#229

Biological Assessment of

Primex Technologies, Inc.

Wakulla County

NPDES #FL0002518

Sampled December 1997

November 1998

Biology Section
Division of Administrative and Technical Services
Bureau of Laboratories

Comprehensive Quality Assurance Plan No. 870346G

Department of Environmental Protection

Results of Fifth Year Inspections

Discharger: Primex Technologies
County: Wakulla
NPDES Number: FL0002518
State Permit Expiration Date: 17 June 1998

Toxics Sampling Inspection (XSI)

Date Sampled: 15 December 1997

Results: No organic pollutants were detected in the effluent. With the exception of mercury (0.11 µg/L), all metals complied with Class III water quality standards. Further sampling is necessary to confirm the mercury concentration.

Compliance Biomonitoring Inspection (CBI)

Date Sampled: 15 December 1997

Results: The chlorinated effluent was toxic to the fish, *Cyprinella leedsi*, and to the invertebrate, *Ceriodaphnia dubia*, with 100% mortality in both tests. Significant mortality (45% of the fish and 55% of the invertebrates) also occurred in the tests performed with dechlorinated sample. This toxicity exceeds the facility permit limit.

Impact Bioassessment Inspection (IBI)

Date Sampled: 15 December 1997

Results: Results of benthic macroinvertebrate sampling indicated adverse effects at the Boggy Branch test site. Decreases in taxa richness, the Florida Index, and Shannon-Weaver diversity occurred between the control and test sites. The 46% reduction in diversity represented a violation of the biological integrity criterion (Rule 62-302.530(11) FAC). The Stream Condition Index (SCI), placed the Boggy Branch control site (with 25 points) in the "good" category, while the test site, with 19 points, was in the "poor" category. There were reductions in periphyton taxa richness, diversity, density, and chlorophyll *a* between the control and test sites.

Water Quality Inspection (WQI)

Date Sampled: 15 December 1997

Results: Significant nitrogen enrichment at the Boggy Branch test site can be directly attributed to the Primex discharge. Ammonia (3.0 mg/L) and nitrate+nitrite (14 mg/L) at the test site greatly exceeded the values found in 95% of other Florida streams. Unionized ammonia in the effluent (0.39 mg/L) exceeded the facility's permit limit of 0.02 mg/L. Algal growth potential was very low at the control and test site alike. The high ammonia at the test site may have had an inhibitory effect on the test algae. Fecal and total coliform counts at the Boggy Branch control site (1,600 /100 mL and 2,600 /100 mL, respectively) exceeded Class III water quality standards. Total residual chlorine in the effluent was 0.36 mg/L, which exceeds the facility's permit limit of 0.01 mg/L.

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

Primex Technologies, manufactures small and intermediate arms propellant and operates an industrial wastewater treatment system consisting of primary and secondary treatment. The facility is located in St. Marks, Wakulla County, Florida (see maps in Appendix).

The primary treatment has a design capacity of 0.789 MGD and includes dual high rate grit separators and a 750,000 gallon equalization tank to remove grit and equalize organic/hydraulic loading. The secondary treatment system includes an extended aeration unit (1,100,000 gal), dual clarification (2,500 sq.ft.), initial chlorination of clarifier overflow, four acre polishing pond, final chlorination with pH adjustment at the polishing pond discharge (Outfall 001) by CO_2 injection, eight acre spray irrigation field with over land flow to the Plant Ditch (Outfall 002), to the Class III Big Boggy Branch, a tributary of the Wakulla River. Outfall 002 is the final discharge point and the discharge consists of treated wastewater and stormwater runoff. The combined flow from Outfall 001 and 002 was 1.75 MGD during this survey.

This facility has had past violations of nitrate+nitrite, zinc, residual chlorine, and nickel (see Facility Summary in Appendix).

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 control site, located in Boggy Branch upstream of the discharge, and a test site, also in Boggy Branch, downstream of the discharge (see maps in Appendix). Because there were reports that the Boggy Branch control site had been dry approximately one month prior to deployment of the Hester-Dendy samplers, an additional control site was established in Moriah Creek, located about 2 miles east of Boggy Branch. 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. The effluent samples were taken a short distance upstream of the final permit compliance point, 002. The effluent was analyzed for metals and for organic constituents (base, neutral, and acid extractables, and pesticide extractables). Additionally, nutrient analyses were performed on the effluent and samples from control and test sites. Methods used for all chemical analyses are on file at the DEP Central Chemistry Laboratory in Tallahassee.

Acute toxicity bioassays using the water flea, *Ceriodaphnia dubia,* and the fish, *Cyprinella leedsi,* as test organisms were performed on an effluent sample. Benthic macroinvertebrate communities were evaluated at control and test sites. Invertebrates were collected from multiple substrates (*e.g.*, snags, leaf packs, vegetation) using discrete dip-net sweeps. Additional invertebrate collections were accomplished using Hester-Dendy multiplate samplers which were incubated for 28 days. Phytoplankton were sampled at both control and test sites, via subsurface grabs. Periphyton were sampled at both control and test sites by incubating glass microscope slides in a standard periphytometer for 28 days. Chlorophyll *a* was also determined for periphyton communities. Bacterial populations were analyzed for total and fecal coliforms. Algal Growth Potential (AGP) was measured using *Selenastrum capricornutum* as the test organism. All biological field and lab procedures were carried out following Biology Section Standard Operating Procedures (SOP's). The latest version of the SOP's can be viewed on our web site at: 'www.dep.state.fl.us/labs/sops.htm'.

Several different measurements of macroinvertebrate and algal community health have been used to determine the effects of a discharge. These measurements include: habitat assessment, taxa richness, Shannon-Weaver Diversity Index, the Florida Index, Ephemeroptera/Plecoptera/Trichoptera (EPT) Index, community composition, functional feeding groups, algal biomass, and the Stream Condition Index (SCI). For a discussion of each of these measures see *Explanation of Measurements of Community Health* in Appendix.

For graphical purposes, the percent differences between the control and test sites involving the number of taxa, the diversity index, the Florida Index, the EPT Index, the diatom to blue-green algae ratio, and the % filter-feeders, are measured as the control site minus test site divided by the control site. The percent differences between sites involving the algal density, chlorophyll *a*, and algal growth potential are measured as the test site minus control site divided by the control site.

The following personnel were involved in this investigation: Jennifer Eichelberger, Ken Espy, Marshall Faircloth, Russel Frydenborg,

Joy Jackson, Scott Lashbrook, Elizabeth Miller, Urania Quintana, Johnny Richardson, Lisa Tamburello, David Whiting, Vicki Whiting, and Steve Wolfe (DEP Central Biology Laboratory in Tallahassee). 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.

Results and Discussion

For the purposes of this study, the primary comparisons will be made between the Boggy Branch control site and the Boggy Branch test site. Moriah Creek was sampled as a "backup" control site to be used in case the Boggy Branch control site was found to be inappropriate due to desiccation.

Habitat quality was "marginal" at the Boggy Branch control site (with 62 points), improving to "suboptimal" at the Boggy Branch test site (which had 97 points). The Boggy Branch control site lost points in the categories of artificial channelization, riparian buffer zone width, and the quality of riparian zone vegetation (see Habitat Assessment Field Data Sheets in Appendix). However, water velocity (0.12 m/s) and substrate availability (95% aquatic vegetation) were adequate. Roots, woody debris, and benthic-leaf mats were present at the Boggy Branch test site, however, water velocity there (0.04 m/s) was marginal. Some physical/chemical measurements were moderately different between the Boggy Branch control and test sites (Table 1). Dissolved oxygen decreased from 7.9 mg/L at the control site to 6.7 mg/L at the test site. The temperature decreased from 11.4°C at the Boggy Branch control site to 9.7°C at the test site. Specific conductance increased from 420 µmhos/cm at the Boggy Branch control site to 700 µmhos/cm at the test site (specific conductance of the effluent was 1,100 µmhos/cm). The pH was near neutral at both sites (with values of 7.1 SU and 7.2 SU at the control and test site, respectively).

No pesticides or organic compounds were detected in the effluent.

Aluminum, iron, mercury, and zinc were detected in the effluent (Table 1). With the exception of the mercury concentration (0.11 µg/L), all metals complied with Class III water quality standards. Additional sampling for mercury is needed to confirm this value. The effluent hardness was 254.5 mg/L (Table 1).

The chlorinated effluent was toxic to the fish, *Cyprinella leedsi*, and to the invertebrate, *Ceriodaphnia dubia*, with 100% mortality in both tests. Significant mortality (45% of the fish, and 55% of the invertebrates) also occurred in the tests performed with dechlorinated sample. This toxicity exceeds the effluent permit limits.

Total residual chlorine in the effluent was 0.36 mg/L, which exceeds the facility's permit limit of 0.01 mg/L.

Fecal and total coliform counts at the Boggy Branch control site (1,600 /100 mL and 2,600 /100 mL, respectively) exceed the facility's permit limit. Fecal and total coliform counts at the test site (156 /100 mL, and 830 /100 mL, respectively) were reduced compared to the control site. Effluent fecal and total coliform counts were very low (< 1/100 mL in both tests).

