

Biological Assessment of

Hastings Reverse Osmosis Reject Water Treatment Plant

St Johns County

NPDES #FL0169226

Sampled February 2000

May 2001

Biology Section

Bureau of Laboratories

Division of Resource Assessment and Management

Comprehensive Quality Assurance Plan No. 870346G

Florida Department of Environmental Protection
Fifth Year Inspection Summary

Discharger:	Hastings Reverse Osmosis Reject Water
County:	St Johns
NPDES Permit Number:	FL0169226
Permit Expiration:	October 18, 2001

Toxics Sampling Inspection (XSI)

Date Sampled: February 22, 2000

Results: Copper, iron and nickel were detected in the effluent at levels that complied with Class III (marine) water quality standards (Table 1). No organic constituents were detected in the effluent

Compliance Biomonitoring Inspection (CBI)

Date Sampled: February 22, 2000

Results: The effluent sample was not toxic to either the fish *Cyprinella leedsi* or the invertebrate *Ceriodaphnia dubia* during the 48-hour acute bioassay test.

Impact Bioassessment Inspection (IBI)

Date Sampled: February 22, 2000

Results: Although there were some differences in community structure among the phytoplankton and macroinvertebrate communities, the dfacility did not appear to be having an adverse effect on the biological communities in the receiving waters. The differences appeared to be more a result of natural variations rather than an effluent related impact.

Water Quality Inspection (WQI)

Date Sampled: February 22, 2000

Results: Nutrients were high at all study sites, indicating sources of nutrients in the watershed other than the effluent. For example, at all sites nitrate+nitrite, total phosphorus, and ortho-phosphate were all at or above 80% of typical values in other Florida streams. Dissolved oxygen levels at the control site (2.8 mg/L), test site 1 (4.0 mg/L) and test site 2 (2.4 mg/L) were below Class III water quality standards (Rule 62-302.530 (31) FAC). The effluent DO value complied with the facility's permit limit (5.0 mg/L) and Class III standards. The effluent water temperature (22.6°C) was 5°C warmer than the ambient temperatures at the study sites. Fecal and total coliform counts complied with Class III water quality standards at all study sites and in the effluent sample. All AGP values were below the 5 mg dry wt/L "problem threshold".

Biological assessments are prepared by FDEP staff to provide information for review of NPDES permit renewal applications. Biological assessments, in conjunction with other information concerning the subject facility and its receiving-water body, are used to determine appropriate permit conditions.

Introduction

The Hastings Reverse Osmosis Water Treatment Plant in St Johns County, Florida, (see map in Appendix) uses reverse osmosis for the production of drinking water. Treatment of the reverse osmosis reject water consists of aeration. The effluent is continuously discharged into Deep Creek, a Class III tributary of the St. Johns River. The reject water is discharged via a 4-inch force main into a multiport diffuser that discharges approximately 7 meters from the shoreline of Deep Creek. The design flow of the Hastings RO wastewater system is 0.087 Million Gallons per Day (MGD) and the flow during this survey was approximately 0.04 MGD (see Facility Summary in Appendix).

State permit limits for the effluent are listed in Table 1. Florida Department of Environmental Protection (FDEP) review of monthly operating reports from the Hastings RO plant indicated that they have not maintained compliance with some permit limits and Rule 62-302 as described below. There was one silver exceedance and six radium exceedances since January 1999 (see Facility Summary in Appendix). The Northeast District addressed radium exceedances through a permit modification allowing an expanded mixing zone. There are three overlapping mixing zones for the Hastings RO facility discharge ranging from 5.0 to 11.2 feet from the diffuser to the discharge port. The mixing zones are for conductivity, silver, chronic toxicity, gross alpha particles, un-ionized ammonia and combined radium (see Facility Summary in Appendix).

Methods

The purpose of this investigation was to determine the effects of the Hastings RO discharge on the tidally influenced Deep Creek. To establish discharge effects, a comparison of biological community health was made between a control site and two test sites. The control site was located in Deep Creek, 400 meters west of the State Road 207 Bridge and 440 meters east and upstream of the Point of Discharge (POD). Test site 1 was located in Deep Creek, 50 meters west and downstream of the POD and test site 2, also in Deep Creek, was 50 meters east and upstream of the POD. Habitat assessments were performed in situ to establish comparability between the field sites. The Hastings RO effluent was analyzed for metals and organic constituents (base neutral and acid extractables). Supplemental physical and chemical data were also collected from the effluent and field sites. Data for this report were collected on February 22, 2000.

The invertebrate, Ceriodaphnia dubia, and the vertebrate, Cyprinella leedsi, were used as test organisms for an acute screening toxicity bioassay on an effluent sample. Bacterial populations were analyzed for total and fecal coliforms. Sediments from control and test sites were analyzed for grain size.

Quantitative benthic macroinvertebrate samples were collected with a Petite ponar sampler from all field sites during an incoming tide. Phytoplankton was sampled at both control and test sites via subsurface grabs. Phytoplankton chlorophyll *a* was determined using a laboratory spectrophotometer for all study sites. The organism, *Dunaliella tertiolecta*, was used for the algal growth potential tests on the effluent and study sites. All field and laboratory methods for FDEP investigations are carried out following the Bureau of Laboratory Standard Operating Procedures (SOPs), and may be reviewed at http://www.myflorida.com/ and navigating through: Environment>Learn>Scientific Services>Laboratories>Library.

Several measurements of macroinvertebrate and algal community health were used to determine the effects of the discharge on those community assemblages in the receiving water. These measurements were: habitat assessment, taxa richness, Shannon-Weaver Diversity Index, community composition, functional feeding groups and algal biomass. For a discussion of each of these measures, see Explanation of Measurements of Community Health in the Appendix.

FDEP personnel involved in this investigation were from the Northeast District: Pat O'Connor, Chris Mason and Heather Wehry. Personnel involved in the analyses from the Central Biology Laboratory in Tallahassee were: Scott Bryan, Rob Buda, Melva Campos, Maosen Chen, Meiqin Chen, Darlene Ellis, Ken Espy, Marshall Faircloth, Shannon Gerardi, Mike Heyn, Joy Jackson, Isaura Lorenzo-Perez, Edwin Loschi, Elizabeth Miller, Chelsea Paparigian, Della Parker-Hanson, Urania Quintana, Julie Riley, Gitta Schmitt, Karla Whiddon, and Steve Wolfe. This report was reviewed by district representatives and the Point Source Review Committee: Dr. Wayne Magley, Michael Tanski, and Chuck Ziegmont.

