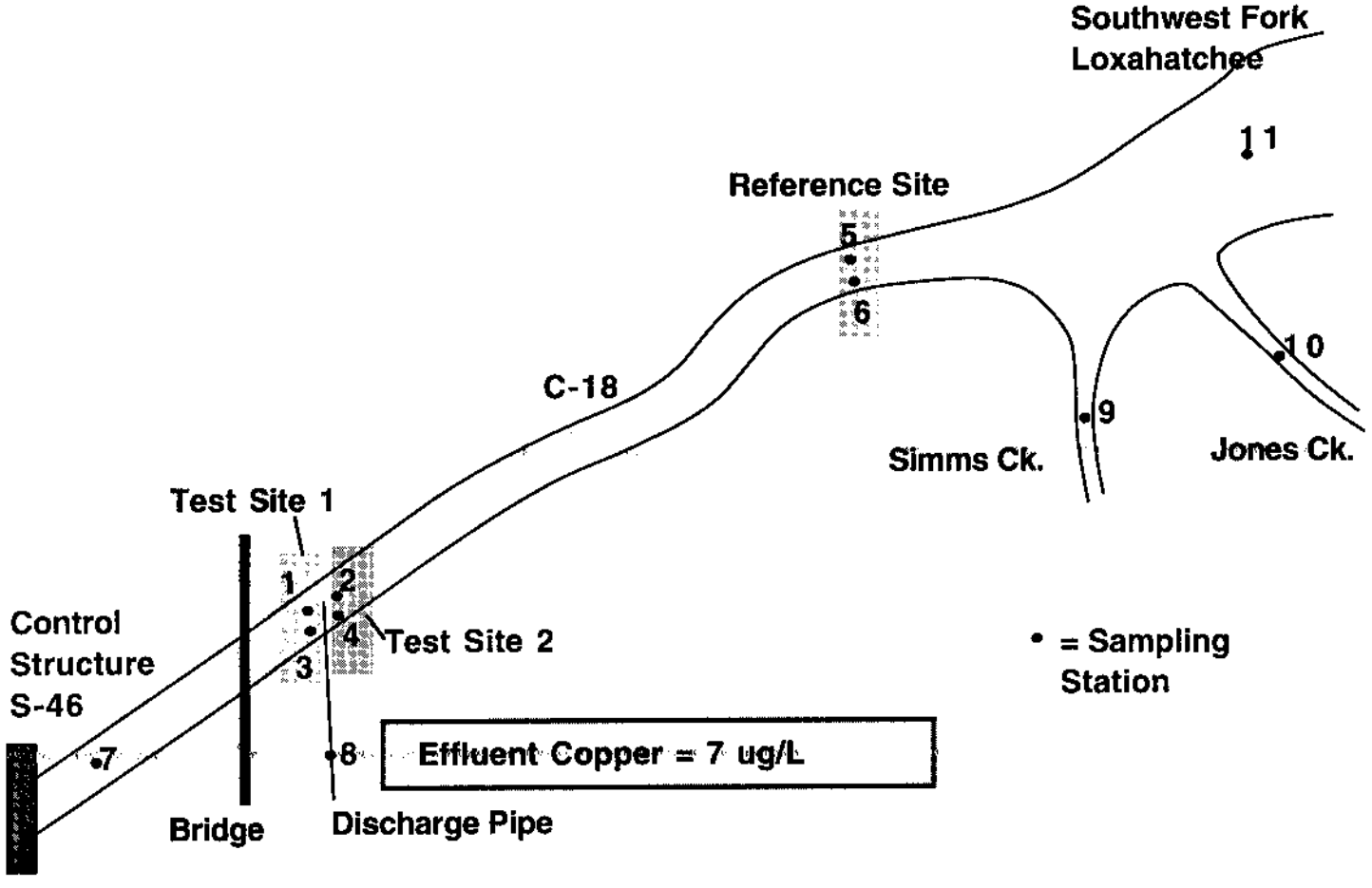


Compared to other estuaries.

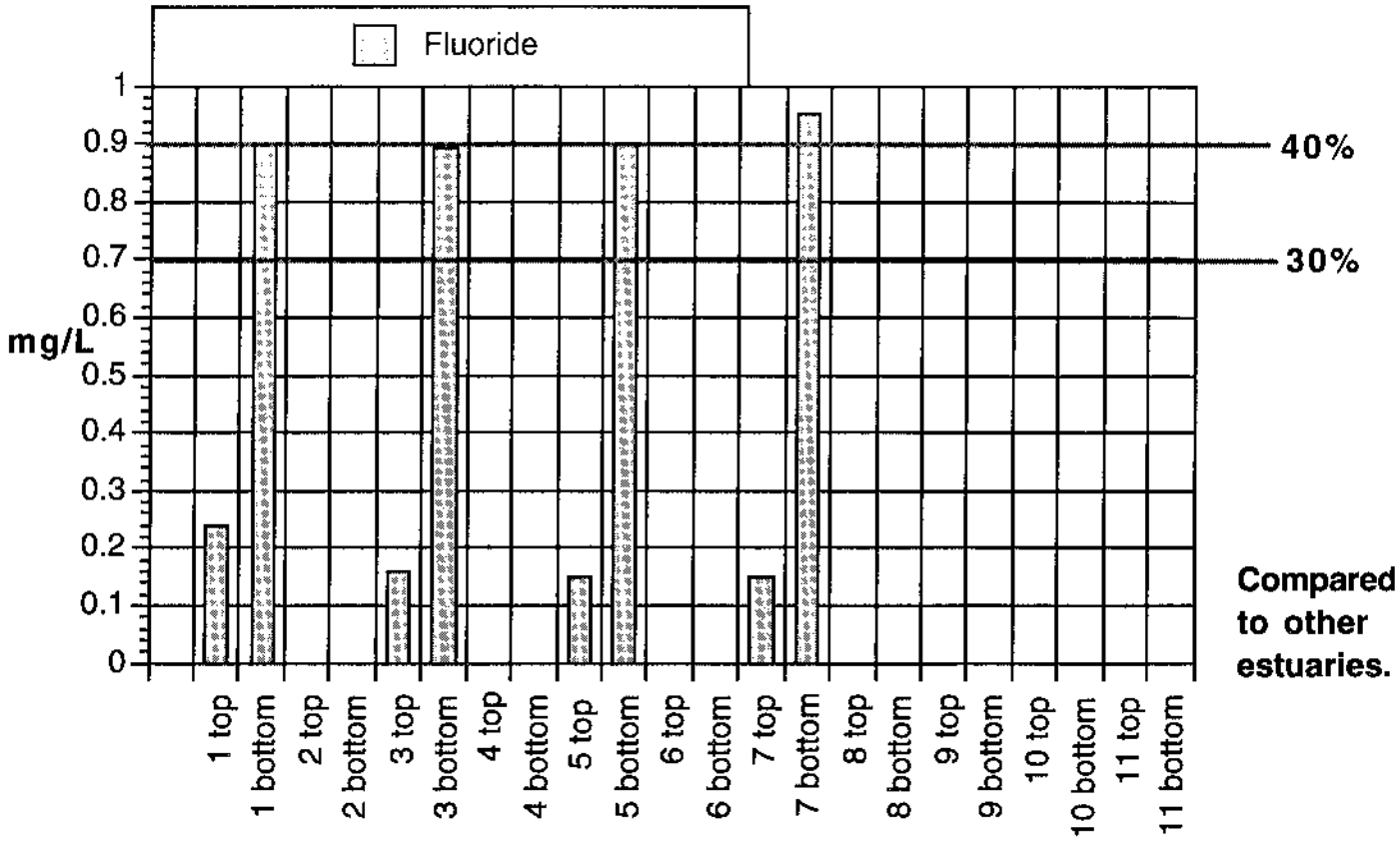


Jupiter RO Bioassessment Study – Copper Data

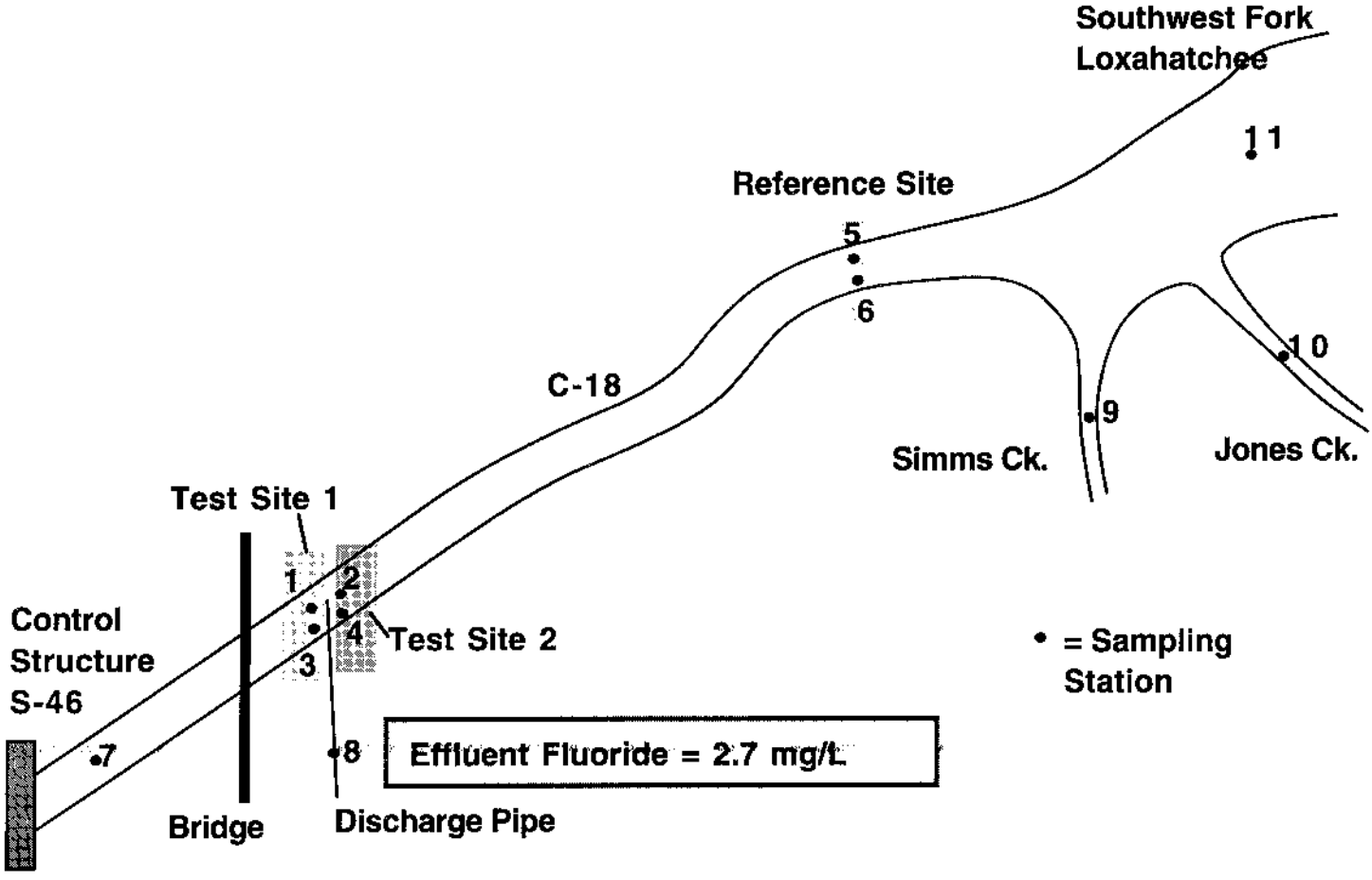




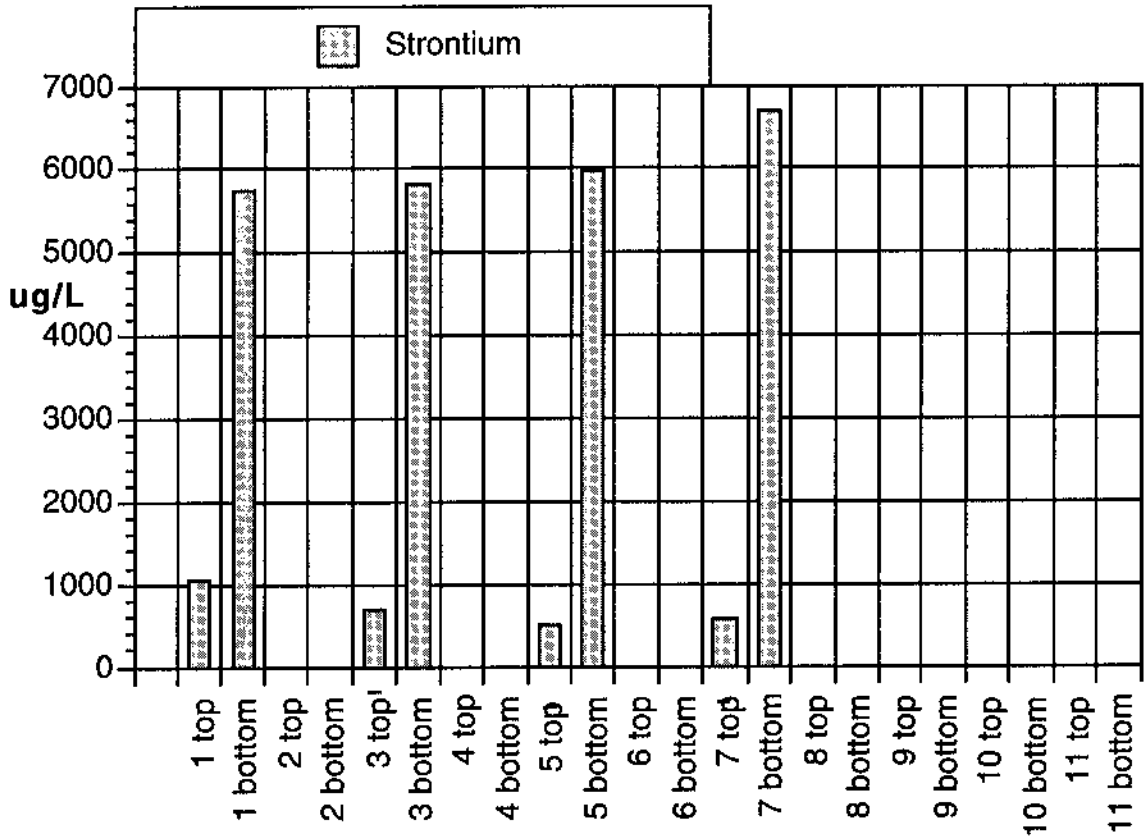
Jupiter RO Bioassessment Study – Fluoride Data