Ammonia increased from 0.014 mg/L at the Boggy Branch control site to 3.0 mg/L at the test site. The test site ammonia concentration was much higher than those found in 95% of other Florida streams (see *Typical Water Quality Values* in Appendix). Ammonia in the effluent sample was 12.0 mg/L. Unionized ammonia in the effluent (0.39 mg/L) exceeded the facility's permit limit of 0.02 mg/L, as well as the Class III water quality standard (Rule 62-302.530(3) FAC). Nitrate+nitrite levels were also extremely elevated at the test site (14 mg/L) and in the effluent (39 mg/L). In contrast, nitrate+nitrite at the Boggy Branch control site (0.016 mg/L) was relatively low. As with ammonia, the test site nitrate+nitrite concentration was much higher than those found in 95% of other Florida streams.

Algal Growth Potential (AGP) was very low at the control site (0.1 mg dry wt/L) and test site (0.7 mg dry wt/L) alike. The effluent AGP was 46.6 mg dry wt/L.

Figure 1 represents changes in the periphyton algal community. Larger differences (that is, higher percentages) correspond with greater degrees of degradation. The Boggy Branch control site was used to compare with the test site in this graph. Several measures indicated the test site periphyton community was different from that of the control site. The number of taxa decreased from 46 taxa at the control site to 36 taxa at the test site (Table 2). Shannon-Weaver diversity also decreased from 4.4 at the control site to 3.8 at the test site. Algal density was reduced from 103,767 organisms/cm^2 at the Boggy Branch control site to 15,757 organisms/cm^2 at the test site. Chlo-

Table 1. Effluent limits and summary of chemistry data.

Primex Technologies	Effluent Limits	Pre-Effluent Sample	Moriah Ck Control	Boggy Branch Control	Boggy Branch Test
Organic Constituents (µg/L)					
None Detected					
Metals (µg/L)					
Aluminum	d	328	-	-	-
Arsenic	d	40 U	-	-	-
Cadium	d	0	-	-	-
Chromium	d	10 U	-	-	-
Copper	d	0	-	-	-
Iron	d	216	-	-	-
Lead	d	0	-	-	-
Mercury	d	0.11 I	-	-	-
Nickel	d	7 U	-	-	-
Selenium	d	50 U	-	-	-
Silver	d	0	-	-	-
Zinc	d	117	-	-	-
Nutrients (mg/L)					
Ortho-phosphate	d	0.20 A	0.027	0.048	0.097
Total phosphorus	d	0.30 A	0.016 I	0.044	0.11
Unionized Ammonia	d	0.39	-	-	-
Ammonia	d	12	0.012 I	0.014 I	3.0
Nitrate+Nitrite	d	39	0.004 I	0.016	14
TKN	d	13 A	0.39	0.19	4.0
Total Nitrogen	d	52	0.394	0.206	18.0
General Phys-Chem Parameters					
Habitat Assessment	d	-	132	50	97
D.O. (mg/L)	d	10.7	7.7	7.9	6.7
pH (SU)	d	7.3	7.6	7.1	7.2
Conductivity (µmhos/cm)	d	1,100	340	420	700
Temperature (°C)	d	10.4	10.3	11.4	9.7
B.O.D., 5 day (mg/L)	d	-	-	-	-
Tot. Residual Chlorine (mg/L)	d	0.36	-	-	-
Flow (MGD)	d	0.57	-	-	-
Hardness (mg $CaCO_3$)	d	254.5	-	-	-
AGP (mg dry wt/L)	d	46.6	0.1	0.1	0.7 I
Toxicity					
Bioassay Fish	d	-	-	-	-
Bioassay Invertebrate	d	-	-	-	-
Microbiology (# organisms/100 mL)					
Fecal Coliforms	d	1 K	310	1,600	156
Total Coliforms	d	1 K	660	2,600	830

d- See facility summary
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 lower than value given
U - Material analyzed for but not detected; value reported is the minimum detection limit

rophyll *a* also decreased from 10.4 mg/m^2 at the control site to 0.7 mg/m^2 at the test site.

Certain measures of macroinvertebrate community health derived from the Hester-Dendy sampler results indicate the discharge was adversely affecting the receiving water community (Table 3). Figure 2 indicates the degree of difference between the invertebrate populations of the control and test sites. The results from the artificial substrates will be emphasized, since they control for differences in substrate between sites, and therefore, more accurately reflect the changes caused by water quality differences between the two sites.

In the Hester-Dendy samples, taxa richness decreased from 23 taxa at the control site to 13 at the test site. Shannon-Weaver diversity declined dramatically, from 3.7 at the control site to 2.0 at the test site. This 45.9% reduction in diversity represents a violation of the biological integrity criterion (Rule 62-302.530(11) FAC). The low diversity at the test site was due to the dominance (83% of the population) of the pollution-tolerant taxa, *Chironomus* sp. and *Hyalella azteca*. The Florida Index (7 at the control site and 6 at the test site) was relatively unchanged between the two sites. The EPT Index was low at both sites (with 2 EPT taxa at the Boggy Branch control and 1 EPT taxon at the test site). Suspension feeders decreased from 10% at the control site to 2% at the test site.

Macroinvertebrate sampling using the 20 dip-net sweep method was performed at all three sites. Although the dip-net method generally yielded slightly higher values for some measures, overall trends were the same as those shown in the Hester-Dendy results. For example, the number of taxa decreased from 29 taxa at the Boggy Branch control site to 23 taxa at the test site. Similarly, the Florida Index dropped from 15 points at the control site to 9 points at the test site. The pollution-sensitive mayfly, *Callibaetis floridanus*, was the dominant taxon at the Boggy Branch control site (accounting for 22% of the total population), while the pollution-tolerant amphipod, *Hyalella azteca*, made up 65% of the test site population. The Boggy Branch control site scored in the "good" category of the Stream Condition Index (SCI), with 25 points. The Boggy Branch test site SCI score was 19, placing it in the "poor" category. In comparison, Moriah Creek also scored 25 SCI points.

Conclusions

No pesticides or organic compounds were detected in the effluent.

With the exception of mercury (0.11 µg/L), all metals complied with Class III water quality standards. Further sampling is needed to confirm the mercury concentration.

The chlorinated effluent was toxic to the fish, *Cyprinella leedsi*, and to the invertebrate, *Ceriodaphnia dubia*, with 100% mortality in both tests. Significant mortality (45% of the fish, and 55% of the invertebrates) also occurred in the tests performed with dechlorinated sample. This toxicity is in excess of effluent permit limits.

Total residual chlorine in the effluent was 0.36 mg/L, which exceeded the facility's permit limit of 0.01 mg/L.

Fecal and total coliform counts at the Boggy Branch control site (1,600/100 mL and 2,600/100 mL, respectively) exceeded Class III water quality standards.

Significant nitrogen enrichment at the test site could be directly attributed to the Primex discharge. Ammonia (3.0 mg/L) and nitrate+nitrite (14 mg/L) at the test site greatly exceeded the values found in 95% of other Florida streams. Unionized ammonia in the effluent (0.39 mg/L) exceeded the facility's permit limit of 0.02 mg/L.

Algal growth potential was very low at the control site (0.1 mg dry wt/L) and test site (0.7 mg dry wt/L) alike. The effluent AGP was 46.6 mg dry wt/L. The high ammonia at the test site may have had an inhibitory effect on the test algae.

There were reductions in periphyton taxa richness, diversity, density, and chlorophyll *a* between the control and test sites. These changes could be caused either by differences in light penetration between the sampling stations, or from the inhibitory effects of the extreme ammonia and nitrate+nitrite values at the test site.

Results of benthic macroinvertebrate sampling indicated adverse effects at the Boggy Branch test site. Decreases in taxa richness, the Florida Index, and Shannon-Weaver diversity occurred between the control and test sites. The 46% reduction in diversity represented a violation of the biological integri-

Table 2. Major characteristics of community structure of control and test sites.

Primex Technologies	Moriah Creek Control	Boggy Branch Control	Boggy Branch Test
Periphyton Algae			
Number of Taxa	6	46	36
Shannon-Weaver Diversity	2.5	4.4	3.8
Algal Density (#/cm^2)	1404.3	103766.5	15757.4
Chlorophyll a (mg/m^2)	0.1 U	10.4	0.7 A
Diatom/Diatom + B-G Ratio	0.63	0.99	0.94
% Green	0.0	6.9	9.3
% Cryptophytes	20.0	0.0	3.3
% Blue-green	30.0	0.6	4.7
% Diatoms	50.0	92.5	80.7
AGP (mg dry wt/L)	0.1 I	0.1 I	0.7 I