Results and Discussion

Chemical and biological results for this report are presented in Tables 1-3. Copper, iron and nickel were detected in the effluent at levels that complied with Class III water quality standards (Table 1). No organic constituents were detected in the effluent. The acute static toxicity test did not indicate toxicity using the vertebrate, *Cyprinella leedsi*, or the invertebrate, *Ceriodaphnia dubia* (see Bioassay Bench Sheets in Appendix).

Dissolved oxygen at the control site (2.8 mg/L), test site 1 (4.0 mg/L), and test site 2 (2.4 mg/L) failed to comply with Class III water quality standards (Rule 62-302.530 (31) FAC). The effluent dissolved oxygen level (7.0 mg/L) complied with the facility's permit of 5.0 mg/L. The effluent water temperature (22.6°C) was several degrees higher than

Table 1. Effluent limits and summary of chemistry data.

Hastings RO Water Treatment Plant	Effluent Limits	Effluent Sample	Control Site	Test Site 1	Test Site 2
Organic Constituents (µg/L)					
None Detected	-	-	-	-	-
Metals (mg/L)					
Aluminum	-	100 U	-	-	-
Arsenic	50 **	8.0 U	-	-	-
Cadmium	7.79 c**	0.080 U	-	-	-
Chromium	1,543.5 c**	1.4 U	-	-	-
Copper	96.2 c**	4.6 I	-	-	-
Iron	1000 **	73 I	-	-	-
Lead	72.3 c**	0.50 U	-	-	-
Nickel	1256.26 c**	2.9 I	-	-	-
Selenium	5.0 **	2.4 U	-	-	-
Silver	0.286 *	0.060 U	-	-	-
Zinc	847.23 c**	10.0 U	-	-	-
Nutrients (mg/L)					
Ortho-phosphate	-	0.004 U	0.16	0.2	0.2
Total phosphorus	-	0.015 U	0.23 A	0.27	0.25
Ammonia	-	0.64	0.12	0.088	0.088
Nitrate+Nitrite	-	0.23	0.15	0.12 A	0.12
TKN	-	1.0 A	0.60 A	0.54	0.55
Organic Nitrogen	-	0.36	0.48	0.452	0.462
Total Nitrogen	-	1.23	0.75	0.66	0.67
General Phys-Chem Parameters					
Habitat Assessment	-	-	132	130	130
D O (mg/L)	5.0 *	7.0	2.8	4.0	2.4
pH (SU)	6.0-8.5 *	7.5	6.6	6.7	6.7
Conductivity (µmhos/cm)	5089 *	4576	2820	2860	2860
Temperature (°C)	**	22.6	17.5	18.0	18.1
BOD, 5 day (mg/L)	**	2.0 K	2.0 K	2.0 K	2.0 K
Total Suspended Solids (mg/L)	-	1.0	1.0	2.0	1.0
Turbidity (NTU)	29 **	1.6	0.9	0.9	0.9
Color (PtCo)	-	5 K	30	30	30
Radium (pCi/L)	12.2 *	-	-	-	-
Gross alpha (pCi/L)	30.0 *	-	-	-	-
Flow (MGD)	0.087 *b	-	-	-	-
Hardness (mg $CaCO_3$)	-	1162.57	-	-	-
AGP (mg dry wt/L)	-	0.1 U	4.0 A	0.2 I	3.0
Microbiology (# counts/100 ml)					
Fecal Coliforms	800	10 B	260 A	430	470
Total Coliforms	2400	10 K	100	200	110
Toxicity (48-hour, static screening bioassay)					
Bioassay - Fish	NOEC/LC50	25 L	-	-	-
Bioassay - Invertebrate	NOEC/LC50	25 L	-	-	-

* Permit Limit	A - Value is the mean of two or more determinations
** Class III water quality standard	B - Colony counts outside the acceptable range
a- Value is hardness based	I - Value is < the MQL, and ε the MDL
b- Daily Max	K - Actual value is known to be less than value given
LC50 - Lethal Concentration to 50% of the test species	L - Actual value is known to be greater than value given
NOEC - No Observable Effect Concentration	U - Analyzed for but not detected; value is the MDL

Table 2. Community structure of control and test sites.

Hastings RO Water Treatment Plant	Control Site	Test Site 1	Test Site 2
Macroinvertebrate Quantitative			
Number of Taxa	32	40	37
Shannon-Weaver Diversity Index	3.73	3.09	2.93
Percent Dominant Taxon	21.7	30.1	46.3
Community Composition			
% Amphipoda	21.7	18.7	17.5
% Chironomidae	11.9	5.5	9.0
% Climacia	1.1	0.0	0.0
% Diptera	11.9	5.6	9.1
% Ephemeroptera	0.5	0.2	0.2
% Gastropoda	26.0	38.9	9.1
% Hydrozoa	0.0	0.5	0.9
% Isopoda	20.4	22.7	51.0
% Oligochaeta	8.4	4.5	8.8
% Pelecypoda	0.5	0.5	1.0
% Planaria	9.3	8.2	2.4
% Other	1.7	1.2	1.1
Functional Feeding Groups			
% Browsers-grazers	12.4	10.2	11.1
% Burrowing Deposit Feeders	7.65	3.36	4.79
% Predators/Carnivores	11.4	9.9	4.9
% Scavengers	29.8	31.1	57.4
% Scrapers	16.2	38.0	9.0
% Surface Deposit Feeders	8.3	2.8	4.8
% Suspension Feeders	4.8	2.1	3.7
% Unknown	8.2	1.3	2.8
Phytoplankton Algae			
Number of Taxa	25	23	20
Shannon-Weaver diversity	2.84	3.89	3.29
Algal Density (#/mL)	492	231	316
% Blue-green	11.8	10.5	12.1
% Cryptophytes	0.4	2.3	0.0
% Diatoms	30.2	52.6	43.3
% Dinoflagellates	0.8	0.8	0.0
% Green	55.7	28.6	42.7

the ambient water temperature at all study sites (Table 1). Conductivities among the study sites were similar and typical of tidally influenced waters (Table 1). The effluent conductivity (4,576 µmhos/cm), although over twice as high as background levels, complied with the facility's permit limit and did not appear to have increased test site levels. The remaining general physical/chemical measurements were similar among the study sites (see Table 1 and Physical-Chemical Characterization Field Data Sheets in Appendix).