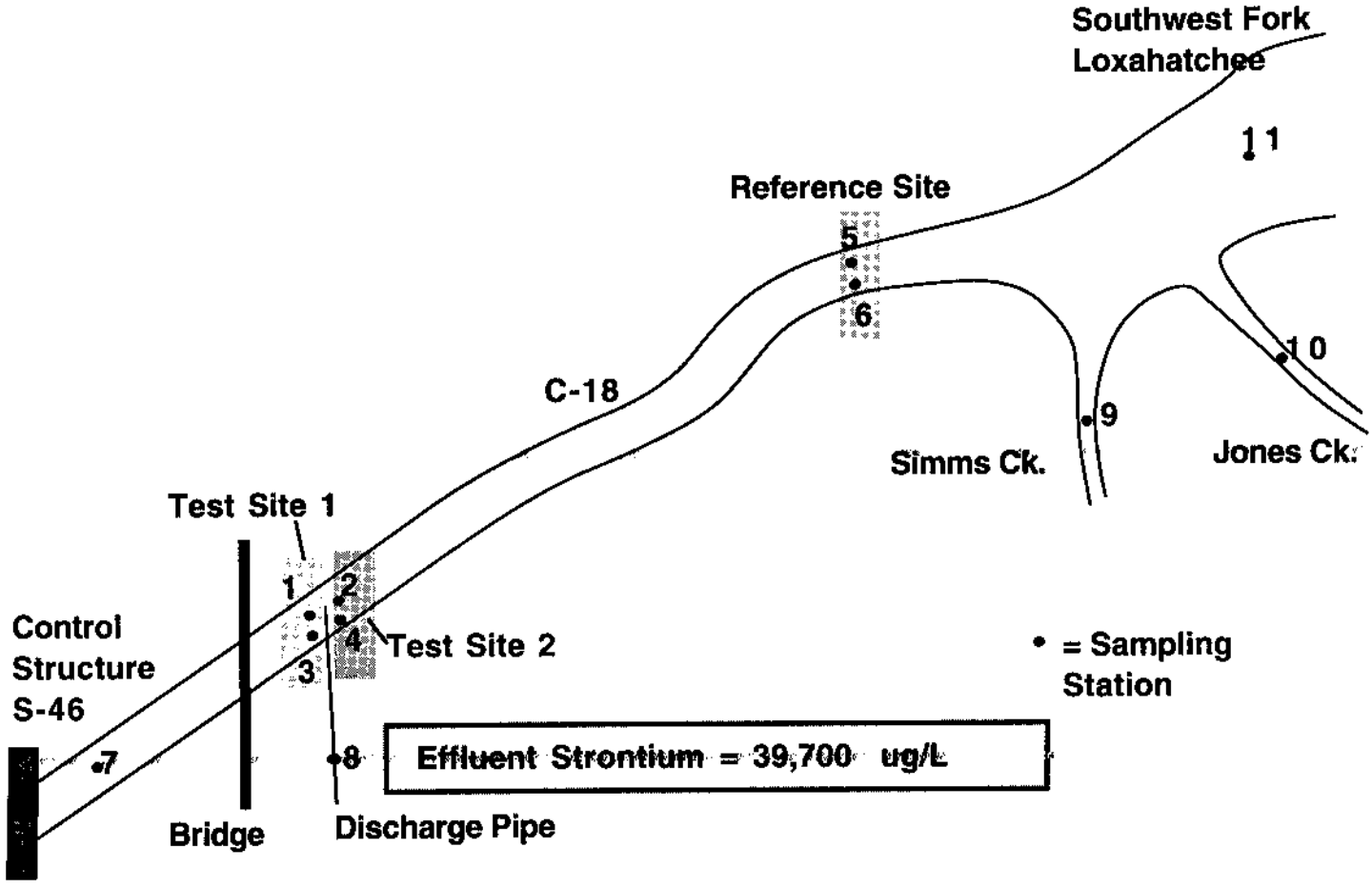


Compared to other estuaries.

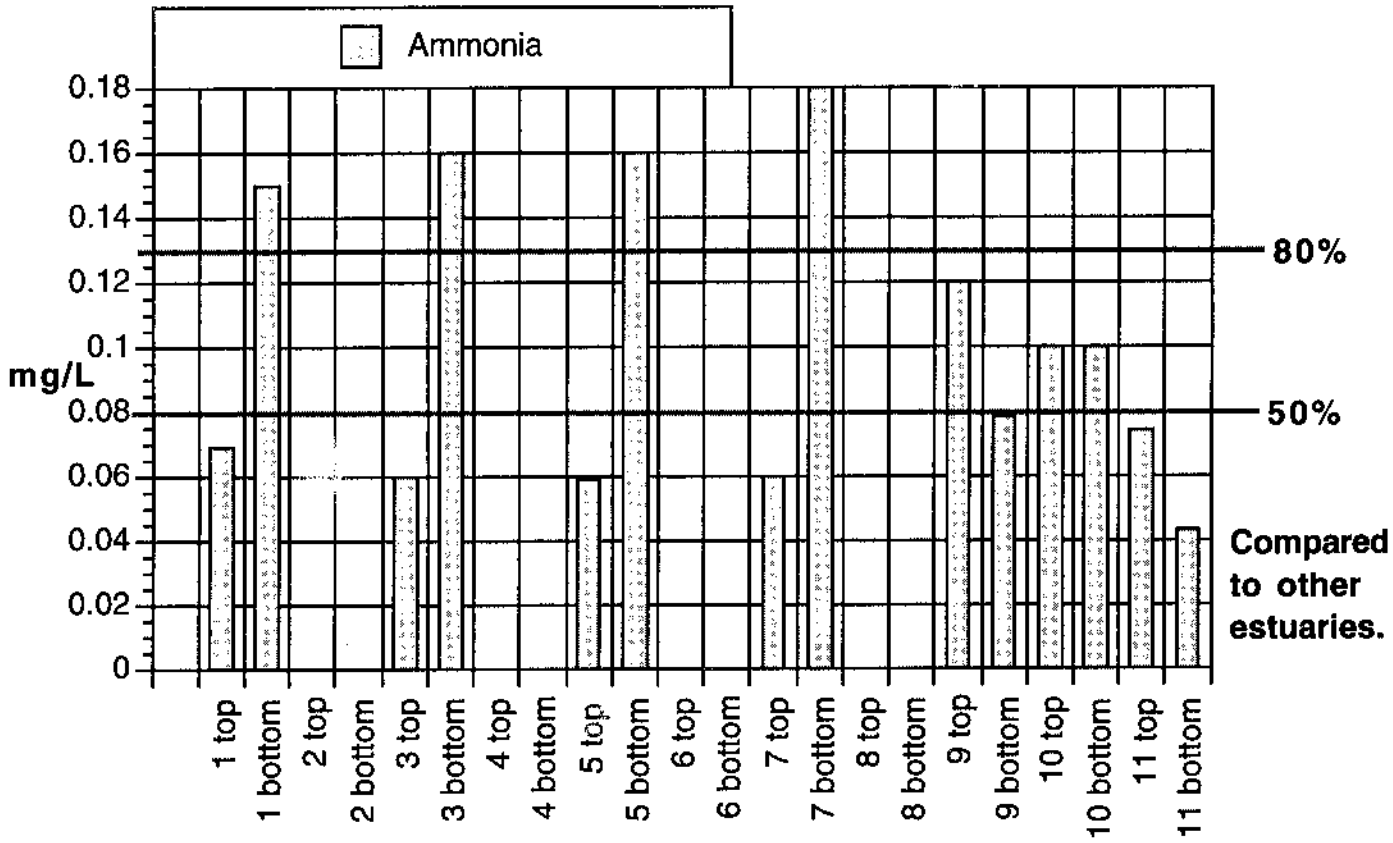


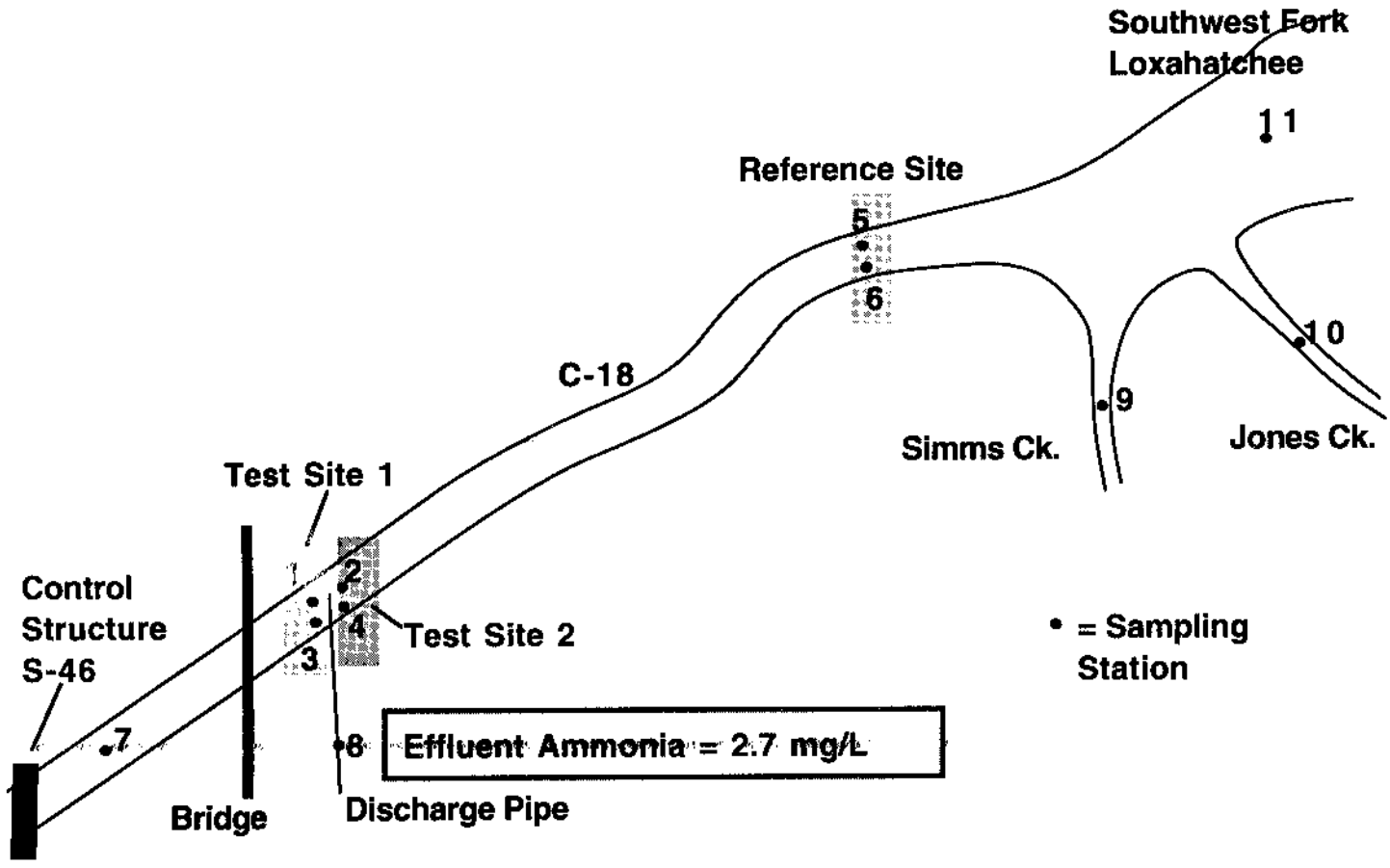
Jupiter RO Bioassessment Study – Strontium Data