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

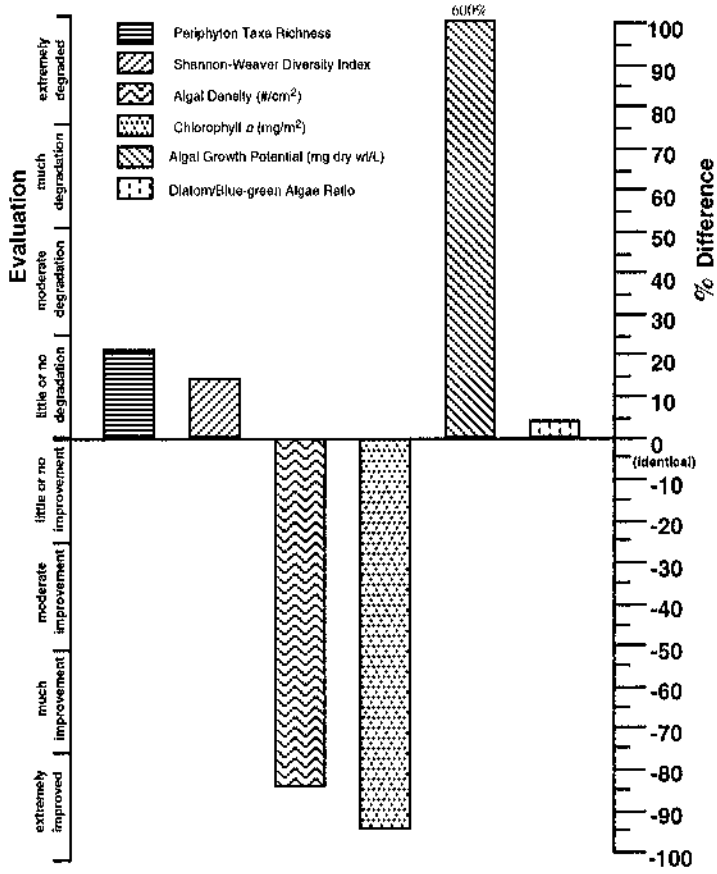


Figure 1. Effect of discharge on the algal community.

ty criterion (Rule 62-302.530(11) FAC). The Stream Condition Index (SCI), placed the Boggy Branch control site (with 25 points) in the "good" category, while the test site, with 19 points, was in the "poor" category.

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Table 3. Major characteristics of community structure of control and test sites.

Primex Technologies	Moriah Ck Control	Boggy Br Control	Boggy Br Test
Macroinvertebrate Qualitative			
Number of Taxa	45	29	23
Florida Index	9	15	9
SCI	25	25	19
EPT Index	3	2	4
% Dominant Taxon	10.1	22.0	64.5
Community Composition			
% Amphipoda	9.1	1.8	64.5
% Coleoptera	22.2	0.0	5.6
% Diptera	27.3	36.7	15.9
% Ephemeroptera	2.0	31.2	3.7
% Gastropoda	18.2	4.6	0.0
% Isopoda	7.1	0.9	0.9
% Odonata	3.0	0.0	0.9
% Oligochaeta	4.0	15.6	0.9
% Trichoptera	1.0	0.9	2.8
% Other	6.0	7.4	3.8
Functional Feeding Groups			
% Browser-grazer	4.6	0.5	0.0
% Burrowing Deposit Feeders	3.0	10.1	0.9
% Predators	7.6	11.0	7.9
% Scavengers	10.6	2.8	0.9
% Scrapers	23.7	4.6	4.2
% Shredders	5.1	5.5	34.6
% Surface Deposit Feeders	30.8	51.8	46.3
% Suspension Feeders	5.6	0.9	2.3
% Unknown	9.1	12.8	1.9
Macroinvertebrate Hester-Dendy			
Number of Taxa	9	23	13
Florida Index	1	7	6
Shannon-Weaver Diversity	2.0	3.7	2.0
EPT Index	1	2	1
Community Composition			
% Amphipoda	17.0	19.6	49.1
% Diptera	4.3	50.0	45.5
% Ephemeroptera	2.1	0.7	0.6
% Gastropoda	10.6	7.3	4.9
% Isopoda	61.7	8.0	0.0
% Trichoptera	0.0	12.3	0.0
% Other	4.3	2.1	0.0
Functional Feeding Groups			
% Browser-grazer	30.9	1.1	1.8
% Predators	10.6	20.3	0.6
% Scavengers	30.9	6.9	1.8
% Scrapers	11.7	6.9	5.2
% Shredders	2.1	9.8	41.8
% Surface Deposit Feeders	10.6	39.1	44.9
% Suspension Feeders	1.1	10.1	1.5
% Unknown	2.1	5.8	2.4

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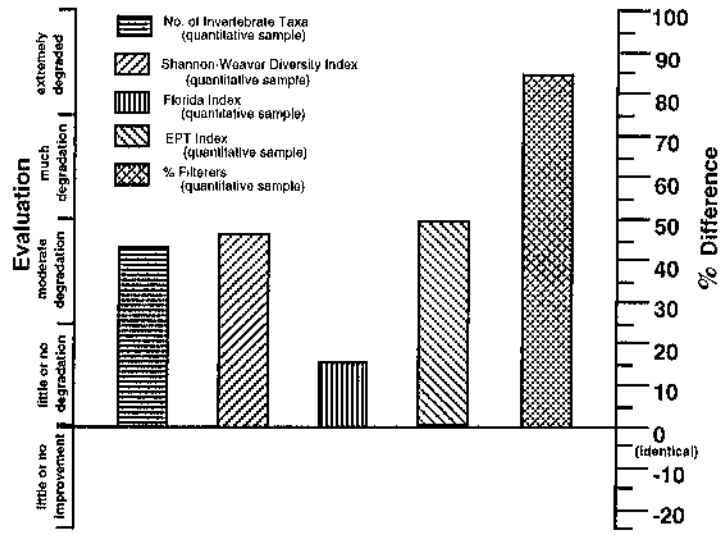


Figure 2. Effect of discharge on the benthic macroinvertebrate community.

Explanation of Measurements of Community Health

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

Habitat Assessment: Seven attributes known to have potential effects on the stream biota were evaluated and scored, with 20 possible points for each factor. Based on the sum of these individual scores, overall habitat quality is assigned to one of four categories: Optimal (105-140 points); Suboptimal (70-104 points); Marginal (35-69 points); and Poor (0-34 points).

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.

The Florida Index: Some organisms become rare or absent as the intensity or duration of disturbance increases. 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.

Ephemeroptera/Plecoptera/Trichoptera (EPT) 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 proportions of major groups of organisms, compared to control conditions, may indicate degradation.

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.

Functional Feeding Groups: 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): The SCI is a composite macroinvertebrate metric (Barbour *et al.* 1996) developed for Florida. The SCI assigns points to a variety of parameters, depending on how closely each parameter approaches an expected control condition (see SCI calculation table in Appendix).

Typical Values for Selected Parameters in Florida Waters

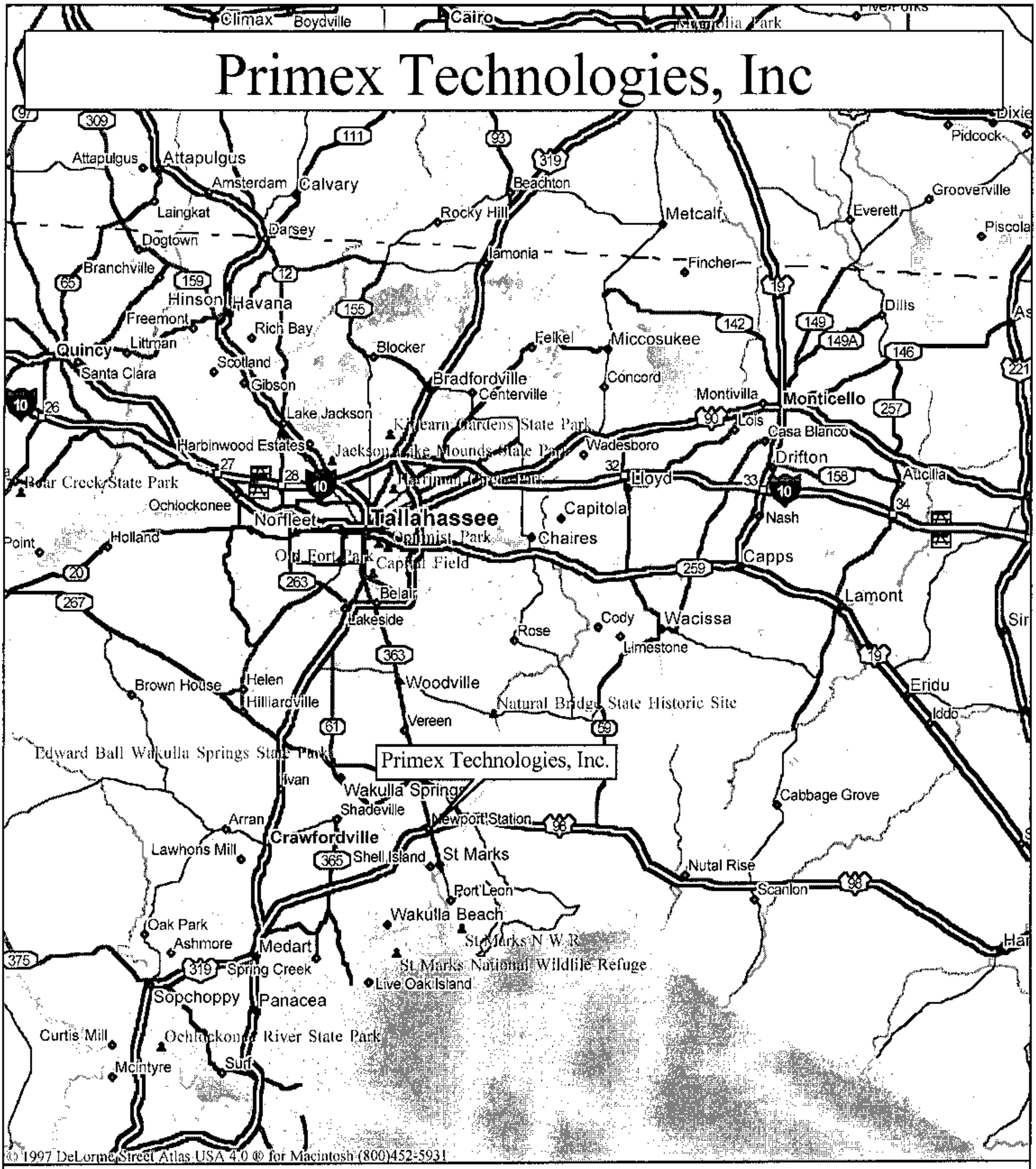
Adapted from Joe Hand, FDER, personal communication, 1991
(data was collected between 1980 and 1989)