Fecal and total coliforms in the effluent and receiveing water samples complied with Class III water quality standards.

Nutrients were similarly elevated at the control and test sites in Deep Creek (Table 1). Several nutrients (nitrate+nitrite, total phosphorus, and ortho-phosphate) were equal to or greater than 80% of typical streams in Florida at the control and test sites. The control site nutrients were generally-higher than test site levels. For example, ammonia was greater than 90% of typical values at the control site compared to 60%-70% at the test sites. The effluent did not appear to contribute to further nutrient enrichment at the test sites (Table 1).

Algal Growth Potential (AGP) measures bioavailable nutrients via algal response. The receiving water and effluent samples were all below the 5 mg dry wt/L "problem threshold" (Raschke and Shultz 1987).

There were some differences in the phytoplankton communities among the study sites (Table 2). For example, test site 1 was dominated by diatoms (52.6%) and test site 2 had a nearly equal abundance of diatoms (43.3%) and green algae (42.7%), while the control site, perhaps due to the higher nutrients, was dominated by green algae (55.7%). Diversity at the control site was 37% and 16% lower compared to test sites 1 and 2, respectively (Table 2). The dominant taxon at all study sites was the dinoflagellate, *Chlamydomonas* sp. (see Phytoplankton Taxa Lists in Appendix).

Habitat assessment scores placed all study sites in the "optimal" category (see Habitat Assessment Field Sheets in Appendix). The macroinvertebrate communities in this study reflect the tidally influenced nature of Deep Creek. The dominant organisms at the control site (*Gammarus* sp.), test site 1 (*Laevapex fuscus*), and test site 2 (*Caecidotea* sp.) reflect the higher conductivities measured during this survey. Diversity decreased by 17% at test site 1 and 21% at test site 2 compared to the

control site. These reductions were due in part to the greater number of organisms at test site 1 (2,113 organisms) and test site 2 (1,356 organisms) compared to the control site (980 organisms) and the greater percent contribution of the dominant taxon at the test sites. The dominant taxon made up 22% of the control site community compared to 30% and 46% contribution at test sites 1 and 2, respectively. On the other hand, taxa richness increased 25% at test site 1 and 13.5% at test site 2 compared to the control site. The benthic substrate at the study sites may account for some of the differences in the macroinvertebrate communities (Table 3). For instance, test site 1 had a significantly higher proportion of particles less than 0.063 mm in diameter while the control site had greater proportion of particles in the 0.5-2.0 mm range.

In general, the differences in the biological communities among the study sites appear to be due more to natural variationrather than an effect associated with the discharge.

Table 3. Sediment analysis of control and test sites.

Hastings RO Water Treatment Plant	Control Site	Test Site 1	Test Site 2
Sediment Particle Size (%Vol)			
< 0.063 mm	38.1	60.5	41.0
0.063-0.125 mm	12.5	14.2	9.67
0.125-0.25 mm	11.9	8.24	16.6
0.25-0.5 mm	10.5	4.1	16.0
0.5-2.0 mm	27.0	12.9	16.7
> 2.0 mm % total dry weight	3.8	3.1	6.0

Literature Cited

Barbour MT, Gerritsen J, White JS (TetraTech Inc, Owings Mills MD). 1996. Development of the Stream Condition Index (SCI) for Florida. Tallahassee (FL): FDEP. 105p. Available from: FDEP, Tallahassee, FL 32399-2400.

EA Engineering, Science, and Technology and Tetra Tech, Inc. 1994. Bioassessment for the Nonpoint Source Program. Draft. Prepared for the FL Dept. Env. Protection Unpaginated. Available from: FDEP, Tallahassee, FL 32399-2400.

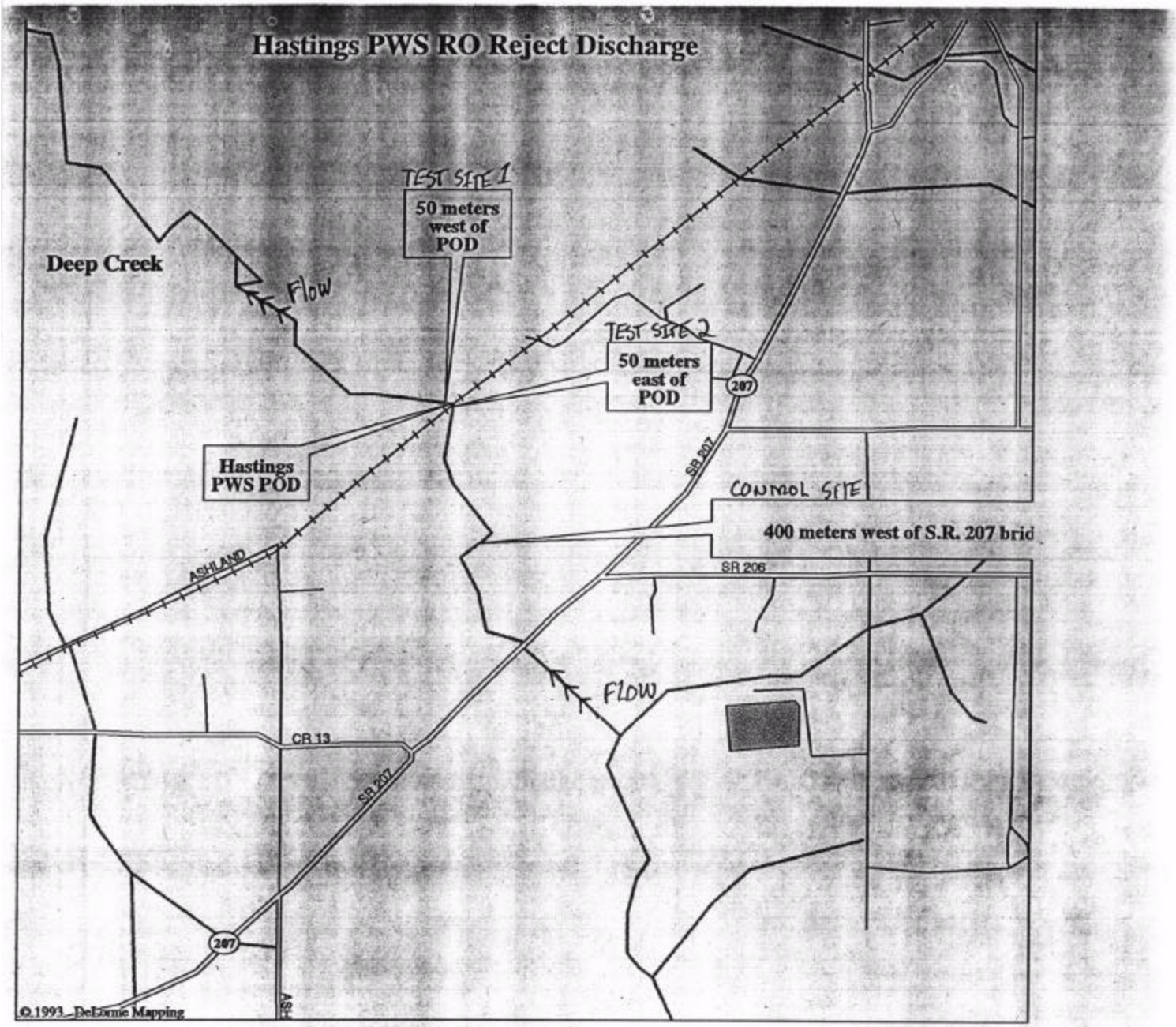
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Florida Department of Environmental Protection. 1994. Lake Bioassessments for the Determination of Nonpoint Source Impairment in Florida. Tallahassee (FL):FDEP. Biology Section. 73p. Available from: FDEP, Tallahassee, FL 32399-2400.