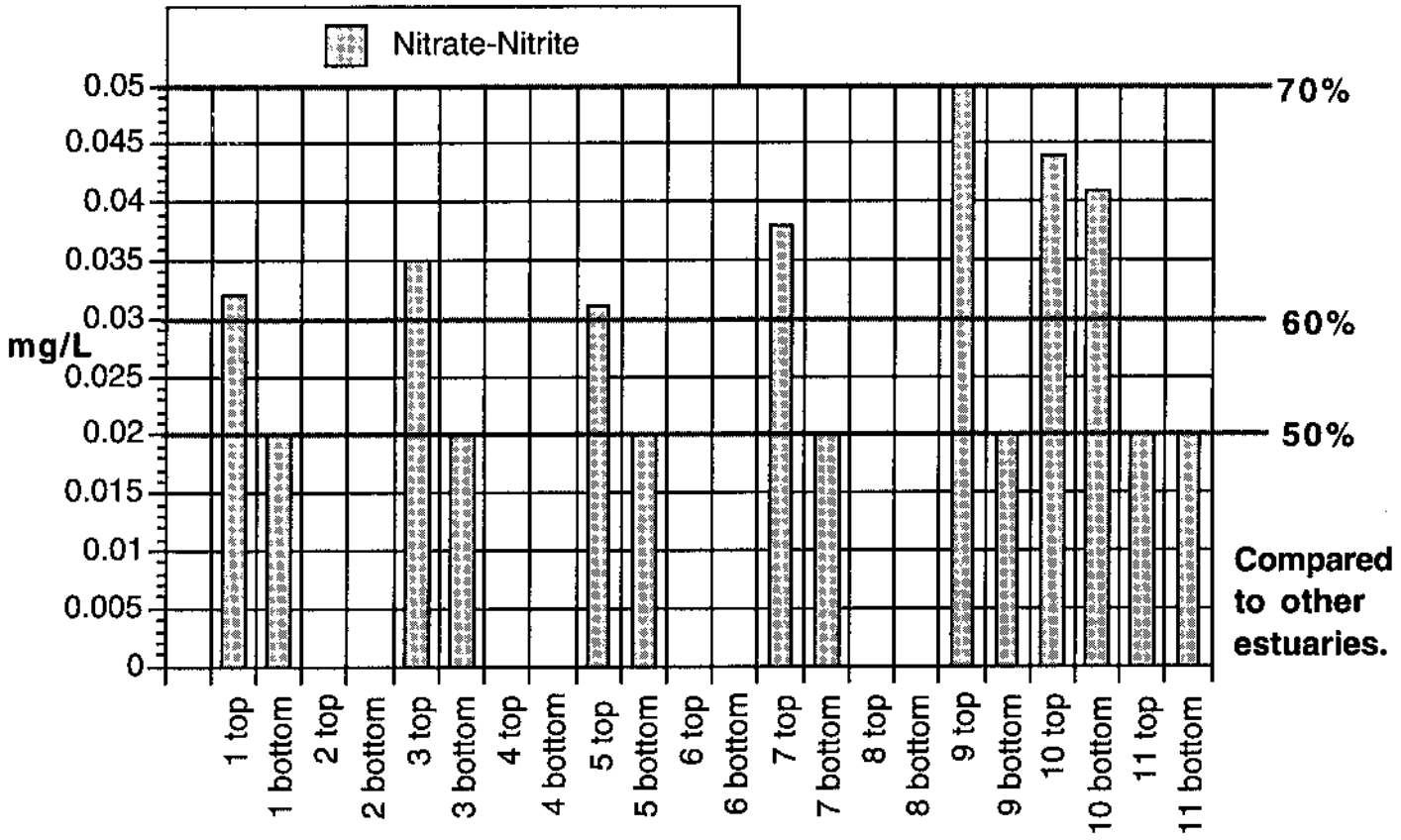


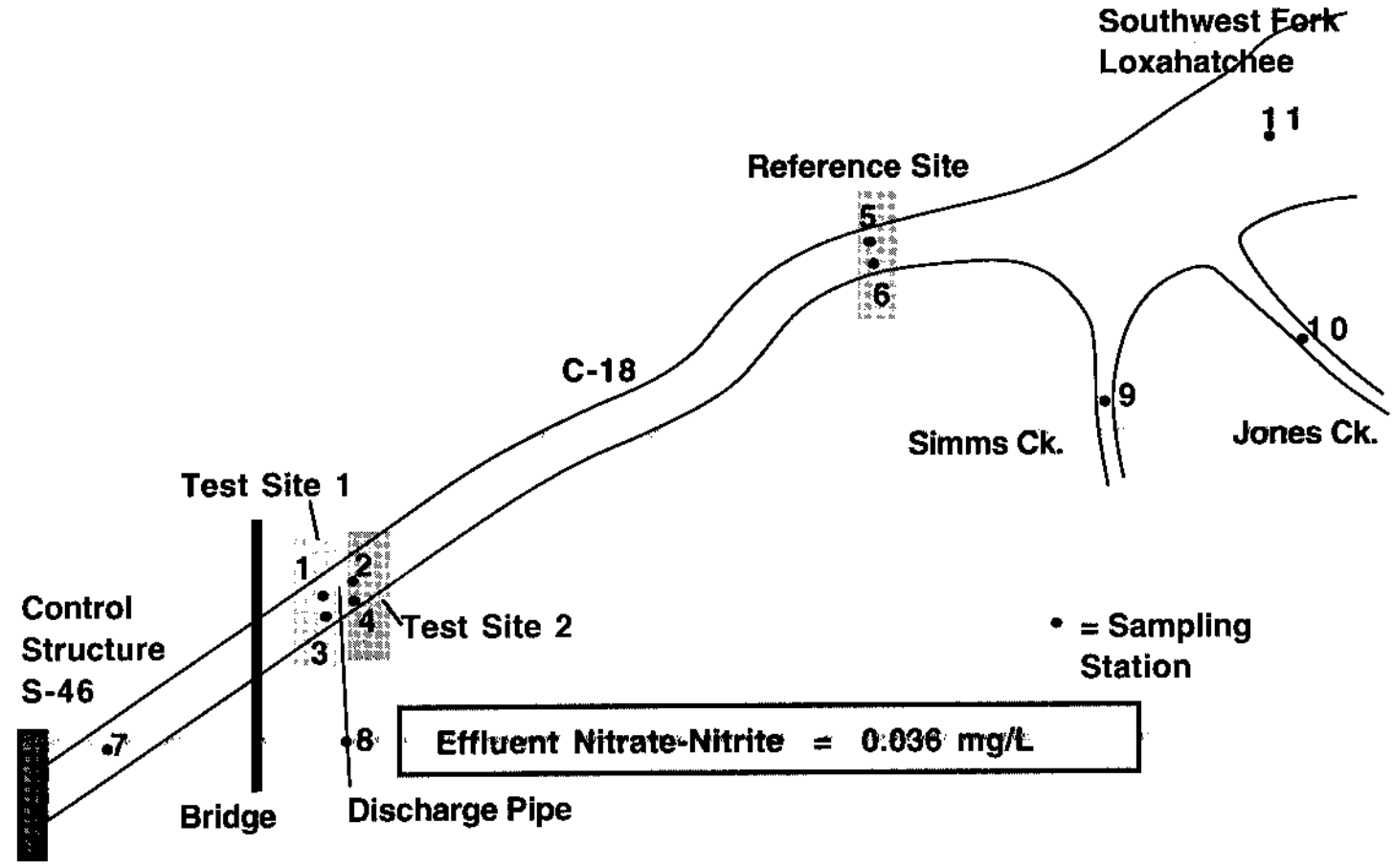
Jupiter RO Bioassessment Study – Ammonia Data