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 Phosphate	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-Phosphate	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-Phosphate	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

Primex Technologies, Inc

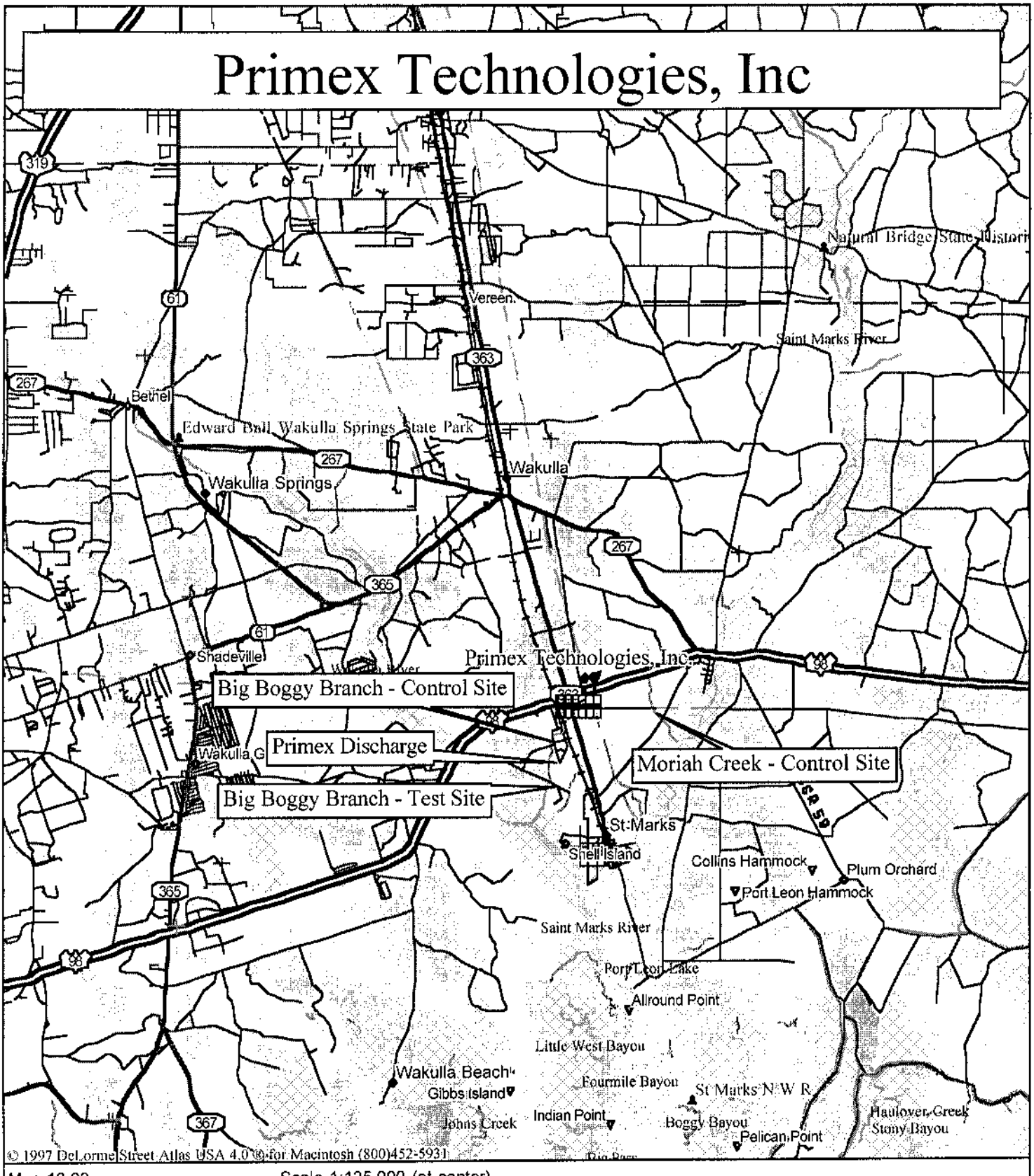


Mag 10.00
Tue Nov 03 17:07 1998

Scale 1:500,000 (at center)
10 Miles
10 KM

Major Connector
Major Forest Road
State Route
Primary State Route

Primex Technologies, Inc



Mag 12.00
Tue Nov 03 17:22 1998

Scale 1:125,000 (at center)

2 Miles

2 KM

Local Road
Major Connector
Major Forest Road
State Route

Facility Summary

FACILITY NAME: Primex Technologies, Inc.

LOCATION: Intersection of U.S. 98 & S.R. 363 St. Marks, FL 32355 **COUNTY:** Wakulla County

DISTRICT: Northwest/10

PERMITS: NPDES: FL0002518 State: IO65-212672

FUNCTION OF FACILITY: Primex manufactures small and intermediate arms propellant and the facility operates an industrial wastewater treatment system consisting of primary and secondary treatment.

DESCRIPTION OF TREATMENT PROCESS: The primary treatment system has a design capacity of 786,000 GPD and includes dual high rate grit separators and a 750,000 gallon equalization tank to remove grit and equalize organic/hydraulic loading. The secondary treatment system includes an extended aeration unit, activated sludge unit (1,100,000 gal), dual clarification (2,500 sq.ft.), initial chlorination of clarifier overflow, four acre polishing pond, final chlorination with pH adjustment at the polishing pond discharge (Outfall 001) by CO_2 injection, eight acre spray irrigation field with over land flow to the Plant Ditch (Outfall 002), to Big Boggy Branch to the Wakulla River. Outfall 002 is the final discharge point and the discharge consists of treated wastewater and stormwater runoff.

RECEIVING WATERS: Big Boggy Branch to Wakulla River **CLASSIFICATION:** III Fresh

DESIGN FLOW (MGD):	MEAN FLOW (MGD):	FLOW DURING SURVEY (MGD):
0.786 (treatment system)	Pond 001: 0.535	Pond 001: 0.572
	Plant Ditch 002: 1.289	Plant Ditch 002: 1.176

DISCHARGE: Continuous

MIXING ZONE: No mixing zone

EFFLUENT LIMITS:

I. Effluent Limitations EPA NPDES Permit FL0002518

A. Effluent Monitoring Point - Pond Effluent

Outfall 001	Effluent Limit				
Parameter	Min	Ave	Max	Freq	Sample Type
Flow, MGD	NA	Report Monthly Ave	Report Monthly Max	1/month	Instantaneous
Temperature	NA	95.0 ^{0}F	100.0 ^{0}F	1/month	Grab
Fecal Coliform	NA	200/100 ml Annual Ave	800/100 ml Daily Max	1/month	Grab
pH	6.0 s.u.	NA	8.5 s.u.	1/month	Grab
There shall be no discharge of floating solids or visible foam in other than trace amounts.					
The effluent shall not cause a visible sheen on the receiving water.					

B. Effluent Monitoring Point - Plant Ditch at weir

Outfall 002	Effluent Limit				
Parameter	**Min**	**Ave**	**Max**	**Freq**	**Sample Type**
Flow, MGD	NA	NA	Report	Continuous	Flowmeter
Temperature	NA	95.0 °F	100.0 °F	1/month	Grab
BOD, 5-day	NA	30.0 mg/l Daily Ave	45.0 mg/l Daily Max	1/week	24 hr Comp
Total Suspended Solids	NA	20.0 mg/l Daily Ave	35.0 mg/l Daily Max	1/week	24 hr Comp
Total Kjeldahl Nitrogen	NA	30.0 mg/l Daily Ave	45.0 mg/l Daily Max	1/week	24 hr Comp
Oil and Grease	NA	3.0 mg/l Daily Ave	5.0 mg/l Daily Max	1/week	Grab
Total Recoverable Chromium	NA	NA	Calculated Note 1	1/month	Grab
Total Recoverable Zinc	NA	NA	Calculated Note 1	1/month	Grab
Total Recoverable Nickel	NA	NA	Calculated Note 1	1/month	Grab
Total Recoverable Lead	NA	NA	Calculated Note 1	1/month	Grab
Total Hardness, (as $CaCO_3$), mg/l	NA	NA	Report Daily Max	1/month	Grab
Total Ammonia (as N), mg/l	NA	NA	Report Daily Max	1/month	Grab
pH	6.0 s.u.	NA	8.5 s.u.	Daily	Grab
Dissolved Oxygen	5.0 mg/l	NA	NA	1/month	Grab
Total Residual Chlorine	NA	NA	0.01 mg/l Daily Max	1/month	Grab
Unionized Ammonia	NA	NA	0.02 mg/l Daily Max	1/month	Grab (calculated)
Chronic Whole Effluent Toxicity			Note 2	2/year	24 hr Comp
Acute Whole Effluent Toxicity			Note 2	1/year	24 hr Comp
There shall be no discharge of floating solids or visible foam in other than trace amounts.					
The effluent shall not cause a visible sheen on the receiving water.					