Miller WE, Maloney TE, Greene JC. 1978. The Selenastrum capricornutum Printz Algal Assay Bottle Test. Cincinnati: USEPA. EPA-600/9-78-018. 126p.

Raschke RL, Schultz DA. 1987. The Use of the Algal Growth Potential Test for Data Assessment. J Wat Pollution Cont Fed 59(4):222-7.

Weber CI. 1993. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. 4th edition. Cincinnati: USEPA EPA/600/4-90/027. 216p.



LEGEND

- Population Center
- State Route
- Street, Road
- Major Street/Road
- State Route
- Railroad
- River
- Open Water
- Intermittent River

Scale 1:15,625 (at center)

1000 Feet

500 Meters

Mag 15.00
Tue Apr 18 08:57:08 2000
Sampled 02/21/00

Explanation of Measurements of Community Health

Different measurements of macroinvertebrate and algal community health are used to determine the biotic effects of a discharge. The measurements are briefly discussed here, (**MN**, marine, **FW**, freshwater).

MN/FW Taxa richness: Environmental stressors tend 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.

MN/FW 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 that is also associated with disturbance.

MN/FW Numbers of pollution sensitive taxa: Some organisms become rare or absent as the intensity or duration of disturbance increases. Species sensitivity data from other sources, such as Chang *et al.* (1992), Farrell (1992), Hudson *et al.* (1990), Hulbert (1990), Lenat (1993), and Whitmore (1989), are used as appropriate.

MN/FW Community structure: Substantial shifts in proportions of major groups of organisms, compared to control 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

MN/FW Functional feeding groups/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).

MN/FW Algal Growth Potential: Evaluates nutrient conditions based on the premise that "maximum yield is proportional to the amount of a nutrient available" (RL Raschke and Schultz, 1987) using *Duniella tertiolecta* for marine water systems and *Selenastrum capricornutum* Printz for freshwater systems.

MN/FW 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.

FW 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).

FW 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.

FW 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.

FW 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).

State of Florida
Department of Environmental Protection
Facility Summary

Facility Name: Hastings Water Treatment Plant – Reverse Osmosis Reject Water		**Prepared By:** Heather Wehry **Date:** 2/17/2000
Location: (See Attached Map)	**County:** 55-St. Johns	**District:** Northeast
Federal Permit No.: FL0169226 **Expiration Date:** 10/18/2001	**State GMS #:** N/A **State Expiration Date:** N/A	**Facility Type:** Industrial
Function of Facility: Water treatment		
Description of treatment process: Treatment of reverse osmosis reject water consists of aeration.		
Receiving Waters: Deep Creek		**Classification:** Class III – Fresh Water
Design Flow: 0.087 MGD (average)	**Mean Flow:** 0.04 MGD (3/99 – 11/99)	**Flow during survey:**
Discharge is: *Continuous*	Intermittent	Seasonal	Rainfall Dependent	Other

Facility Mixing Zone Details: There are mixing zones for un-ionized ammonia, specific conductivity, silver, combined radium, chronic toxicity, and gross alpha. The mixing zone extends for a radius of 11.2 feet from the diffuser discharge port for combined radium. The mixing zone for specific conductivity, silver, chronic toxicity, and gross alpha extends for a radius of 5.0 feet from the diffuser discharge port. The mixing zone for un-ionized ammonia extends for a radius of 10.0 feet from the diffuser discharge port. The mixing zones for combined radium and chronic toxicity were recently expanded in February 2000 by a permit modification.

List effluent limits:

Parameter	Limit	Describe special permit conditions and permit modifications:
Flow (MGD)	Report monthly average 0.087 mgd daily max	
Dissolved oxygen (mg/l)	5.0 Daily Maximum	
Specific conductivity (umhos/cm)	5089.0 Daily Max	
Hydrogen sulfide (mg/l)	Report Daily Max.	
Un-ionized ammonia (mg/l)	0.16 Daily Max.	
Silver (µg/l)	0.286 Daily Max.	
Radium 226+228 (pCi/l)	12.2 Daily Max.	
Gross alpha (pCi/l)	30.0 Daily Max.	

pH (s.u.) Chronic Toxicity	6.0 < pH <8.5	Survival and Reproduction test on Ceriodaphnia dubia and Larval Survival and Growth test on Pimephales promelas
Description of permitted outfall: Wastewater discharges through an 4 inch force main into a multi-port diffuser pipe, which discharges approximately 20 feet from the shore line of the Deep Creek.		
List permit violations (MOR data) and plant upsets that occurred at the plant within the past year: The facility has experienced six radium and one silver exceedances since January 1999. The radium exceedances have resulted in the approval of an expanded mixing zone, which was detailed above.		
Describe previous impact bioassessments, WQBEL's, and previous or current enforcement actions: Samples have not been collected from the reverse osmosis reject stream.		
Discuss MOR trends to prior data; is the trend improving or declining: There has been no noticeable trend in the submitted data.		
Additional Information: N/A		