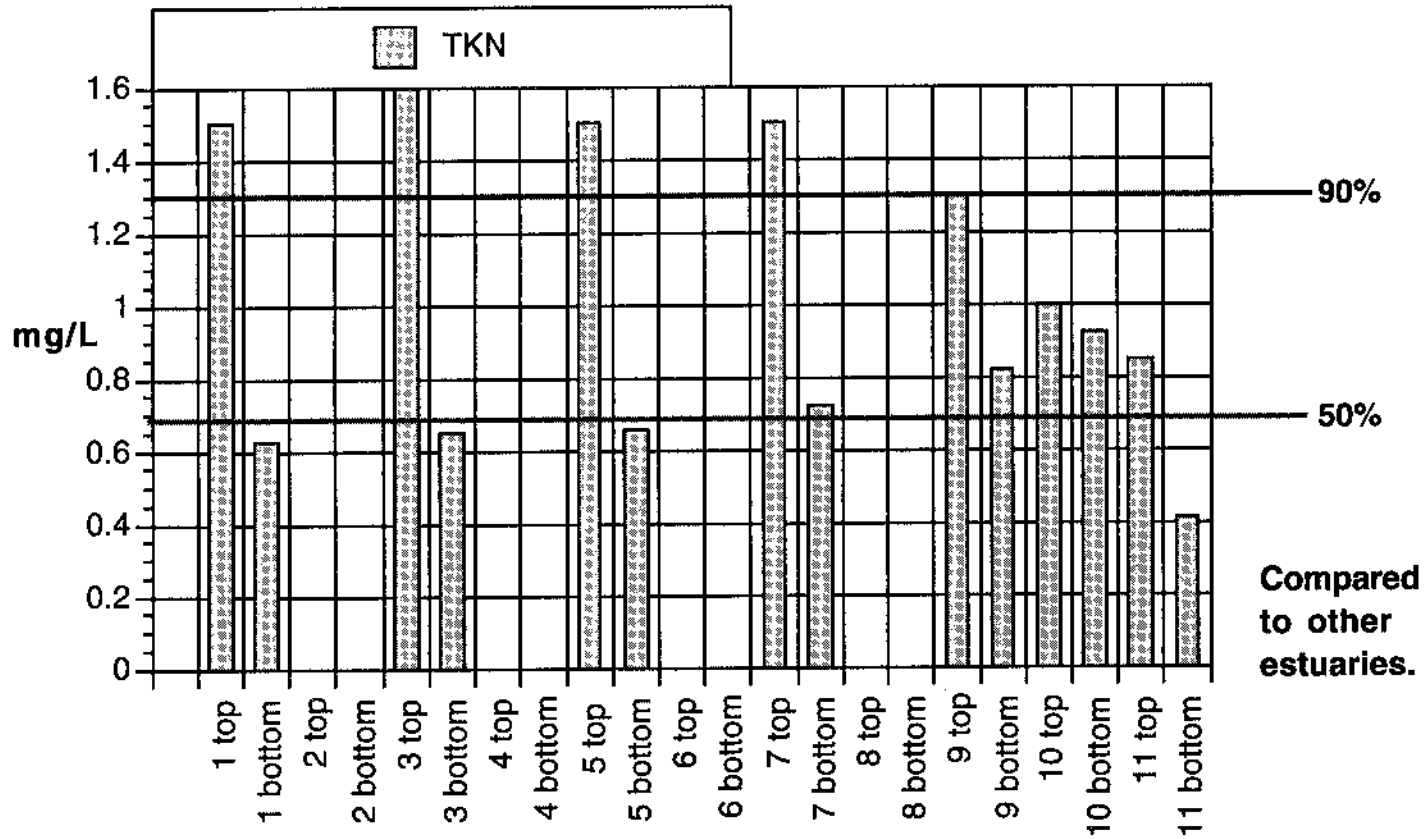


Jupiter RO Bioassessment Study – Nitrate-Nitrite Data

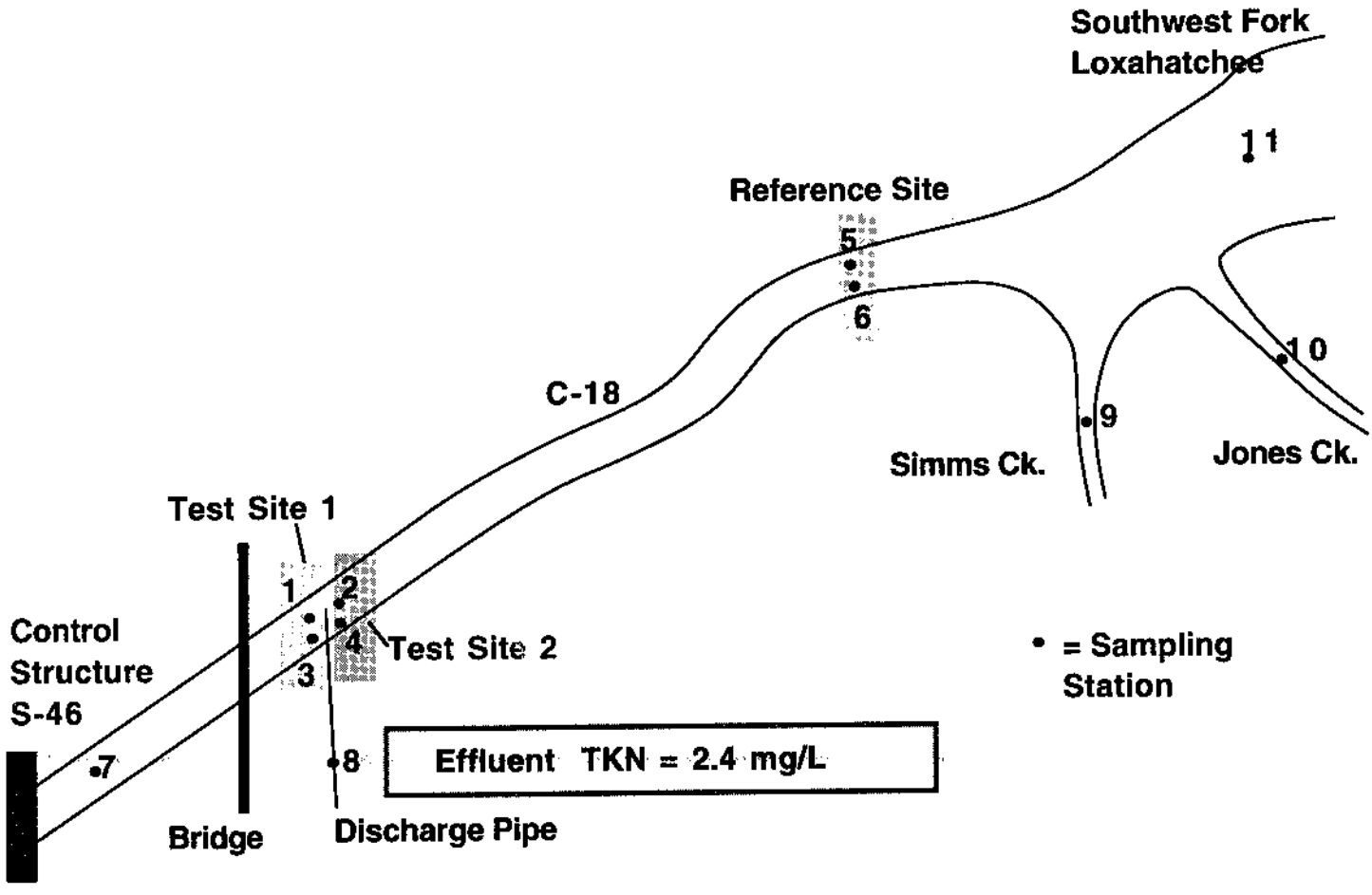




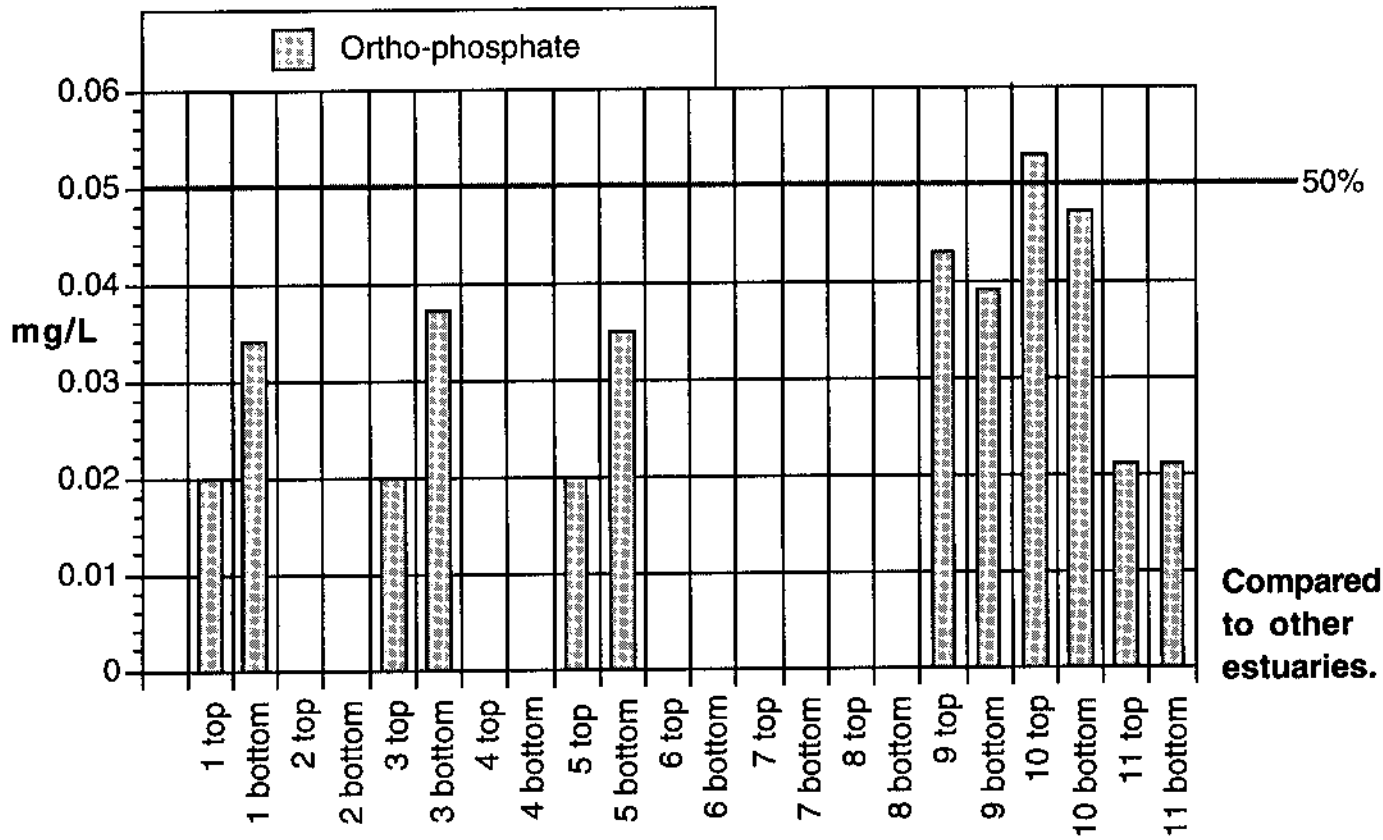
Jupiter RO Bioassessment Study – TKN Data



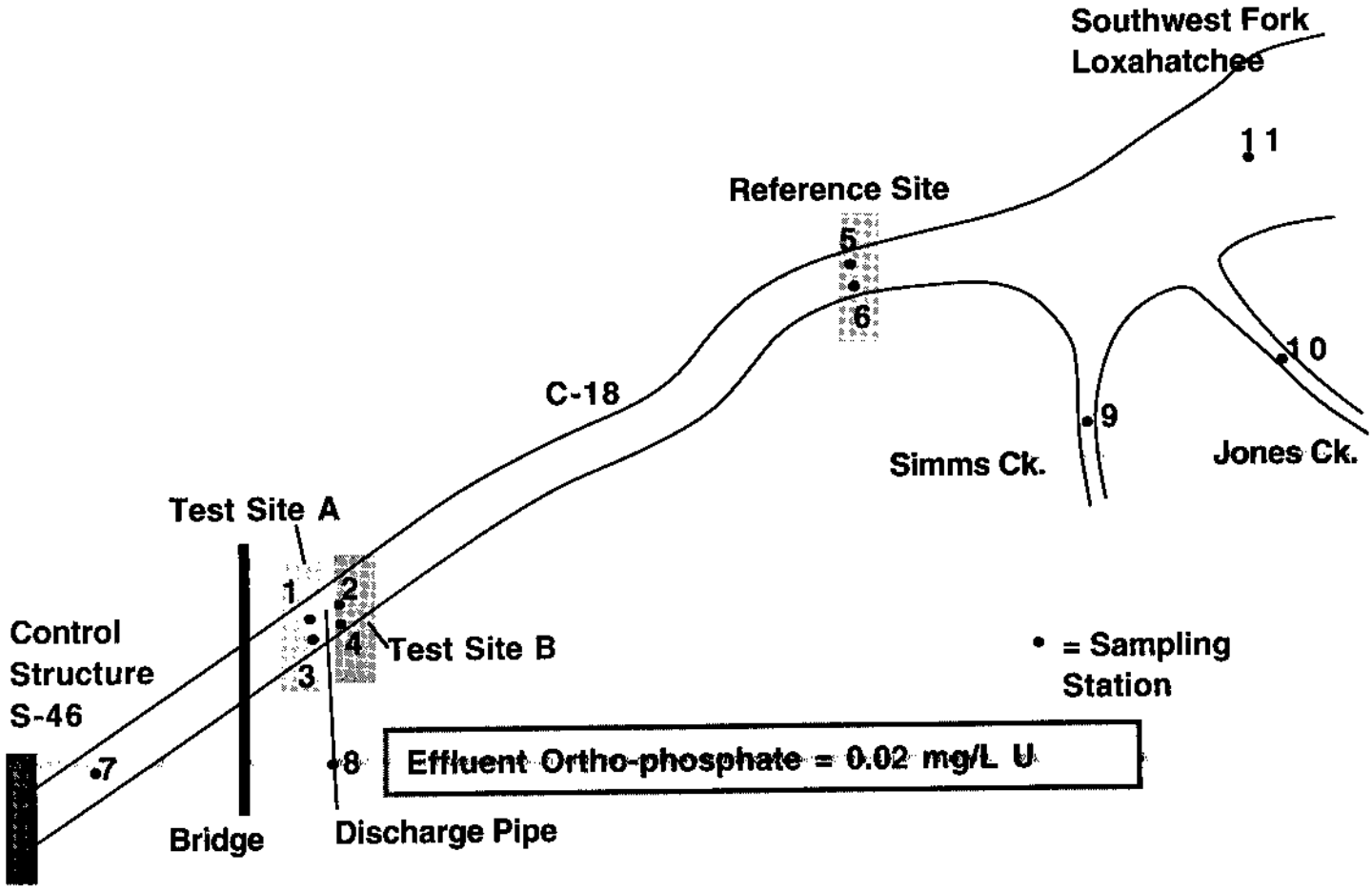
Compared to other estuaries.



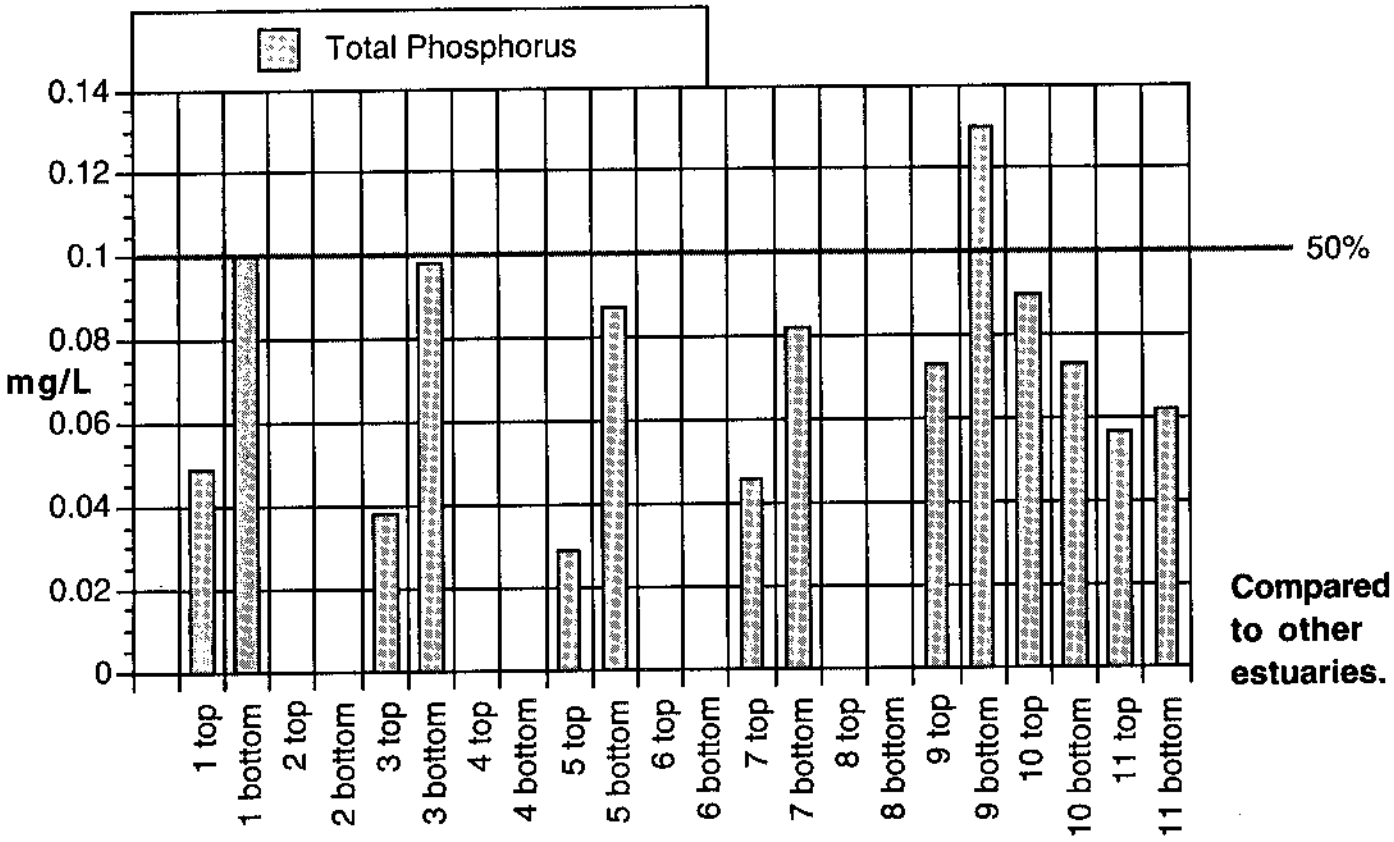
Jupiter RO Bioassessment Study – Ortho-phosphate Data