Note 1. The daily maximum in mg/l for total recoverable metals shall be calculated based on the total hardness as follows ("ln H means the natural logarithm of total hardness expressed as mg/l of $CaCO_3$):

Total Recoverable Chromium: $Cr \leq e^{[0.819 (\ln H) + 1.561]}$
Total Recoverable Zinc: $Zn \leq e^{[0.8473 (\ln H) + 0.7614]}$
Total Recoverable Nickel: $Ni \leq e^{[0.846 (\ln H) + 1.1645]}$
Total Recoverable Lead: $Pb \leq e^{[1.273 (\ln H) + 4.705]}$

Note 2. The WET will be unacceptable if either test results in an NOEC of less than 100.0%

II. Effluent Limitations State Permit IO65-212672

A. Effluent Monitoring - Plant Ditch

Station #1	Effluent Limit				
Parameter	Min	Ave	Max	Freq	Sample Type
pH (note 1)	6.0 s.u.	NA	8.5 s.u.	1/month	Grab
Dissolved Oxygen	≥ 5.0 mg/l	NA	NA	1/month	Grab
BOD, 5-day	NA	NA	30.0 mg/l Max	1/month	24 hr Comp
Total Kjeldahl Nitrogen	NA	30.0 mg/l Monthly Ave	45.0 mg/l Max	1/month	24 hr Comp
Nitrate & Nitrite	NA	NA	NA	1/month	Grab
Total Recoverable Zinc			Calculated note 2	1/month	24 hr Comp
Total Hardness, (as $CaCO_3$), mg/l	NA	NA	NA	1/month	24 hr Comp
Flow, MGD	NA	NA	Report	Continuous	Recorder
Total Suspended Solids	NA	20.0 mg/l Monthly Ave	35.0 mg/l Max	1/month	24 hr Comp
Oil and Grease	NA	NA	5.0 mg/l Max	1/month	Grab
Fecal Coliform	NA	200/100 ml Ave	NA	1/month	Grab
Total Recoverable Lead	NA	NA	Calculated note 2	1/month	24 hr Comp
Total Recoverable Nickel	NA	NA	Calculated note 2	1/month	24 hr Comp
Total Residual Chlorine	NA	NA	0.01 mg/l Max	1/month	Grab
Total Recoverable Chromium	NA	NA	Calculated note 2	1/month	Grab
Unionized Ammonia	NA	NA	0.02 mg/l Max	NA	NA

Note 1. The pH shall be within one unit of the background value and between 6.0 and 8.5 s.u.

Note 2. The maximum in mg/l for total recoverable metals shall be calculated based on the total hardness as follows ("ln H means the natural logarithm of total hardness expressed as mg/l of $CaCO_3$):

Total Recoverable Chromium: $Cr \leq e^{[0.819\,(\ln H) + 1.561]}$

Total Recoverable Zinc: $Zn \leq e^{[0.8473\,(\ln H) + 0.7614]}$

Total Recoverable Nickel: $Ni \leq e^{[0.846\,(\ln H) + 1.1645]}$

Total Recoverable Lead: $Pb \leq e^{[1.273\,(\ln H) + 4.705]}$

PERMIT VIOLATIONS AND PLANT UPSETS WITHIN PAST YEAR: None.

PREVIOUS IMPACT BIOASSESSMENTS:

Past impact assessments conducted on September 16, 1991, found zinc in the discharge at 38 µg/l. Also, it revealed that there was a large number of Hyalella, an amphipod, which lowered the diversity index. At that time the effects of Primex being applied on Big Boggy were not excessive, however, some nitrogen enrichment was noticed from AGP results.

COMPARABILITY OF MOR RESULTS:

Compliance Sampling Inspections (CSI) were completed on 11/4/96 and 6/8/95 which showed Primex to be in compliance.

No Compliance Sampling Inspections (CSI0 have been performed recently.

ADDITIONAL INFORMATION:

Staff contributing to this review (signature):

Glenn Butts _____ Biologist

Allan Karrer _____ Engineer

Derek Adkins _____ Other

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		12/15/97	10:00	

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	Wakulla	Primex - Effluent	Effluent

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)

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

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☐ Moderate potential ☐ Obvious sources ☐

Width of riparian vegetation (m) on least buffered side: | *List & map dominant vegetation on back*

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect

m wide | m/s | m/s | m/s | m deep | m deep | m deep

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

Artificially Impounded ☐ yes

High Water Mark: _____ (m above present water level) + _____ (present depth in m) = _____ (m above bed)

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			
Leaf Packs or Mats				Mud/Muck/Silt			
Aquatic Vegetation				Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots				*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	0.1	10.4	7.3	10.7	1100			
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:
Sampled effluent after it passed through part of the spray field treatment. Effluent was chlorinated

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☐	☐
Fish	☐	☐	☐	☐
Aquatic Macrophytes	☐	☐	☐	☐
Iron/sulfur Bacteria	☐	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
		12/15/97

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-90)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		12/15/97	10:30	Wakulla River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	Wakulla	Primex Tech., Inc	Boggy Branch - Test Site

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
80						20	

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

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☒ Moderate potential ☐ Obvious sources ☐

Width of riparian vegetation (m) on least buffered side: >18m

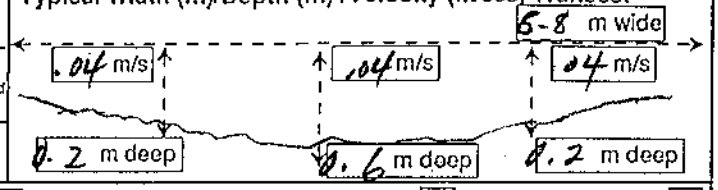
List & map dominant vegetation on back

Artificially Channelized ☒ no ☐ recent, severe ☐ some recovery ☐ mostly recovered, more sinuous

Artificially Impounded ☐ yes

High Water Mark: .6 (m above present water level) + 0.6 (present depth in m) = 1.1 (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



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)	3	IIII		Sand			
Leaf Packs or Mats	70	0		Mud/Muck/Silt	16		
Aquatic Vegetation				Other: gravel	< 1	1	
Rock or Shell Rubble				Other:			
Undercut banks/Roots	10	IIII IIII		*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	0.1	9.7	7.2	6.7	700			
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: ☒ Anerobic

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:
OVERCAST; 50's; Strong anerobic smell

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☒	☐	☐	☐
Fish	☒	☐	☐	☐
Aquatic Macrophytes	☒	☐	☐	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
K Espey, J. Richardson, J. Jackson	Jon P Jackson	12/15/97

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (4-22-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		12/15/97	Wakulla River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	Wakulla	Primex Tech, Inc	Boggy Branch - Test

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Substrate Types & Availability [8]	Greater than 30% snags, logs, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock, or other stable habitat. 20 19 18 17 16	16% to 30% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 15% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. 10 9 (8) 7 6	Less than 5% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Water Velocity [1]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 18 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec 15 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 (1)
Artificial Channelization [20]	No artificial channelization or dredging. Stream with normal, sinuous pattern (20) 19 18 17 16	May have been channelized in the past (>20 yrs), but mostly recovered, fairly good sinuous pattern 15 14 13 12 11	Channelized, somewhat recovered, but > 80% of area affected 10 9 8 7 6	Artificially channelized, box-cut banks, straight, instream habitat highly altered 5 4 3 2 1
Habitat Smothering [8]	Less than 20% of habitats affected by sand or silt accumulation 20 19 18 17 16	20%-50% of habitats affected by sand or silt accumulation 15 14 13 12 11	Smothering of 50%-80% of habitats with sand or silt, pools shallow, frequent sediment movement 10 9 (8) 7 6	Smothering of >80% of habitats with sand or silt, a severe problem, pools absent 5 4 3 2 1
Bank Stability [20]	Stable. No evidence of erosion or bank failure. Little potential for future problems. (20) 19 18 17 16	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 15 14 13 12 11	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 10 9 8 7 6	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 5 4 3 2 1
Riparian Buffer Zone Width [20]	Width of native vegetation (least buffered side) greater than 18 m (20) 19 18 17 16	Width of native vegetation (least buffered side) 12 m to 18 m 15 14 13 12 11	Width of native vegetation 6 to 12 m, human activities still close to system 10 9 8 7 6	Less than 6 m of native buffer zone due to intensive human activities 5 4 3 2 1
Riparian Zone Vegetation Quality [20]	Over 80% of riparian surfaces consist of native plants, including trees, understory shrubs, or non-woody macrophytes. Normal, expected plant community for given sunlight & habitat conditions. (20) 19 18 17 16	50% to 80% of riparian zone is vegetated, and/or one class of plants normally expected for the sunlight & habitat conditions is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, and/or one or two expected classes of plants are not represented. Patches of bare soil or closely cropped vegetation, disruption obvious. 10 9 8 7 6	Less than 25% of streambank surfaces are vegetated and/or poor plant community (*e.g.* grass monoculture or exotics) present. Vegetation removed to stubble height of 2 inches or less. 5 4 3 2 1