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:
	20030733	2/22/00	1110	St. Johns River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	St. Johns	Deep Creek 400 m West of SR 207 Bridge	Control 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)
5	5		80	5			5 WETLANDS

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

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

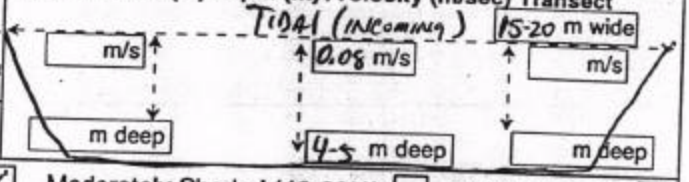
Width of riparian vegetation (m) on least buffered side: >18 — List & map dominant vegetation on back

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

Artificially Impounded ☐ yes

High Water Mark: 0.6 (m above present water level) + 4.5 (present depth in m) = 5.1 (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)	7			Sand			
Leaf Packs or Mats	45	3	P Ponar	Mud/Muck/Silt	32		
Aquatic Vegetation	7			Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots	3						

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								
Mid-depth	2.3	17.5	6.61	2.84	2820			2.6
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:
Cool Clear Surrounding Farm Land Currently Being Irrigated + Fertilized

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

SAMPLING TEAM: Mason, O'Connor

SIGNATURE: Patrick W O'Connor

DATE:

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (5-27-98)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
	20030733	2/22/00	St. Johns River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	St Johns	Deep Creek 400 m West of SR 207 Bridge	Control Site

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Primary Habitat Components **Substrate Diversity** [20]	Four or more productive habitats present (snags, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock). 20 19 18 17 16	Three productive habitats present. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	Two productive habitats present. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	One or less productive habitat. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Substrate Availability [20]	Greater than 30% productive habitat present at site. 20 19 18 17 16	16% to 30% productive habitat, by aerial extent. 15 14 13 12 11	6% to 15 % productive habitat 10 9 8 7 6	Less than 5% productive habitat. 5 4 3 2 1
Water Velocity [10]	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
Habitat Smothering [18]	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
Primary Score [68]				
Secondary Habitat Components **Artificial Channelization** [10]	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
Bank Stability Right Bank [7] Left Bank [7]	Stable. No evidence of erosion or bank failure. Little potential for future problems. 10 9	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 8 7 6	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 5 4	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 3 2 1
Riparian Buffer Zone Width Right Bank [10] Left Bank [10]	Width of native vegetation (least buffered side) greater than 18 m 10 9	Width of native vegetation (least buffered side) 12 m to 18 m 8 7 6	Width of native vegetation 6 to 12 m, human activities still close to system 5 4	Less than 6 m of native buffer zone due to intensive human activities 3 2 1
Riparian Zone Vegetation Quality Right Bank [10] Left Bank [10]	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. 10 9	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. 8 7 6	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. 5 4	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. 3 2 1
Secondary Score [64]				

TOTAL SCORE [132]

ANALYSIS DATE:	ANALYST:	SIGNATURE:
2/22/00	O'Connor	Patrick O'Connor

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:
	20030731	2/22/00	1230	St Johns River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	St Johns	Deep Creek 50 m East of Hastings PWS POD	Test Site 2

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)
5	5		80	5			5 WETLANDS

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: >18

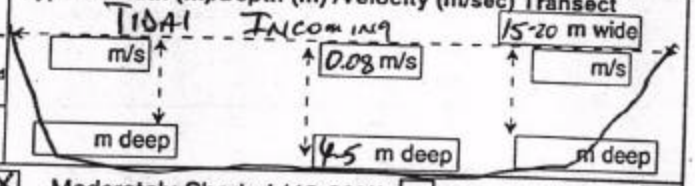
List & map dominant vegetation on back

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

Artificially Impounded ☐ yes more sinuous

High Water Mark: 0.6 (m above present water level) + 4.5 (present depth in m) = 5.1 (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			Sand			
Leaf Packs or Mats	40	3	P Ponar	Mud/Muck/Silt	53		
Aquatic Vegetation	2			Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots	2						

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								
Mid-depth	2.3	18.1	6.67	2.44	2860			2.8
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: Cool Clear
Surrounding Farm land currently being Irrigated & Fertilized

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

SAMPLING TEAM: Mason, O'Connor

SIGNATURE:

DATE: 2/22/00

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (5-27-98)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
	20030731	2/22/00	St Johns River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	St Johns	Deep Creek 50 m East of Hastings PWS POD	Test Site 2

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Primary Habitat Components **Substrate Diversity** 20	Four or more productive habitats present (snags, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock). 20 19 18 17 16	Three productive habitats present. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	Two productive habitats present. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	One or less productive habitat. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
Substrate Availability 20	Greater than 30% productive habitat present at site. 20 19 18 17 16	16% to 30% productive habitat, by aerial extent. 15 14 13 12 11	6% to 15 % productive habitat 10 9 8 7 6	Less than 5% productive habitat. 5 4 3 2 1
Water Velocity 10	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
Habitat Smothering 16	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
Primary Score 66				
Secondary Habitat Components **Artificial Channelization** 10	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
Bank Stability Right Bank 7 Left Bank 7	Stable. No evidence of erosion or bank failure. Little potential for future problems. 10 9	Moderately stable. Infrequent or small areas of erosion, mostly healed over. 8 7 6	Moderately unstable. Moderate areas of erosion, high erosion potential during floods. 5 4	Unstable. Many (60%-80%) raw, eroded areas. Obvious bank sloughing. 3 2 1
Riparian Buffer Zone Width Right Bank 10 Left Bank 10	Width of native vegetation (least buffered side) greater than 18 m 10 9	Width of native vegetation (least buffered side) 12 m to 18 m 8 7 6	Width of native vegetation 6 to 12 m, human activities still close to system 5 4	Less than 6 m of native buffer zone due to intensive human activities 3 2 1
Riparian Zone Vegetation Quality Right Bank 10 Left Bank 10	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. 10 9	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. 8 7 6	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. 5 4	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. 3 2 1
Secondary Score 64				