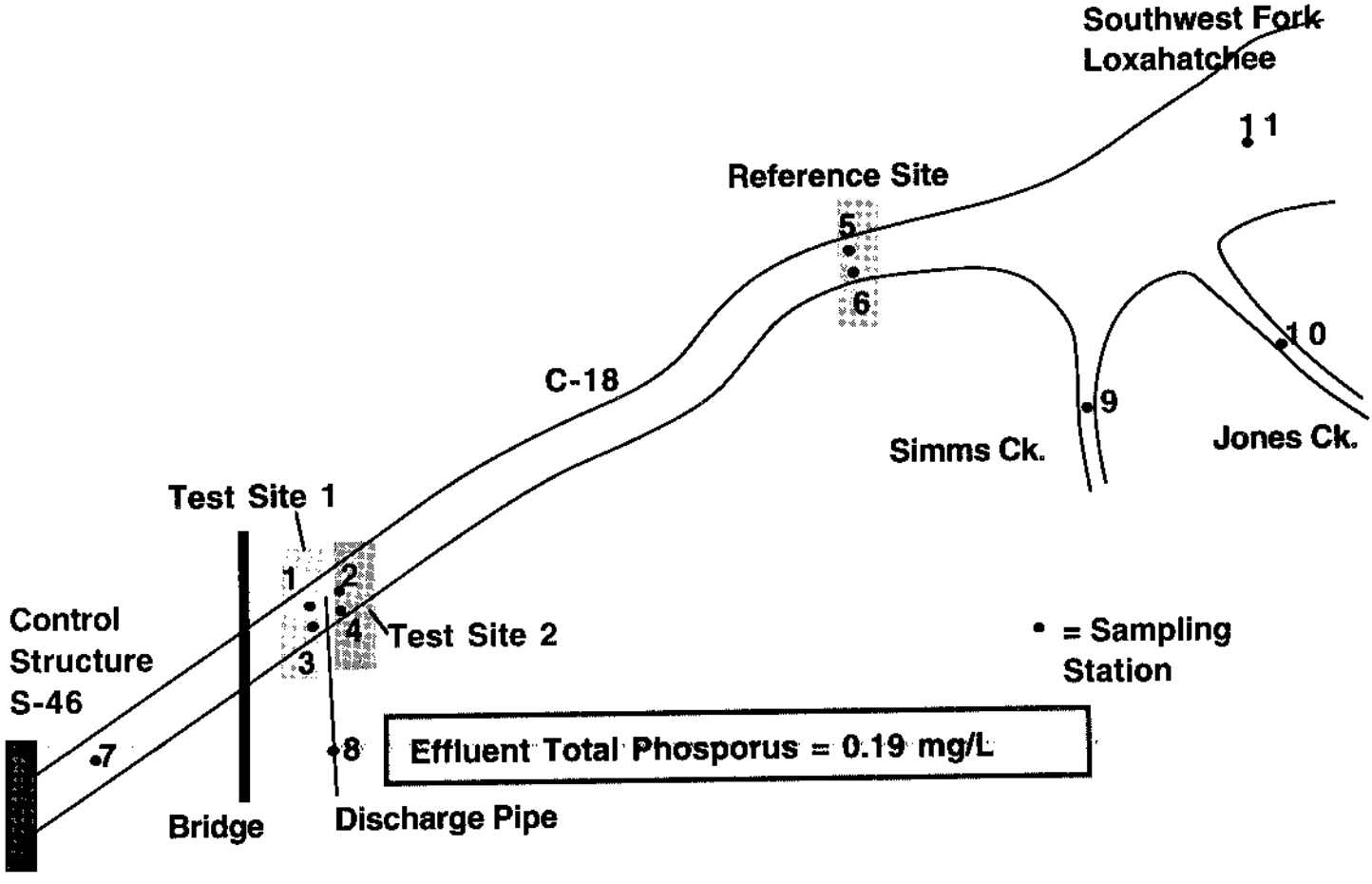
Compared to other estuaries.



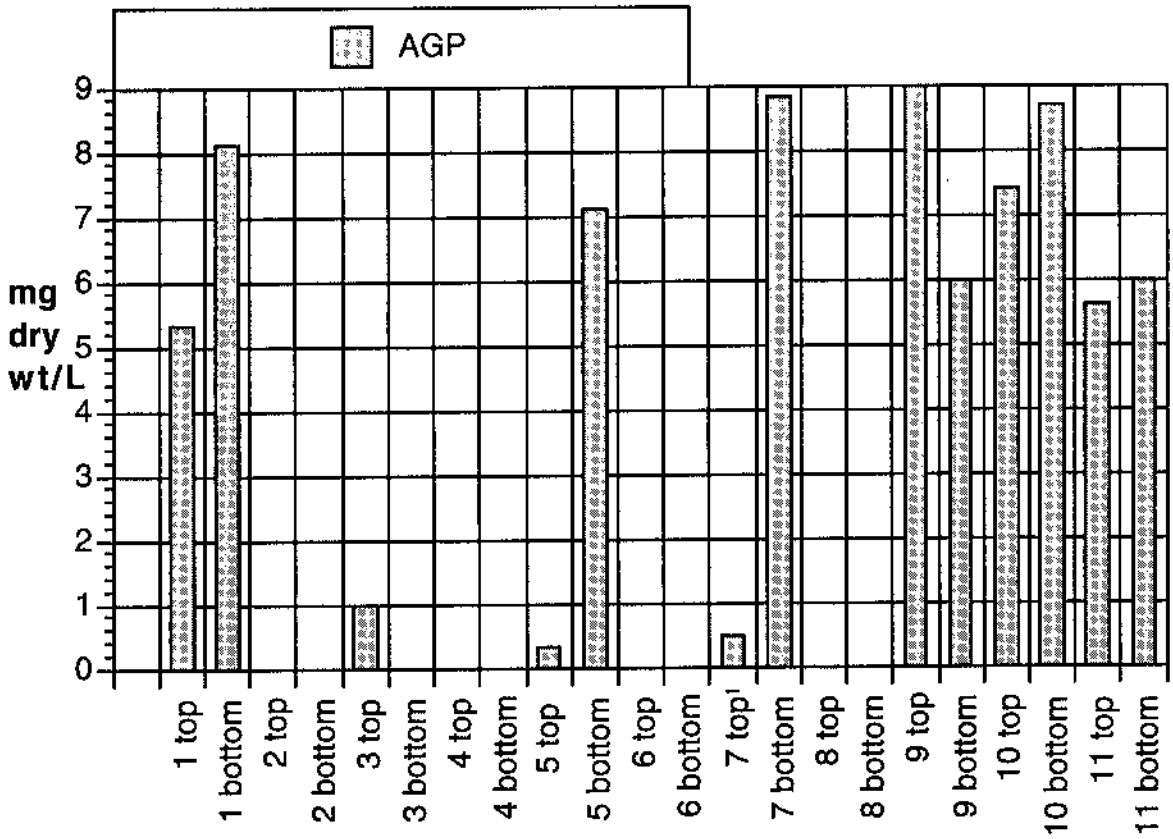
Jupiter RO Bioassessment Study – Total Phosphorus Data



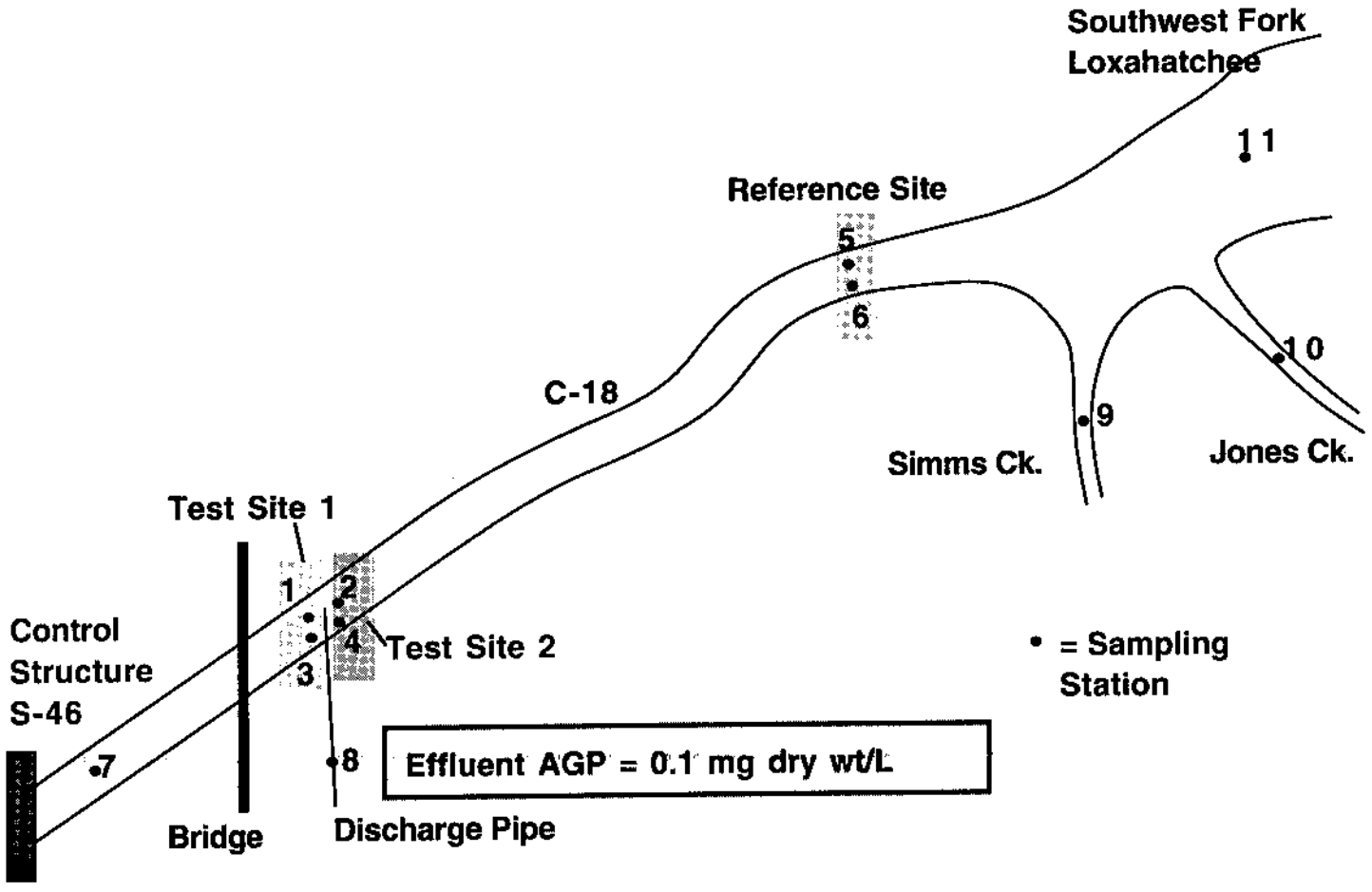
Compared to other estuaries.



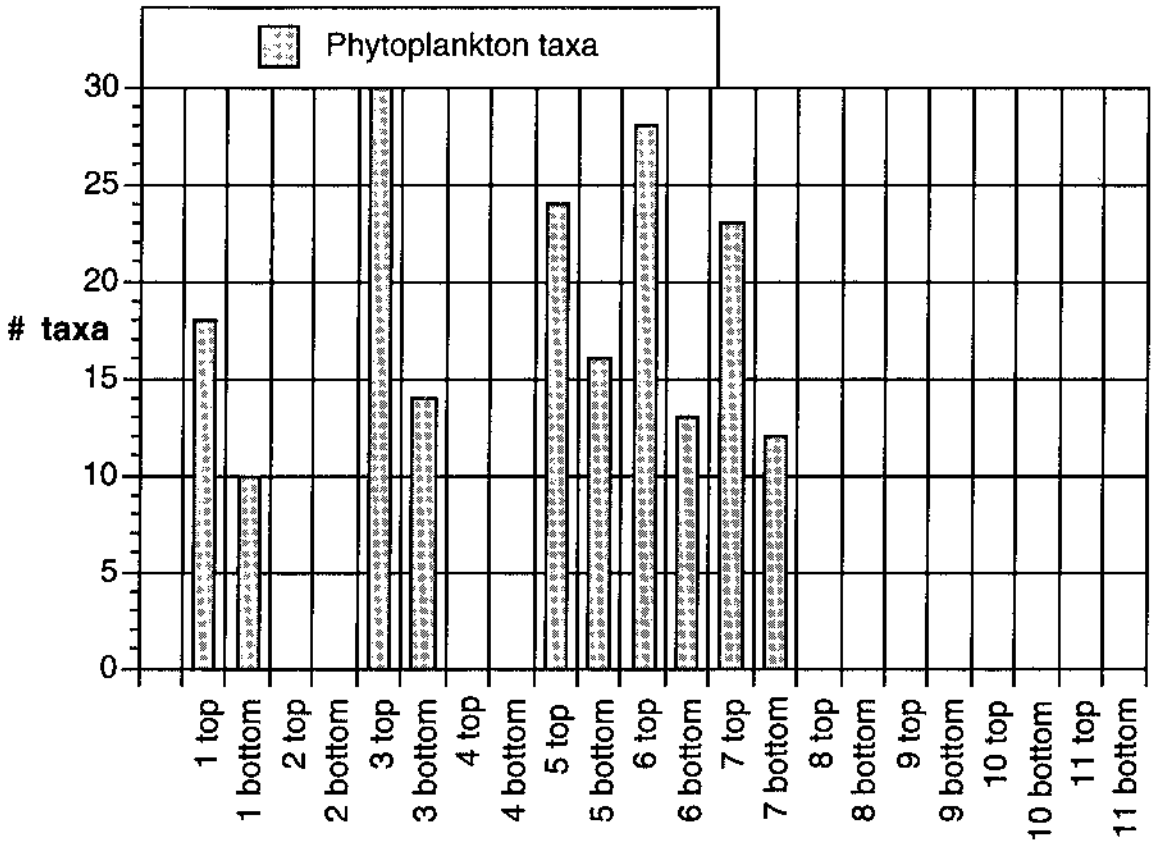
Jupiter RO Bioassessment Study -- Algal Growth Potential Data