[ ] Add 5 points if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

Comments

[97] **TOTAL SCORE**

ANALYSIS DATE:	ANALYST:	SIGNATURE:
12/15/97	Jay A Jackson	Jay A Jackson

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-90)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		12/15/97	9:15	Wakulla River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	Wakulla	Primex Tech., Inc	Boggy Branch - Ref

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
50						50	

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

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☒ Moderate potential ☐ Obvious sources ☐

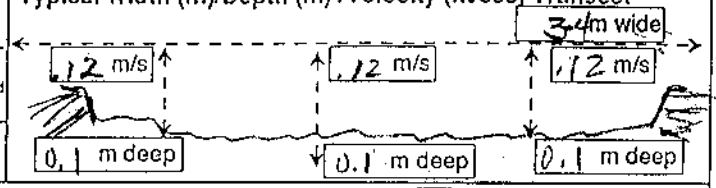
Width of riparian vegetation (m) on least buffered side: (| *List & map dominant vegetation on back*

Artificially Channelized ☐ no ☒ recent, severe ☐ some recovery ☐ mostly recovered more sinuous

Artificially Impounded ☐ yes

High Water Mark: ____ (m above present water level) + ____ (present depth in m) = ____ (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



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			
Leaf Packs or Mats				Mud/Muck/Silt	5		
Aquatic Vegetation	95	20		Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots				*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	0.1	11.4	7.1	7.9	420			
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: Lots of periphyton attached to plants
cool 40's, drizzle, overcast,
HD's were completely submerged in a pool.

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☐	☐	☐	☒
Fish	☒	☐	☐	☐
Aquatic Macrophytes	☐	☐	☐	☒
Iron/sulfur Bacteria	☒	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
K Espay, J Richardson, J. Jackson, P. Lachtanik, S Underwood	Jon A Jackson	12/15/97

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (4-22-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		12/15/97	Wakulla River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	Wakulla	Primex	Boggy Branch - Ref

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Substrate Types & Availability [20]	Greater than 30% snags, logs, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock, or other stable habitat. (20) 19 18 17 16	16% to 30% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 15% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	Less than 5% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Water Velocity [11]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 18 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec 15 14 13 12 (11)	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 1
Artificial Channelization [5]	No artificial channelization or dredging. Stream with normal, sinuous pattern 20 19 18 17 16	May have been channelized in the past (>20 yrs), but mostly recovered, fairly good sinuous pattern 15 14 13 12 11	Channelized, somewhat recovered, but > 80% of area affected 10 9 8 7 6	Artificially channelized, box-cut banks, straight, instream habitat highly altered (5) 4 3 2 1
Habitat Smothering [8]	Less than 20% of habitats affected by sand or silt accumulation 20 19 18 17 16	20%-50% of habitats affected by sand or silt accumulation 15 14 13 12 11	Smothering of 50%-80% of habitats with sand or (silt) pools shallow, frequent sediment movement 10 9 (8) 7 6	Smothering of >80% of habitats with sand or silt, a severe problem, pools absent 5 4 3 2 1
Bank Stability [16]	Stable. No evidence of erosion or bank failure. Little potential for future problems. 20 19 18 17 (16)	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 15 14 13 12 11	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 10 9 8 7 6	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 5 4 3 2 1
Riparian Buffer Zone Width [1]	Width of native vegetation (least buffered side) greater than 18 m 20 19 18 17 16	Width of native vegetation (least buffered side) 12 m to 18 m 15 14 13 12 11	Width of native vegetation 6 to 12 m, human activities still close to system 10 9 8 7 6	Less than 6 m of native buffer zone due to intensive human activities 5 4 3 2 (1)
Riparian Zone Vegetation Quality [1]	Over 80% of riparian surfaces consist of native plants, including trees, understory shrubs, or non-woody macrophytes. Normal, expected plant community for given sunlight & habitat conditions. 20 19 18 17 16	50% to 80% of riparian zone is vegetated, and/or one class of plants normally expected for the sunlight & habitat conditions is not represented. Some disruption in community evident. 15 14 13 12 11	25% to 50% of riparian zone is vegetated, and/or one or two expected classes of plants are not represented. Patches of bare soil or closely cropped vegetation, disruption obvious. 10 9 8 7 6	Less than 25% of streambank surfaces are vegetated and/or poor plant community (*e.g.* grass monoculture or exotics) present. Vegetation removed to stubble height of 2 inches or less. 5 4 3 2 (1)

[ ] Add 5 points if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

Comments

62 ~~50~~ TOTAL SCORE

ANALYSIS DATE:	ANALYST:	SIGNATURE:
12/15/97	Tony A Jackson	Tony A Jackson

Note: Leafpacks were "new"

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PHYSICAL/CHEMICAL CHARACTERIZATION FIELD DATA SHEET (5-10-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	TIME	RECEIVING BODY OF WATER:
		12/15/97	11:55	St. Marks River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	Wakulla	Primex	Moreih Creek - Ref

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
95						5	

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

Local Watershed NPS Pollution (check box): No evidence ☐ Slight ☒ Moderate potential ☐ Obvious sources ☐

Width of riparian vegetation (m) on least buffered side: >18m

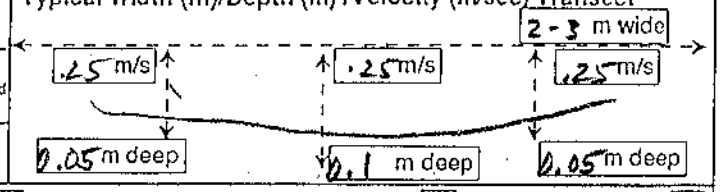
List & map dominant vegetation on back

Artificially Channelized ☒ no ☐ recent, severe ☐ some recovery ☐ mostly recovered

Artificially Impounded ☐ yes ☐ more sinuous

High Water Mark: 0.5 (m above present water level) + 0.1 (present depth in m) = 0.6 (m above bed)

Typical Width (m)/Depth (m) /Velocity (m/sec) Transect



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)	8	6	DN	Sand	18	DN	
Leaf Packs or Mats	70	6	DN	Mud/Muck/Silt			
Aquatic Vegetation	1	2	DN	Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots	3	6	DN	*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	0.1	10.3	7.6	7.7	340			
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:
partly cloudy, 50's

Abundance:	Absent	Rare	Common	Abundant
Periphyton	☒	☐	☐	☐
Fish	☐	☒	☐	☐
Aquatic Macrophytes	☐	☒	☐	☐
Iron/sulfur Bacteria	☒	☐	☐	☐

SAMPLING TEAM:	SIGNATURE:	DATE:
K Epps, J Richardson, J Jackson	Jerry Jackson	12/15/97

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (4-22-96)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
		12/15/97	St. Marks River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	Wakulla	Primex	Moriah Creek - Ref

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Substrate Types & Availability [20]	Greater than 30% snags, logs, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock, or other stable habitat. (20) 19 18 17 16	16% to 30% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	5% to 15% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	Less than 5% snags, logs, tree roots, aquatic vegetation, leaf packs, etc. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Water Velocity [15]	Max. observed at typical transect: >0.25 m/sec. but < 1 m/sec 20 19 18 17 16	Max. observed at typical transect: 0.1 to 0.25 m/sec (15) 14 13 12 11	Max. observed at typical transect: 0.05 to 0.1 m/sec 10 9 8 7 6	Max. observed at typical transect <0.05 m/sec, or spate occurring; > 1 m/sec 5 4 3 2 1
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[ ] Add 5 points if cross-sectional area of flow is estimated to be > one square meter during periods of normal flow.