130 TOTAL SCORE

ANALYSIS DATE:	ANALYST:	SIGNATURE:
2/22/00	O'Connor	Patrick W O'Connor

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:
	20030732	2/22/00	1310	St Johns River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	St Johns	Deep Creek 50 m West of Hastings PWS POD	Test Site 1

RIPARIAN ZONE/INSTREAM FEATURES

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

Forest/Natural	Silviculture	Field/Pasture	Agricultural	Residential	Commercial	Industrial	Other (Specify)
5	5		80	5			5

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

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

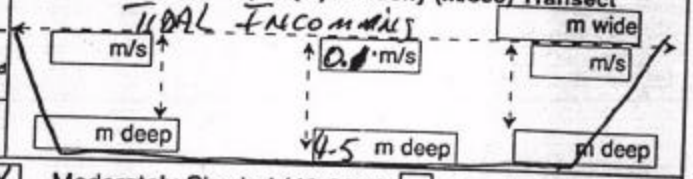
Width of riparian vegetation (m) on least buffered side: *List & map dominant vegetation on back*

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

Artificially Impounded ☐ yes more sinuous

High Water Mark: 0.6 (m above present water level) + 4.5 (present depth in m) = 5.1 (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			Sand			
Leaf Packs or Mats	40	3	P. Ponar	Mud/Muck/Silt	53		
Aquatic Vegetation	2			Other:			
Rock or Shell Rubble				Other:			
Undercut banks/Roots	2			*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								
Mid-depth	2.2	18.0	6.67	4.04	2860			2.4
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: Clear Cool
SURROUNDING FARM LANDS CURRENTLY BEING IRRIGATED & FERTILIZED

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

SAMPLING TEAM:	SIGNATURE:	DATE:
MASON, O'CONNOR	[signature]	2/22/00

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
FRESHWATER BENTHIC HABITAT ASSESSMENT FIELD DATA SHEET (5-27-98)

SUBMITTING AGENCY CODE: / SUBMITTING AGENCY NAME:	STORET STATION NUMBER:	DATE (M/D/Y):	RECEIVING BODY OF WATER:
	20030732	2/22/00	St Johns River

REMARKS:	COUNTY:	LOCATION:	FIELD ID/NAME:
	St. Johns	Deep Creek 50 m West of Hastings PWS #00	Test Site 1

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
Primary Habitat Components				
Substrate Diversity [20]	Four or more productive habitats present (snags, tree roots, aquatic vegetation, leaf packs (partially decayed), undercut banks, rock). 20 19 18 17 16	Three productive habitats present. Adequate habitat. Some substrates may be new fall (fresh leaves or snags). 15 14 13 12 11	Two productive habitats present. Less than desirable habitat, frequently disturbed or removed. 10 9 8 7 6	One or less productive habitat. Lack of habitat is obvious, substrates unstable or smothered. 5 4 3 2 1
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Primary Score [66]				
Secondary Habitat Components				
Artificial Channelization [10]	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
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Riparian Buffer Zone Width Right Bank [10] Left Bank [10]	Width of native vegetation (least buffered side) greater than 18 m 10 9	Width of native vegetation (least buffered side) 12 m to 18 m 8 7 6	Width of native vegetation 6 to 12 m, human activities still close to system 5 4	Less than 6 m of native buffer zone due to intensive human activities 3 2 1
Riparian Zone Vegetation Quality Right Bank [10] Left Bank [10]	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. 10 9	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. 8 7 6	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. 5 4	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. 3 2 1
Secondary Score [64]				

TOTAL SCORE [130]

ANALYSIS DATE:	ANALYST:	SIGNATURE:
2/22/00	O'Connor	Robert a O'Connor

STATE OF FLORIDA
DEPT. OF ENVIRONMENTAL PROTECTION
NORTHEAST DISTRICT

Division of Water Facilities
Surface Water Section

MICROBIOLOGICAL ANALYSIS REPORT

NAME OF SURVEY			COLLECTOR
City of Hastings PWS			O'Connor Wehry
DATE: COLLECTED	**RECEIVED**	**ANALYSES STARTED**	**COMPLETED**
02/21/00	1530 02/21/00	1600 02/21/00	1645 02/22/00
SURVEY TYPE	**SAMPLE TYPE**	**COUNTY**	**ANALYTICAL METHOD**
Industrial Waste FYI5	Effluent Surface Water	St. Johns	Membrane Filter
ANALYST	**COMMENTS**		
Niedbalski			

LAB NO.	STORET NO.	SITE LOCATION	COLL TIME	SET UP TIME	TOTAL COLIFORM #/100ML	TOTAL COLIFORM CODE	FECAL COLIFORM #/100ML	FECAL COLIFORM CODE
00184	CONTROL	Deep Creek 100 m West of SR 207 (Control)	1110	1705	260	A	100	
00185	TEST 1	Deep Creek 50 m West of Hastings PWS POD	1310	1705	430		200	
00186		City of Hastings PWS Final Effluent; RO Reject	1100	1705	10	B	10	K
00187	TEST 2	Deep Creek 50 m East of Hastings PWS POD	1230	1705	470		110	

RESULTS APPROVED BY:	DATE
Mike Hoyt	03/22/00

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Town of Hastings
County: St. Johns
Contact / District: Heather Wehry / NE-DIST
NPDES Permit #: FL0[illegible]169226
LIMS Sample #: 43690 LIMS Job #: TLH-2000-02-22-11-01
sample log 2-2500
Test Type: Screening / Definitive
Static / Static Renewal / Flow-through
Test Number: 2 of 2

Sample Collection: Date 2/21/00 Time 1100
Test Beginning: Date 2/22/00 Time 1300
Test Ending: Date 2/24/00 Time 1400
Organism Batch #: 12 Diluent Batch #: Well
Organism Age: 11 days SRT toxicant batch #: N/A
Test organism: C. leedsi

Remarks: * Temperature of culture room @ loading time was near 23.5°C !!
2/25/00 DPH LC50 > 25% mf 2/25/00
Sample was Diluted to 25% with well water. mf 2/25/00