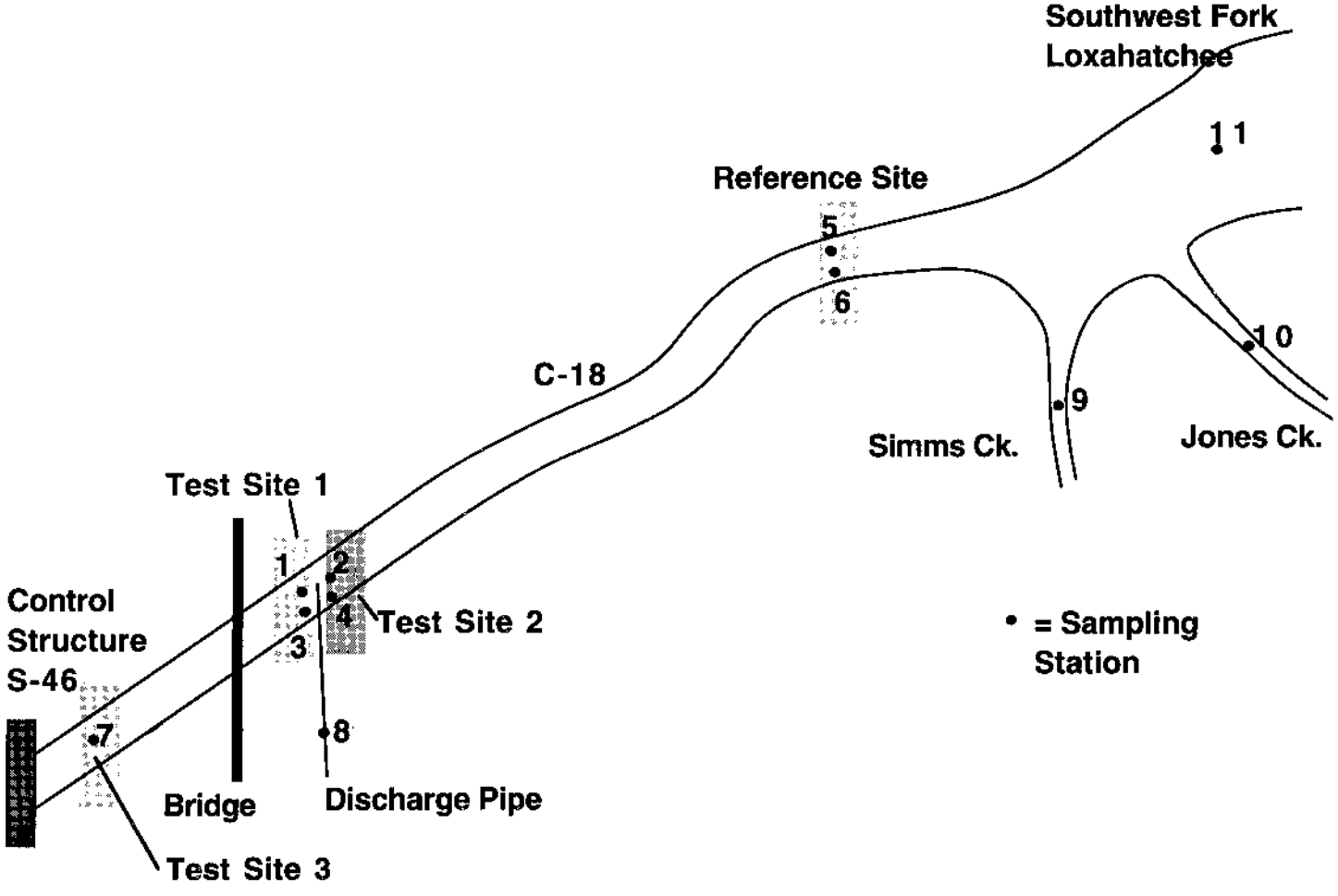


All values below marine problem threshold of 10 mg dry wt/L.

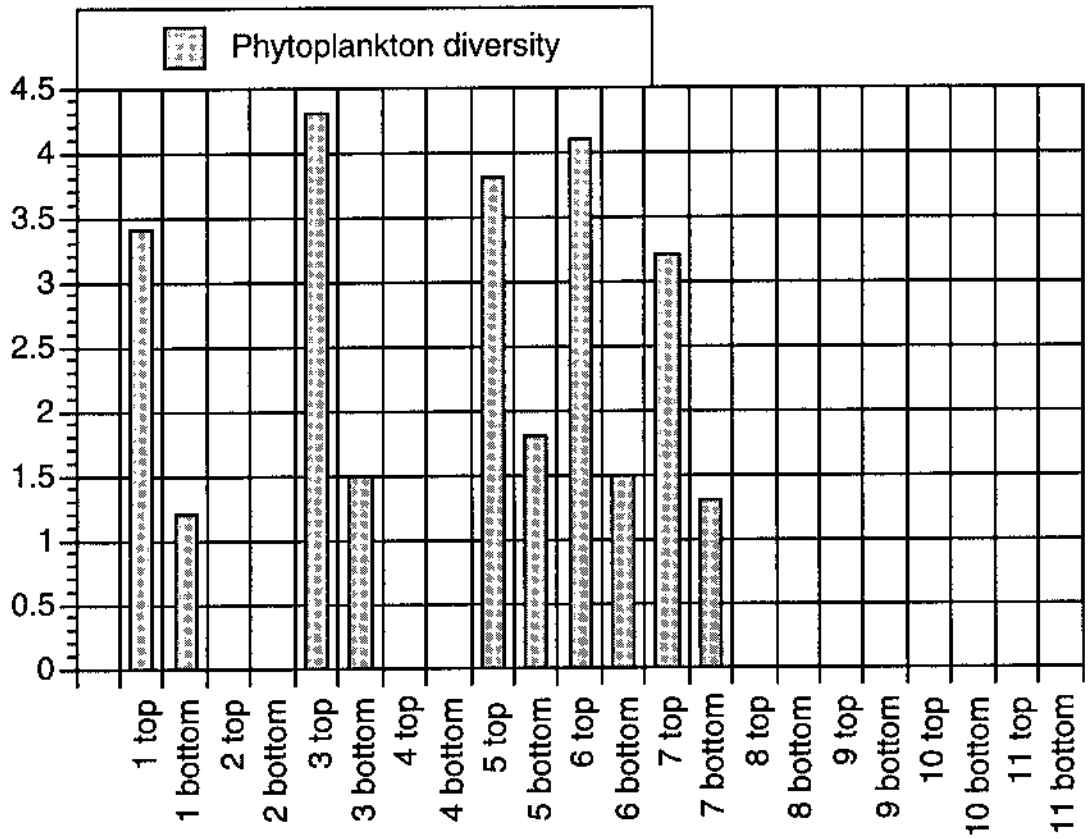


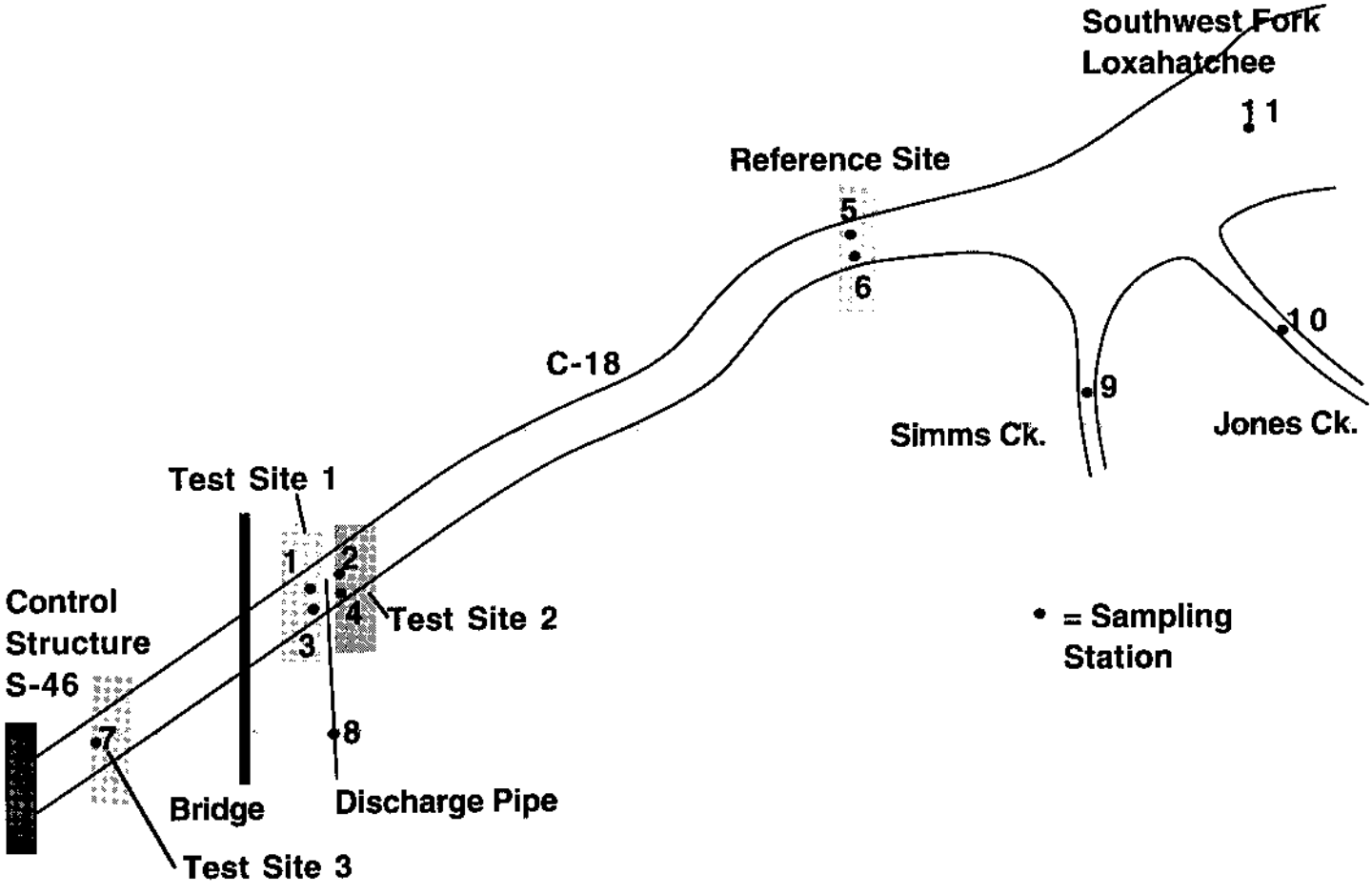
Jupiter RO Bioassessment Study – Phytoplankton taxa richness.