Comments

XXX 33 [B-] TOTAL SCORE

ANALYSIS DATE:	ANALYST:	SIGNATURE:
12/15/97	Joy A Jackson	Joy A Jackson

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Primex
County: Wakulla
Contact / District: Jay Jackson / Central Labs (MWD)
NPDES Permit #: FL00 1065-21672
LIMS Sample #: 204048 LIMS Job #: 97-DEC-16-07
sample log: 12/12/97 RV

Sample Collection: Date 12/15/97 Time 10:00 AM
Test Beginning: Date 12/16/97 Time 1420
Test Ending: Date 12-18-97 Time 1430
Organism Batch #: 49 Diluent Batch #: 56
Organism Age: <24 hr
Test Organism: Ceriodaphnia dubia

Test Type: Screening | Definitive
Static | Static Renewal | Flow-through
Temperature range: room 24.0-25.0°C
incubator 23.4-25.6°C
Test Number: 1 of 2

Remarks: D = dead, M = missing
Total residual chlorine of dechlorinated effluent was <0.05mg/L. Aliquot was dechlorinated with 0.45 mL of 0.025N Sodium Thiosulfate per liter of sample. Total Ammonia of dechlorinated aliquot was 7.88 mg/L, corrected Ammonia @ 48hours = 7.7 mg/L 6.85 mF 12/18/97 incorrect # written

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	24.1 @ 24.2	8.3 @ 24.6 °C	103.9 @ 103.6 986 @ 1005 @ 24.8 °C
24 hr	7.0 @ 7.0 9.0 @ 9.0	21.1 @ 21.1	8.2 @ 25.1 °C	9950 @ 10057 102.6 @ 103.6 971 @ 1005 @ 24.7 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	21.4 @ 21.4	8.3 @ 25.0 °C	103.2 @ 103.6 986 @ 1005 @ 24.6 °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 h	48 h
Ctr	A	5	5	5	8.0		8.2	23.5		23.4	7.9		6.2	215		170
Ctr	B	5	5	5			8.2			23.2			6.3			170
Ctr	C	5	5	5			8.2			23.3			6.3			175
Ctr	D	5	5	5			8.2			23.3			6.4			195
100 %	A	5	0	—	8.1	8.6	—	23.4	23.4	—	8.1	8.0	—	1400	1480	—
100 %	B	5	0	—		8.6	—		23.3	—		8.0	—		1450	—
100 %	C	5	0	—		8.6	—		23.3	—		8.1	—		1470	—
100 %	D	5	0	—		8.6	—		23.1	—		8.2	—		1480	—
100% DeCl	A	5	5	1	8.1		8.7	22.8		23.4	8.1		6.3	1415		1405
100% DeCl	B	5	5	2			8.7			23.4			6.4			1480
100% DeCl	C	5	5	1			8.7			23.4			6.4			1510
100% DeCl	D	5	5	5			8.7			23.4			6.4			1650
Measured/Loaded by:		MF	MF	MF	JC	MF	KJ	JC	MF	KJ	JC	MF	KJ	JC	MF	KJ
Recorded by:		KJ	MF	MF	DW	MF	JC	DW	MF	JC	DW	MF	JC	DW	MF	JC

Investigators' Signatures

Marshall Faircloth
John Couch Jr.
Keri Johnson

reviewer

form updated 4/01/96

Salt Water / Well Water — Water Quality Parameters verified by MF

	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):	not measured			
Lab Total Residual Cl2 (mg/L):	<0.03	0.30	DR-100	MF/JC
Alkalinity (mg/L as $CaCO_3$):	67	267	Hach	KJ
Hardness (mg/L as $CaCO_3$):	82	256	Hach	KJ
Total ammonia (mg/L as N):	<0.017	8.05	anion	MF

Ammonia Meter #98136 Ammonia Meter Slope: -55.6 Ammonia Blank: <0.017 Control Salinity: <1 ppt Sample Salinity: <1 ppt

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Primex
County: Wakulla
Contact / District: Joy Jackson Central Lab (NWD)
NPDES Permit #: FL00 1065-2/2672 (State)
LIMS Sample #: 204048 LIMS Job #: 97-DEC-16-07
sample log: 12/23/96 pw

Sample Collection: Date 12/15/97 Time 10:00 AM
Test Beginning: Date 12/16/97 Time 15 45
Test Ending: Date 12-18-97 Time 1540
Organism Batch #: 96 Diluent Batch #: well
Organism Age: 12 days
Test Organism: Cyprinella leedsi

Test Type: Screening | Definitive
Static | Static Renewal | Flow-through
Temperature range: room 24.0 -25.0 °C
incubator 25.0-27.0°C
Test Number: 2 of 2

Remarks: D = dead, M = missing
Total residual chlorine of dechlorinated aliquot was <0.03mg/L, Aliquot was dechlorinated with 0.025N Sodium Thiosulfate at the rate of 0.45mL/L of sample, Total Ammonia of dechlorinated aliquot was 2.85mg/L.

Instrument Calibrations:	pH	Temperature °C	D.O. mg/L	Conductivity µmhos/cm
meter #	7851	90H018262	90H018262	G9005749
0 hr	7.0 @ 7.0 9.0 @ 9.0	24.1 @ 24.2	8.3 @ 24.6 °C	103.9 @ 103.6 986 @ 1005 @ 24.8 °C (9850 @ 10057)
24 hr	7.0 @ 7.0 9.0 @ 9.0	21.1 @ 21.1	3.1 @ 25.1 °C	102.6 @ 103.6 979 @ 1005 @ 24.7 °C
48 hr	7.0 @ 7.0 9.0 @ 9.0	21.4 @ 21.4	8.3 @ 25.0 °C	103.2 @ 1036 986 @ 1005 @ 24.6 °C

Conc.	Chamber #	Number Live 0 hr	Number Live 24 hr	Number Live 48 hr	pH 0 hr	pH 24 hr	pH 48 hr	Temperature (°C) 0 hr	Temperature (°C) 24 hr	Temperature (°C) 48 hr	D.O. (mg/L) 0 hr	D.O. (mg/L) 24 hr	D.O. (mg/L) 48 hr	UNCORRECTED Cond. (mmhos/cm) Cond. (µmhos/cm) 0 hr	24 hr	48 hr
Ctl A	F1	5	5	5	7.6	8.2	8.5	24.2	24.1	24.0	7.5	8.1	6.1	250	260	260
Ctl B	F2	5	5	5	7.6	8.2	8.5	24.1	23.9	24.0	7.6	8.1	6.1	250	260	260
Ctl C	F3	5	5	5	7.7	8.3	8.5	24.0	26.0	24.8	7.7	8.0	6.1	250	270	270
Ctl D	F4	5	5	5	7.7	8.3	8.5	24.0	24.7	24.8	7.7	8.0	6.1	250	260	270
100% A	F5	5	0 (5D)	0 (5D)	7.9	8.4	—	24.0	25.1	—	8.1	7.8	—	1490	1530	—
100% B	F6	5	0 (5D)	0 (5D)	7.9	8.3	—	23.9	25.1	—	8.2	7.8	—	1495	1540	—
100% C	F7	5	0	0 (5D)	7.9	8.3	—	23.9	24.2	—	8.6	7.6	—	1495	1540	—
100% D	F8	5	0	0 (5D)	7.9	8.3	—	23.9	25.9	—	8.7	7.5	—	1505	1570	—
100% Dech A	F9	5	5	4 (1D)	7.9	8.3	8.5	23.9	25.7	24.6	8.5	7.6	6.1	1500	1570	1570
100% Dech B	F10	5	5	4 (1D)	7.9	8.4	8.6	23.9	27.1	24.3	8.5	7.4	6.2	1505	1655	1585
100% Dech C	F11	5	4 (1D)	2 (3D)	7.9	8.4	8.6	23.9	26.6	24.7	8.6	7.3	6.2	1505	1600	1590
100% Dech D	F12	5	3 (2D)	1 (4D)	7.9	8.4	8.5	23.9	24.8	24.5	8.6	7.5	6.1	1505	~~1490~~ A1535	1570
															incorrect number called out MF 12/19/97	
Measured/Loaded by:		DW	MF	KJ	DW	JC	KJ	DW	JC	KJ	DW	JC	KJ	DW	JC	KJ
Recorded by:		JC	MF	KJ	JC	MF	JC	JC	MF	JC	JC	MF	JC	JC	MF	JC

Investigators' Signatures

John Cook Jr.
Marshall Patrick
Kari Johnson

reviewer

Water Quality Parameters (entered by MF)

	Salt Water (Well Water)	20% Min Water	Sample	Method	Measured by
Field Total Residual Cl2 (mg/L):			not measured		
Lab Total Residual Cl2 (mg/L):	<0.03		0.36	DR-IW	MF
Alkalinity (mg/L as $CaCO_3$):	120		267	Hach	KJ
Hardness (mg/L as $CaCO_3$):	130		256	Hach	KJ
Total ammonia (mg/L as N):	<0.017		8.05	orion	MF

Ammonia Meter #98136 Ammonia Meter Slope: -55.6 Ammonia Blank: <0.017 Control Salinity: 21 ppt Sample Salinity: 21 ppt

Phytoplankton taxa list and densities (#/mL) for Primex Technologies, collected via subsurface grabs in Moriah Creek and Big Boggy Branch, on 15 December, 1997.

	Moriah Ck Control	Boggy Br Control	Boggy Br Test
Bacillariophyceae			
Cocconeis sp.	–	–	3
Cyclotella sp.	–	6	15
Cymbella sp.	6	3	–
Epithemia sp.	–	3	–
Gomphonema sp.	–	3	6
Melosira sp.	29	–	–
Navicula minima	–	–	3
Navicula sp.	9	26	15
Nitzschia sp.	15	41	15
Rhopalodia sp.	–	6	–
Surirella sp.	3	–	–
Undetermined Diatomaceae	–	–	3
Undetermined Pennate Diatom	3	–	9
Chlorophyceae			
Chlamydomonas sp.	–	38	35
Golenkinia sp.	–	–	9
Kirchneriella sp.	–	–	15
Scenedesmus sp.	–	–	15
Selenastrum sp.	–	–	12
Tetraedron sp.	–	3	6
Trochiscia sp.	–	3	–
Undetermined Chlorophyceae	12	21	32
Chrysophyceae			
Synura sp.	–	3	6
Cryptophyceae			
Chroomonas sp.	6	18	9
Cryptomonas sp.	6	9	12
Cyanophyceae			
Dactylococcopsis sp.	–	–	26
Oscillatoria sp.	–	6	6
Synechococcus sp.	–	15	497
Euglenophyceae			
Euglena sp.	–	3	9
Lepocinclis sp.	–	–	3

Periphyton taxa list and densities (#/mm^2) for Primex Technologies, collected via glass microscope slides in Moriah Creek and Big Boggy Branch, on 15 December, 1997.