Conc.	Chamber #	Number Live 0 hr	24 h	48 h	pH 0 hr	24 h	48 h	Temperature (°C) 0 hr	24 h	48 h	D.O. (mg/L) 0 hr	24 h	48 h	UNCORRECTED Cond. (mmhos/cm) Cond (umhos/cm) 0 hr	24 h	48 h
CONT. A	C1	5	5	5	8.0	8.2	8.4	23.2	24.3	24.6	8.6	8.2	8.4	245	260	265
B	C2	5	5	5	8.0	8.3	8.4	23.0	25.4	24.7	8.5	8.1	8.5	245	260	265
C	C3	5	5	5	8.0	8.2	8.4	23.0	25.4	24.6	8.6	8.2	8.5	245	270	265
D	C4	5	5	5	8.0	8.3	8.4	23.2	24.6	24.5	8.7	8.2	8.6	245	265	270
25% ~~100%~~ A	C5	5	5	5	8.0	8.2	8.3	23.4	24.1	24.5	8.6	8.4	8.7	1405	1450	1450
B	C6	5	5	5	8.0	8.3	8.4	23.4	24.7	24.5	8.6	8.4	8.7	1445	1495	1530
C	C7	5	5	5	8.0	8.3	8.4	23.5	24.5	24.6	8.6	8.4	8.7	1440	1510	1575
D	C8	5	5	5	8.0	8.3	8.4	23.4	24.3	24.6	8.6	8.4	8.8	1455	1480	1535
	~~8~~															
measured by:		DPH	SG	SG	MF	SG	DPH	MF	SG	DPH	MF	SG	DPH	MF	SG	DPH
recorded by:		SG	SG	SG	SG	DPH	SG	SG	DPH	SG	SG	DPH	SG	SG	DPH	SG

Investigators' Signatures
Shannon Gerard
Marshall Faircloth
Della Parker Hanx
AH Wolfe
reviewer

Temperature Range °C
Incubator # 3 24.5°-25.5°C
Room B246 23.6°-25.0°C

Salt Water / Well Water

Water Quality Parameters	20% Min Water	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):		NA	NA	N/A	SG
Lab Total Residual Cl2 (mg/L):	<0.03	<0.03	DR100	DPH	SG
Alkalinity (mg/L as $CaCO_3$):	124	200	Hach	DPH/SG	SG
Hardness (mg/L as $CaCO_3$):	144	—	Hach	DPH/SG	SG
Total ammonia (mg/L as N):	<0.017	<0.017	Denver	DPH	SG
Salinity:	0	≈3	YSI	SG	SG

form updated 3/3/99

FDEP Biology Section — Acute Bioassay Bench Sheet

Sample Source: Town of Hastings
County: St Johns
Contact / District: Heather Wehrg / NE-DIST.
NPDES Permit #: FL0B169226
LIMS Sample #: 436190 NF LIMS Job #: TLH2000-02-22-11-01
sample log 2-25-00
Test Type: Screening / Definitive
Static / Static Renewal / Flow-through
Test Number: 1 of 2

Sample Collection: Date 2/21/00 Time 1100
Test Beginning: Date 2/22/00 Time 1430
Test Ending: Date 2/24/00 Time 1400
Organism Batch #: 9 Diluent Batch #: Dmw #5
Organism Age: 24 hrs. SRT toxicant batch #: N/A
Test organism: C. dubia

Remarks: 2/25/00 DPH LC50 71% 95% mf 2/25/00.
Sample was diluted to 25% with 20% DMW. 2/23/00 mf

Conc.	Chamber #	Number Live 0 hr	24 h	48 h	pH 0 hr	24 h	48 h	Temperature (°C) 0 hr	24 h	48 h	D.O. (mg/L) 0 hr	24 h	48 h	UNCORRECTED Cond. (mmhos/cm) Cond (µmhos/cm) 0 hr	24 h	48 h
CNTL.	A	5	5	5	8.4	—	8.3	23.2	—	24.6	8.9	—	8.8	185	—	475
	B	5	5	5	—	—	8.4	—	—	24.6	—	—	8.8	—	—	265
	C	5	5	5	—	—	8.4	—	—	24.5	—	—	8.8	—	—	245
mf	D	5	5	5	—	—	8.4	—	—	24.5	—	—	8.8	—	—	245
25% 100%	A	5	5	5	8.2	—	8.3	23.3	—	24.5	8.9	—	8.8	1380	—	1500
	B	5	5	5	—	—	8.4	—	—	24.5	—	—	8.9	—	—	1640
	C	5	5	5	—	—	8.4	—	—	24.5	—	—	8.8	—	—	1715
	D	5	5	5	—	—	8.5	—	—	24.5	—	—	8.9	—	—	1745
measured by:		SG	SG	DPH	SG	—	DPH SG	SG	—	DPH	SG	—	DPH	SG	—	DPH
recorded by:		DPH	SG	DPH	DPH	—	SG	DPH	—	SG	DPH	—	SG	DPH	—	SG

Investigators' Signatures
Shannon Gerard
Marshall Faircloth
Della Hankins-Hayes
A H Wolfe
reviewer

Temperature Range °C
Incubator # 2 26.5°-27.0°C
Room B246 23.5°-25.0°C

Water Quality Parameters	Salt Water / Well Water	20% Min Water	Sample	Method	Measured by	Verified by
Field Total Residual Cl2 (mg/L):			N/A	N/A	N/A	SG
Lab Total Residual Cl2 (mg/L):		<0.03	<0.03	DR/100	DPH	SG
Alkalinity (mg/L as $CaCO_3$):		76	200	Hach	DPH/SG	SG
Hardness (mg/L as $CaCO_3$):		82	—	Hach	DPH/SG	SG
Total ammonia (mg/L as N):		<0.017	<0.017	Denver	DPH	SG
Salinity:		0	≈3	YSI	SG	SG

form updated 3/3/99

Benthic macroinvertebrate taxa list for Hastings Water Treatment Plant, collected via Ponar grab samples in Deep Creek on 21 February 2000. Densities, in number/m^2, represent the mean of three replicates.