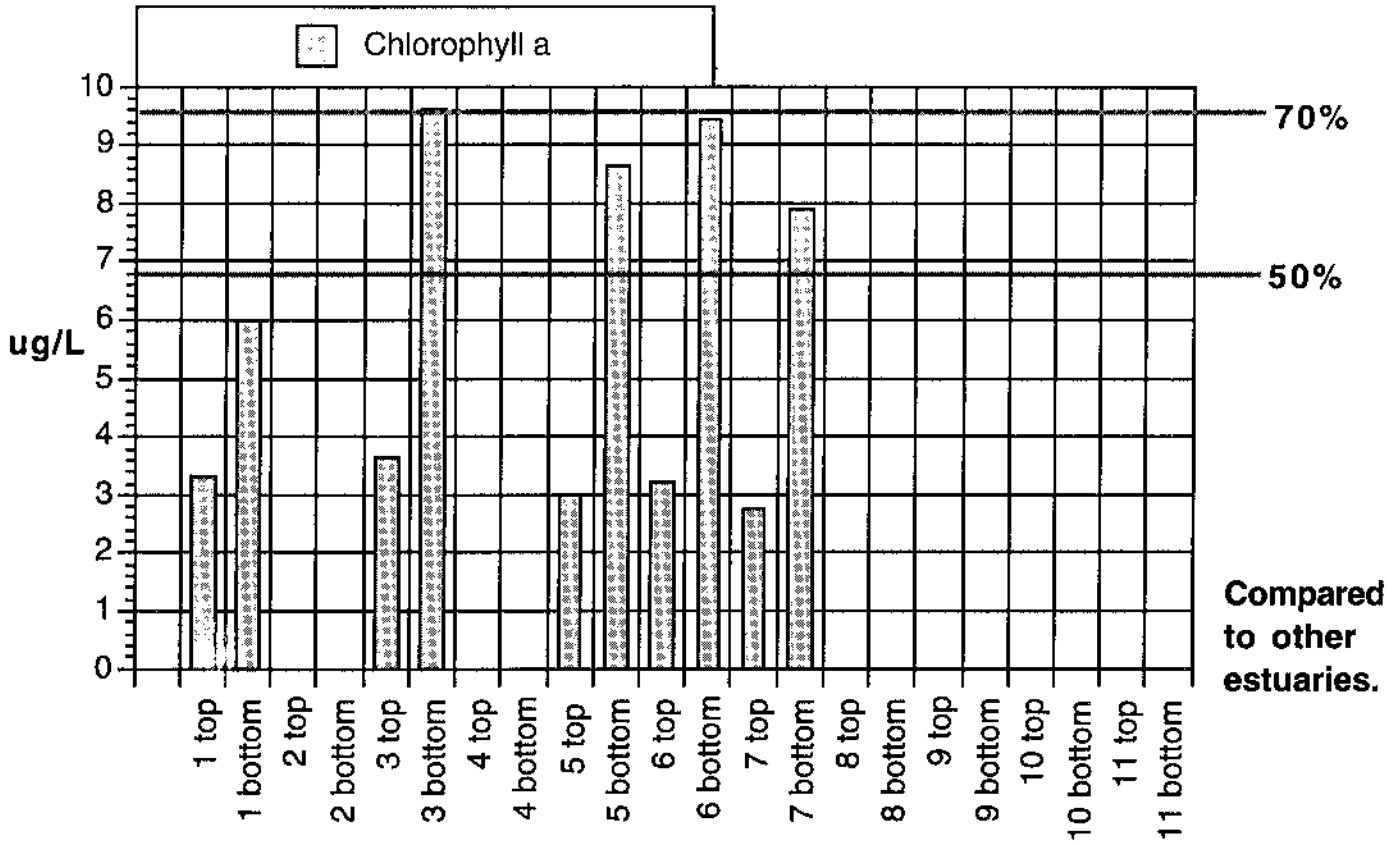


Jupiter RO Plant Bioassessment Study –
Phytoplankton Shannon-Weaver diversity.

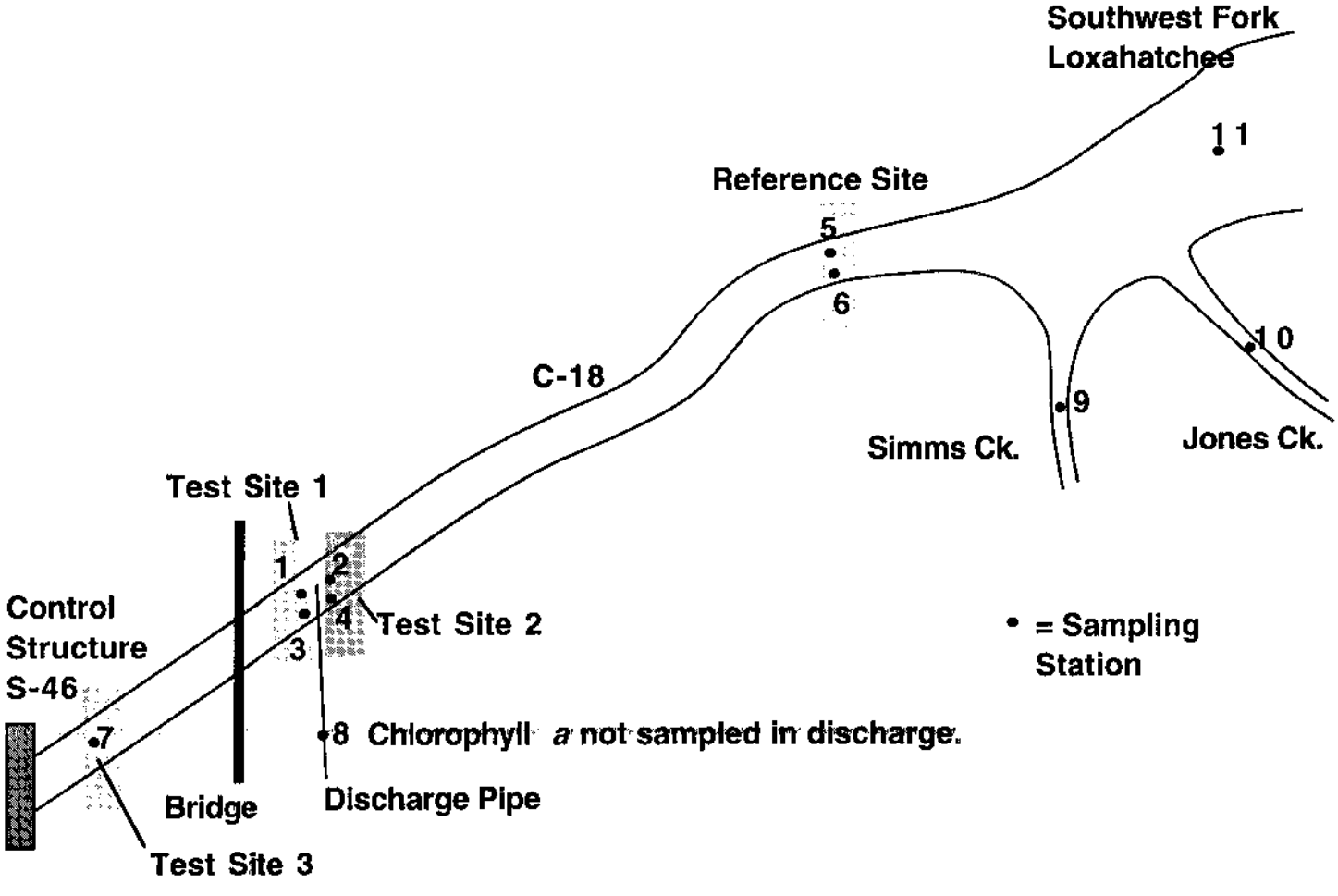




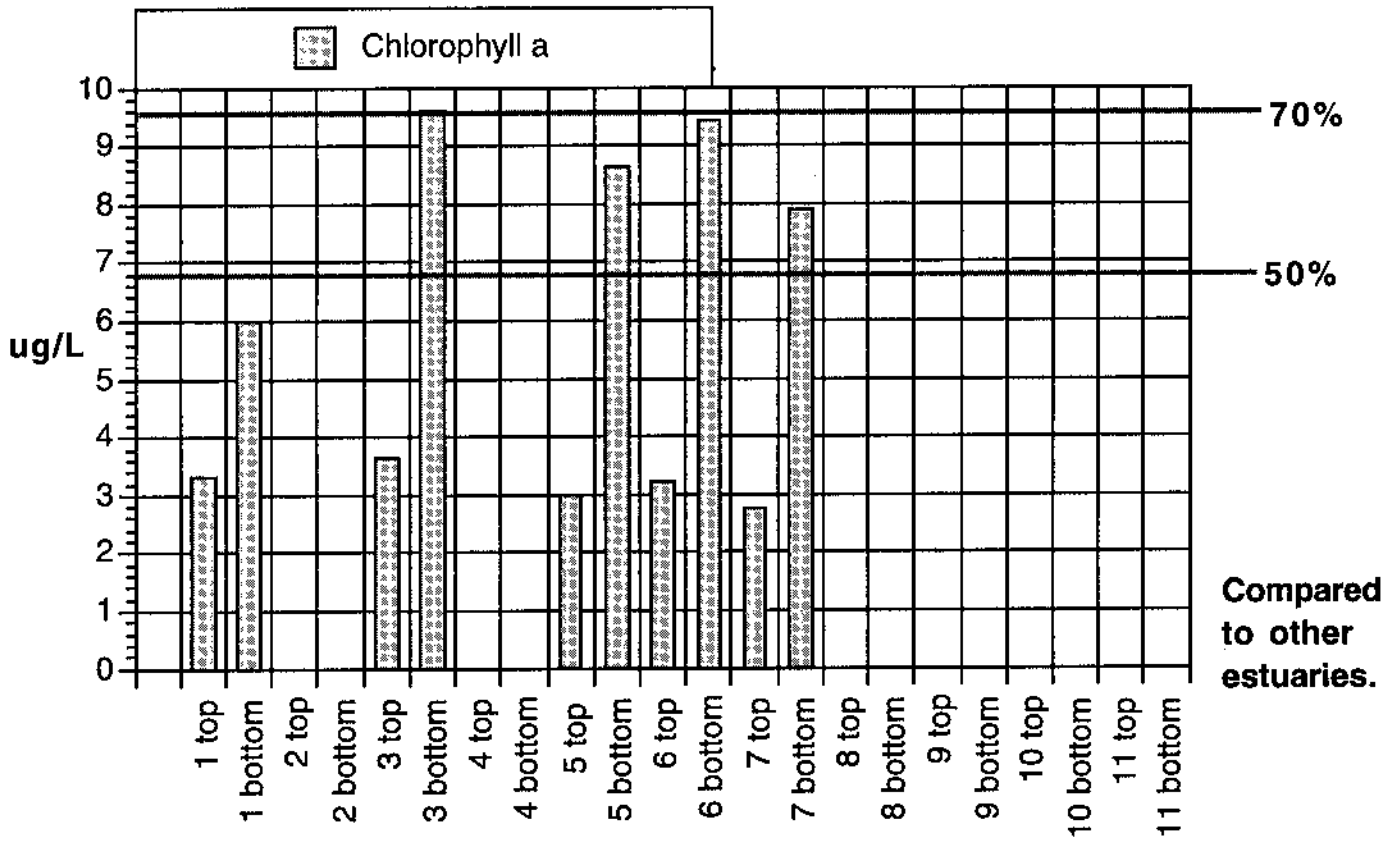
Jupiter RO Bioassessment Study – Chlorophyll Data



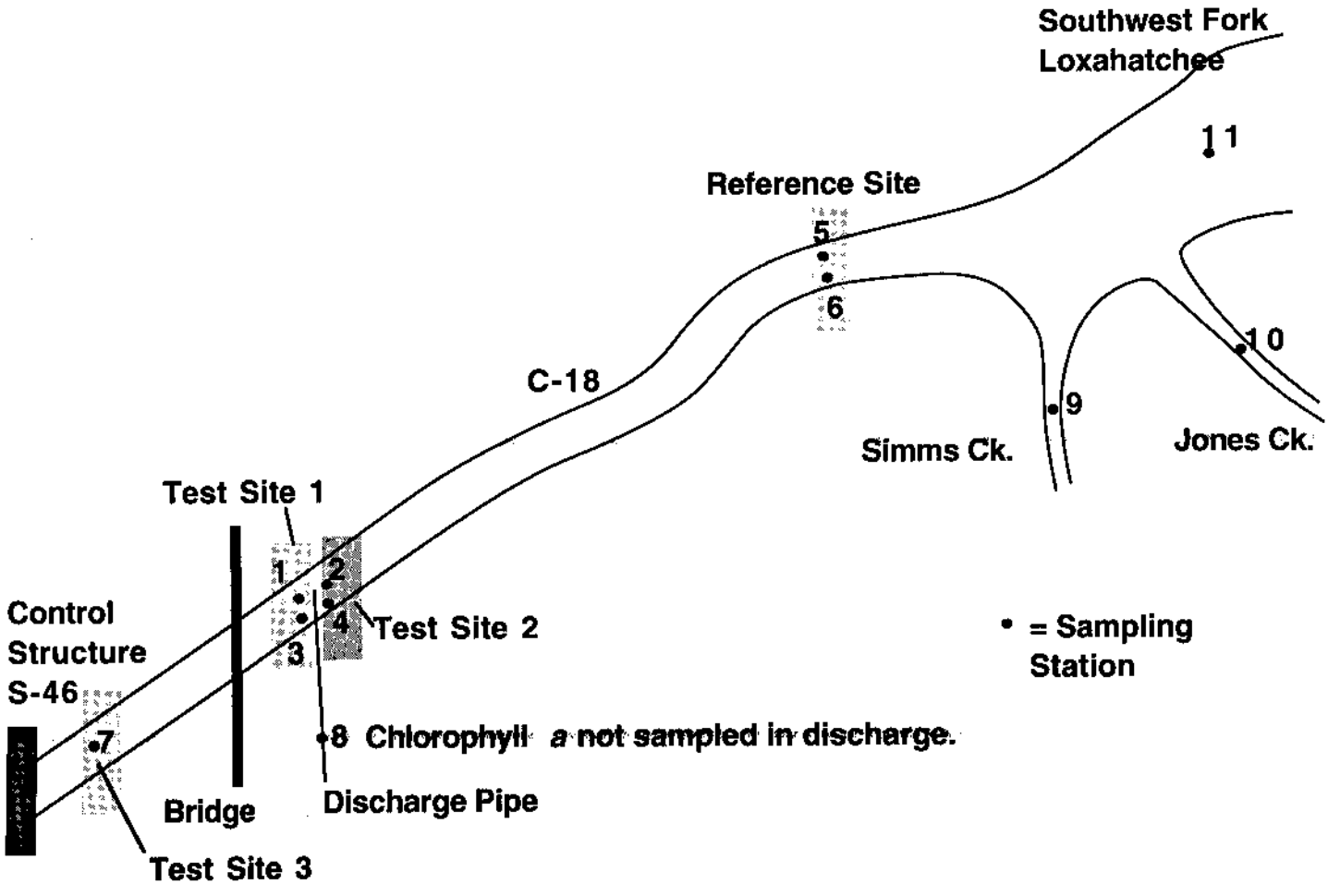
Compared to other estuaries.