	Moriah Ck Control	Boggy Br Control	Boggy Br Test
Bacillariophyceae			
Achnanthes exigua	–	1193	105
Achnanthes hungarica	–	–	105
Achnanthes lanceolata	–	398	–
Achnanthes lanceolata dubia	–	2982	105
Achnanthes linearis	–	2385	–
Achnanthes sp.	–	–	105
Amphora sp.	–	–	105
Bacillaria paradoxa	–	–	105
Capartogramma crucicula	–	–	105
Cocconeis sp.	–	–	105
Cyclotella sp.	–	398	420
Cymbella aspera	–	398	–
Cymbella minuta	–	398	–
Cymbella sp.	–	398	–
Denticula sp.	–	398	–
Epithemia turgida	–	1193	–
Fragilaria construens	–	398	420
Fragilaria sp.	–	21867	4727
Gomphonema parvulum	–	398	–
Gomphonema tenellum	–	398	–
Gyrosigma sp.	–	–	105
Melosira sp.	–	795	1891
Navicula arvensis	–	–	105
Navicula capitata hungarica	–	–	105
Navicula cincta	–	–	105
Navicula confervacea	–	11132	105
Navicula cryptocephala	–	4970	105
Navicula cuspidata	–	–	210
Navicula heufleri	–	795	–
Navicula minima	–	2385	105
Navicula mutica	–	795	–
Navicula rhynchocephala	–	–	105
Navicula sp.	–	2385	210
Nitzschia amphibia	–	2584	–
Nitzschia filiformis	–	4970	–
Nitzschia fonticola	–	2982	–
Nitzschia palea	140	6958	210
Nitzschia sp.	281	9144	210
Undetermined Pennales	–	3379	2521
Pinnularia sp.	281	–	–
Pinnularia viridis	–	–	105
Rhopalodia gibberula	–	1988	–

Surirella angustata	–	398	–
Surirella ovata	–	2584	–
Synedra gaillonii	–	3777	–
Synedra sp.	–	795	105
Chlorophyceae			
Characium sp.	–	199	–
Chlamydomonas sp.	–	199	105
Chlorococcum sp.	–	398	105
Cosmarium sp.	–	795	–
Desmatractum sp.	–	199	–
Gloeocystis sp.	–	994	–
Oedogonium sp.	–	398	–
Scenedesmus sp.	–	398	1261
Spirogyra sp.	–	199	–
Tetraedron sp.	–	596	–
Ulothrix sp.	–	2783	–
Cryptophyceae			
Chroomonas sp.	281	–	525
Cyanophyceae			
Anabaena sp.	–	199	–
Aphanocapsa sp.	–	–	105
Chroococcus sp.	–	–	210
Lyngbya sp.	–	–	315
Microcystis sp.	281	–	–
Oscillatoria sp.	–	199	–
Spirulina sp.	140	199	105
Euglenophyceae			
Euglena sp.	–	–	315

Benthic macroinvertebrate taxa list for Primex Technologies, collected via Hester-Dendy artificial substrates in Moriah Creek and Big Boggy Branch, on 15 December, 1997. Densities, in number/m^2, represent the mean of three replicates.

	Moriah Creek Control	Boggy Br Control	Boggy Br Test
Amphipoda			
Crangonyx sp.	16	71	–
Gammarus sp.	–	–	16
Hyalella azteca	5	–	198
Coleoptera			
Neoporus sp.	5	–	–
Diptera			
Ablabesmyia mallochi	–	16	5
Asheum beckae	–	–	3
Chironomus sp.	–	63	164
Cladotanytarsus sp.	–	–	8
Corynoneura sp. C Epler	–	–	5
Cricotopus bicinctus	–	8	–
Dicrotendipes modestus	–	5	–
Endochironomus nigricans	–	–	3
Microtendipes pedellus	3	–	–
Tanytarsus sp.	–	19	3
Tanytarsus sp. A Epler	–	3	–
Tanytarsus sp. F Epler	–	–	3
Tanytarsus sp. G Epler	–	34	–
Tanytarsus sp. L Epler	–	3	–
Tanytarsus sp. T Epler	–	11	–
Undetermined Chironomidae	3	21	5
Ephemeroptera			
Baetis sp.	–	3	–
Caenis sp.	–	–	3
Stenacron floridense	3	–	–
Gastropoda			
Amnicola dalli	3	–	–
Ferrissia hendersoni	–	16	–
Neritina reclivata	11	–	21
Undetermined Ancylidae	–	3	–
Undetermined Gastropoda	–	3	–
Undetermined Hydrobiidae	–	3	–
Undetermined Lymnaeidae	–	3	–
Isopoda			
Caecidotea sp.	–	21	–
Lirceus sp.	77	8	–
Odonata			
Undetermined Aeshnidae	–	3	–
Undetermined Coenagrionidae	–	3	–
Undetermined Odonata	–	3	–
Trichoptera			
Oxyethira sp.	–	45	–

Benthic macroinvertebrate taxa list for Primex Technologies, collected via 20 discrete dip net sweeps in Moriah Creek and Big Boggy Branch, on 15 December, 1997.

	Moriah Ck Control	Boggy Br Control	Boggy Br Test
Amphipoda			
Crangonyx sp.	1	1	–
Hyalella azteca	2	–	69
Undetermined Amphipoda	6	1	–
Coleoptera			
Dineutus sp.	2	–	–
Dubiraphia sp.	10	–	–
Dubiraphia vittata	–	–	6
Macronychus sp.	2	–	–
Microcylloepus sp.	5	–	–
Stenelmis sp.	2	–	–
Undetermined Elmidae	1	–	–
Decapoda			
Cambarus sp.	2	–	–
Undetermined Cambaridae	–	3	–
Diptera			
Ablabesmyia mallochi	1	1	1
Asheum beckae	–	1	–
Chironomus sp.	1	2	1
Cladotanytarsus sp.	–	–	4
Clinotanypus sp.	–	1	–
Corynoneura sp.	–	7	3
Corynoneura sp. C Epler	–	8	2
Corynoneura taris	2	1	–
Cricotopus bicinctus	–	6	–
Culicoides sp.	–	3	–
Dicrotendipes modestus	1	–	1
Glyptotendipes sp.	–	–	1
Goeldichironomus natans	1	–	–
Merycomyia sp.	–	–	1
Microtendipes pedellus grp.	5	–	–
Nanocladius sp.	–	3	1
Parachironomus sp.	–	–	1
Parametriocnemus sp.	2	–	–
Parametriocnemus sp. F Epler	2	–	–
Phaenopsectra punctipes grp.	1	–	–
Polypedilum illinoense	–	4	1
Polypedilum illinoense grp.	5	–	–
Polypedilum scalaenum grp.	1	–	–
Stempellinella sp.	1	–	–
Tanypus carinatus	–	1	–
Tanytarsus sp.	–	2	–
Tanytarsus sp. L Epler	1	–	–
Tanytarsus sp. M Epler	1	–	–
Tanytarsus sp. S Epler	1	–	–
Tribelos jucundus	1	–	–
Ephemeroptera			
Baetis sp.	1	–	–
Caenis sp.	1	–	3

Callibaetis floridanus	–	24	–
Callibaetis sp.	–	10	1
Gomphus sp.	2	–	–
Gastropoda			
Ferrissia sp.	–	3	–
Fossaria sp.	–	1	–
Laevapex fuscus	4	–	–
Neritina reclivata	1	–	–
Physella sp.	–	1	–
Undetermined Ancylidae	3	–	–
Undetermined Gastropoda	1	–	–
Undetermined Hydrobiidae	6	–	–
Undetermined Planorbidae	3	–	–
Hemiptera			
Undetermined Hemiptera	–	5	–
Isopoda			
Caecidotea sp.	4	1	1
Lirceus sp.	3	–	–
Odonata			
Enallagma sp.	–	1	2
Libellula sp.	1	–	–
Pachydiplax longipennis	–	–	1
Undetermined Coenagrionidae	–	–	1
Oligochaeta			
Dero digitata	–	1	–
Eclipidrilus palustris	–	–	1
Eclipidrilus sp.	1	2	–
Haber speciosus	1	–	–
Haemonais waldvogeli	1	–	–
Limnodrilus hoffmeisteri	1	8	–
Spirosperma ferox	–	6	–
Pelecypoda			
Undetermined Sphaeriidae	3	–	–
Trichoptera			
Oecetis sp.	1	–	2
Oxyethira sp.	–	1	–
Undetermined Hydroptilidae	–	–	1
Turbellaria			
Dugesia tigrina	–	–	2
Undetermined Planariidae	1	–	–

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

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0002518		971215		X	S	2

Remarks

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

1	2	3	11	12	17	18	19	20
Transaction Code		NPDES NUMBER		YR/MO/DA		Insp Type	Inspector	Fac Type
N	5	FL0002518		971215		B	S	2

Remarks

21 66