	Control Site	Test Site 1	Test Site 2
Acarina			
Lebertia sp.	–	83	–
Amphipoda			
Gammarus sp.	8875	16375	9750
Hyalella azteca	–	42	–
Undetermined Amphipoda	–	–	125
Cnidaria			
Hydrozoa	–	458	500
Decapoda			
Procambarus sp.	–	42	–
Diptera			
Cecidomyiidae	–	–	125
Chironomus sp.	–	42	208
Coelotanypus sp.	–	42	–
Coelotanypus scapularis	167	–	–
Cryptotendipes sp.	42	–	–
Dicrotendipes modestus	125	–	42
Dicrotendipes simpsoni	1333	–	83
Glyptotendipes sp.	–	42	–
Goeldichironomus sp.	–	–	42
Goeldichironomus fluctuans	333	–	–
Kiefferulus sp.	–	–	125
Palpomyia/Bezzia grp.	–	42	–
Parachironomus sp.	–	–	42
Paramerina sp.	–	–	42
Phaenopsectra punctipes grp.	–	42	–
Polypedilum halterale grp.	542	458	333
Polypedilum illinoense grp.	–	42	–
Procladius sp.	42	208	292
Tanypus sp.	–	42	83
Tanytarsus sp.	667	208	125
Tanytarsus sp. G Epler	208	250	–
Tanytarsus sp. L Epler	375	125	167
Tanytarsus sp. T Epler	792	2208	2667
Tribelos sp.	–	42	–
Tribelos jucundum	42	458	500
Undetermined Chironomidae	208	625	125

Benthic macroinvertebrate taxa list for Hastings Water Treatment Plant, collected via Ponar grab samples in Deep Creek on 21 February 2000. Densities, in number/m^2, represent the mean of three replicates.

	Control Site	Test Site 1	Test Site 2
Diptera			
Zavreliella marmorata	–	83	167
Ephemeroptera			
Caenis sp.	208	208	125
Gastropoda			
Amnicola dalli	167	–	–
Amnicola dalli johnsoni	–	792	42
Ancylidae	3125	19208	2333
Hebetancylus excentricus	583	–	–
Hydrobiidae	1000	625	958
Laevapex fuscus	1250	5792	875
Marisa cornuarietis	–	83	–
Micromenetus sp.	–	1667	–
Micromenetus dilatatus	–	2917	–
Micromenetus dilatatus avus	2458	–	83
Micromenetus floridensis	–	208	–
Physella sp.	250	583	292
Planorbella sp.	83	–	–
Pyrogophorus platyrachis	–	417	375
Undetermined Gastropoda	1708	1958	208
Hirudinea			
Gloiobdella elongata	–	83	333
Glossiphoniidae	83	–	125
Helobdella triserialis	167	750	583
Placobdella hollensis	–	–	42
Undetermined Hirudinea	–	42	–
Isopoda			
Caecidotea sp.	7125	18375	26167
Cyathura sp.	42	–	–
Cyathura polita	–	–	42
Sphaeroma sp.	1167	1583	2583
Neuroptera			
Climacia sp.	458	–	–
Oligochaeta			
Aulodrilus pigueti	2417	708	333
Dero digitata complex	42	125	1167
Dero lodeni	–	–	42
Enchytraeidae	–	42	–

Benthic macroinvertebrate taxa list for Hastings Water Treatment Plant, collected via Ponar grab samples in Deep Creek on 21 February 2000. Densities, in number/m^2, represent the mean of three replicates.

	Control Site	Test Site 1	Test Site 2
Oligochaeta			
Haber speciosus	–	42	–
Haemonais waldvogeli	125	–	83
Limnodrilus hoffmeisteri	583	2167	2125
Pristina sp.	–	42	–
Slavina appendiculata	–	–	83
Tubificidae	–	–	42
Pelecypoda			
Sphaeriidae (mollusca)	208	458	542
Polychaeta			
Undetermined Polychaeta	42	–	–
Tricladida			
Planariidae	3792	7208	1375

Phytoplankton taxa list and densities (#/mL) for Hastings Water Treatment Plant, collected via subsurface grabs in Deep Creek on 21 February 2000.

	Control Site	Test Site 1	Test Site 2
Bacillariophyceae			
Attheya sp.	1	–	–
Coscinodiscus sp.	–	1	2
Cyclotella sp.	7	6	7
Cymbellaceae sp.	2	1	2
Diatomaceae	3	–	2
Diploneis sp.	1	1	4
Entomoneis sp.	2	2	2
Gomphonema sp.	1	–	1
Gyrosigma sp.	4	3	4
Melosira sp.	4	11	2
Navicula sp.	3	4	3
Nitzschia sp.	6	3	3
Nitzschia reversa	5	2	–
Surirella sp.	–	2	–
Undetermined Pennales	38	34	36
Chlorophyceae			
Actinotaenium sp.	1	–	–
Ankistrodesmus falcatus	2	1	–
Chlamydomonas sp.	9	4	1
Chlorella sp.	–	2	–
Scenedesmus sp.	–	–	1
Scenedesmus quadricauda	1	–	1
Selenastrum sp.	4	2	2
Spermatozoopsis sp.	–	–	1
Tetraedron minimum	1	–	–
Tetraselmis sp.	2	6	–
Undetermined Chlorophyceae	14	11	8
Volvocales sp.	110	18	54
Cryptophyceae			
Cryptomonas sp.	1	3	–
Cyanophyceae			
Anabaena sp.	1	1	–
Chroococcaceae	6	2	3
Chroococcus sp.	–	1	–
Lyngbya sp.	2	2	2
Lyngbya contorta	–	1	–
Oscillatoria sp.	9	6	6
Synechococcus sp.	12	1	8

Phytoplankton taxa list and densities (#/mL) for Hastings Water Treatment Plant, collected via subsurface grabs in Deep Creek on 21 February 2000.

	Control Site	Test Site 1	Test Site 2
Dinophyceae			
Glenodinium sp.	2	1	–
Euglenophyceae			
Euglena sp.	1	1	1
Trachelomonas sp.	–	–	1

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

Transaction Code	NPDES NUMBER	YR/MO/DA	Insp Type	Inspector	Fac Type
1 N 2 5	3 FL0169226 11	12 000222 17	18 X	19 S	20 1

Remarks

21 66

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

Transaction Code	NPDES NUMBER	YR/MO/DA	Insp Type	Inspector	Fac Type
1 N 2 5	3 FL0169226 11	12 000222 17	18 B	19 S	20 1

Remarks

21 66