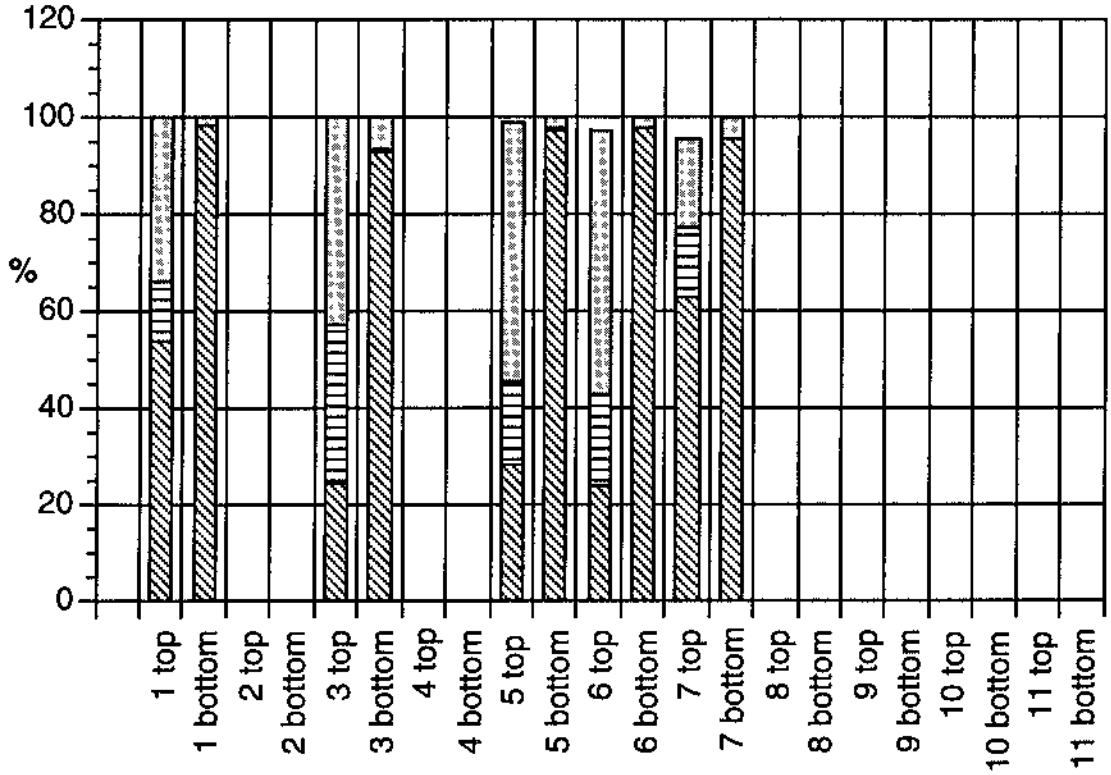
Jupiter RO Bioassessment Study – Chlorophyll *a* Data

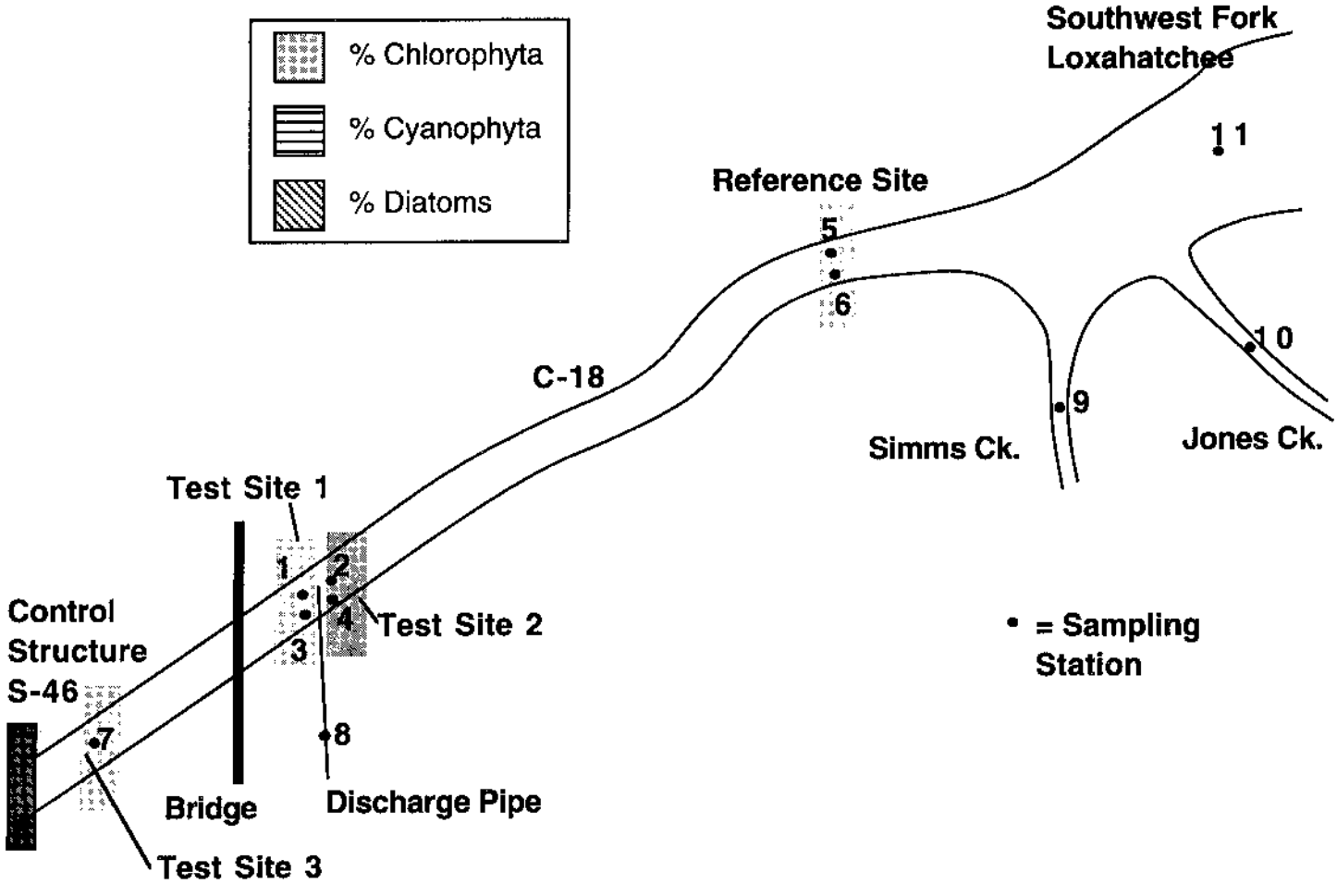


Compared to other estuaries.



Jupiter RO Bioassessment Study – Phytoplankton Community Composition





Benthic macroinvertebrate taxa list for Jupiter Reverse Osmosis Water Treatment Plant, collected via Petite Ponar on 12 September 1995. Test site 1 was located 10 m west of the discharge (in C-18), test site 2 was 10 m east of the discharge (in C-18), and the reference site was in C-18 near the mouth of the southwest fork of the Loxahatchee River estuary.

	Test Site 1	Test Site 2	Reference Site
Nemterea			
Dugesia sp.	14	–	14
Micrura sp.	–	–	14
Polychaeta			
Capitella capitata	14	–	–
Capitella sp.	–	14	–
Capitellidae	–	7	14
Leitoscoloplos sp.	–	–	28
Paraprionospio pinnata	–	–	70
Paraprionospio sp.	–	–	28
Streblospio benedicti	–	139	430
Nereidae	28	–	–
Orbiniidae	14	–	–
Spionidae	–	139	166
Oligochaeta			
Dero trifida	70	–	–
Limnodrilus hoffmeisteri	–	–	14
Gastropoda			
Littoridinops sp.	–	7	–
Littoridinops monroensis	98	7	14
Neritina reclivata	–	7	–
Physella sp.	28	–	–
Neritidae	152	35	14
Pelecypoda			
Mulinia sp.	–	14	–
Mulinia lateralis	–	–	56
Musculium sp.	28	–	–
Tellina sp.	14	–	–
Tellinidae	14	21	28
Acarina			
Arrenurus apopkensis	14	–	–
Thoracica			
Balanus improvisus	42	–	–
Mysidacea			
Mysidopsis almyra	–	–	14
Mysidopsis bahia	–	–	14
Tanaidacea			
Apseudes sp.	14	–	584
Isopoda			
Anopsilana jonesi	14	–	–
Edotea sp.	–	–	14
Uromunna reynoldsi	14	7	–

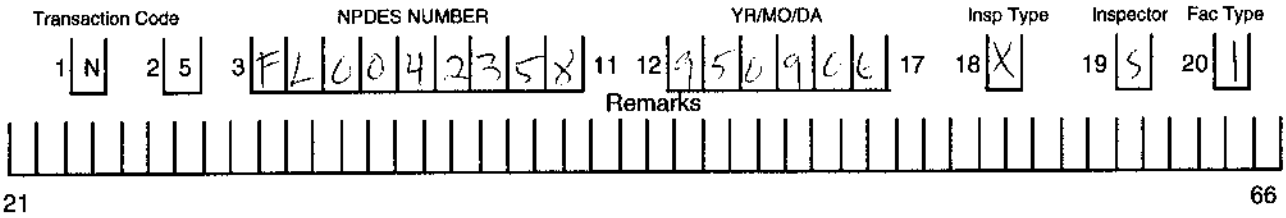
Amphipoda			
Corophium ellisi	28	118	–
Grandidierella bonnieroides	1626	597	444
Aoridae	–	56	–
Decapoda			
Rhithropanopeus harrisii	14	–	–
Ephemeroptera			
Caenis sp.	–	–	14
Coleoptera			
Stenelmis sp.	14	–	–
Trichoptera			
Trichoptera	14	7	–
Diptera			
Ablabesmyia mallochi	–	–	14
Ablabesmyia rhamphe grp.	–	7	–
Beardius truncatus	14	–	–
Chaoborus albatus	28	–	14
Chaoborus sp.	–	7	14
Dicrotendipes modestus	28	–	–
Paratanytarsus sp. C Epler	14	–	–
Polypedilum halterale grp.	14	–	–
Polypedilum illinoense grp.	14	–	–
Polypedilum scalaenum grp.	–	42	–

Phytoplankton taxa list (with #/mL) for Jupiter Reverse Osmosis Water Treatment Plant, collected on 6 September 1995. See map for station loctions.

	Reference Site	Test Site 1	Test Site 3
Cyanophyta			
Anabaena sp.	18	–	–
Aphanocapsa sp.	30	10	36
Aphanothece sp.	–	6	–
Chroococcus sp.	10	10	–
Dactylococcopsis sp.	26	102	–
Gloeocapsa sp.	–	6	–
Lyngbya sp.	16	20	5
Marssoniella sp.	–	6	–
Merismopedia sp.	16	10	5
Microcystis sp.	20	–	–
Oscillatoria sp.	30	16	–
Phormidium sp.	–	6	–
Romeria sp.	6	6	–
Synechococcus sp.	–	10	–
Chrysophyta			
Mallomonas sp.	–	–	5
Bacillariophyta			
Achnanthes sp.	18	50	5
Amphora sp.	12	20	–
Asterionella sp.	306	158	106
Chaetoceros sp.	60	204	60
Cocconeis sp.	16	–	–
Cyclotella sp.	64	56	10
Cymbella sp.	–	20	5
Eunotia sp.	18	–	20
Gomphonema sp.	–	–	5
Gyrosigma sp.	12	–	5
Leptocylindrus sp.	48	128	40
Melosira sp.	–	20	20
Navicula sp.	62	72	–
Nitzschia closterium	16	–	–
Nitzschia sp.	76	84	25
Pinnularia sp.	–	6	–
Plagiogramma sp.	16	–	–
Rhizosolenia sp.	98	58	20
Skeletonema sp.	2992	5064	2200
Synedra sp.	–	–	25
Synedra ulna	–	6	–
Centrales	42	46	–
Pennales	60	290	–
Chlorophyta			
Ankistrodesmus sp.	16	16	10
Chlorella sp.	60	114	80

Chlorococcum sp.	36	26	5
Closterium sp.	–	20	–
Coelastrum sp.	6	–	–
Crucigenia sp.	26	–	5
Cylindrotheca sp.	134	32	40
Dictyosphaerium sp.	–	6	–
Dunaliella sp.	186	228	51
Euastrum sp.	–	20	–
Eudorina sp.	–	6	–
Gloeocystis sp.	6	16	–
Gonatozygon sp.	–	–	5
Kirchneriella sp.	6	16	–
Micractinium sp.	6	–	–
Oocystis sp.	6	6	–
Scenedesmus sp.	82	76	5
Schroederia sp.	–	40	–
Staurastrum sp.	6	–	–
Tetradesmus sp.	–	6	5
Tetraedron sp.	36	–	–
Chlamydomonadaceae	30	–	10
Chlorophyceae	6	16	–
Euglenophyta			
Phacus sp.	–	–	5
Pyrrhophyta			
Peridinium sp.	6	–	5
Cryptophyta			
Cryptomonas sp.	10	–	–

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



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

