

Bioassays of

Julington Creek Wastewater Reclaimation Facility

Jacksonville, St. John's County, Florida

NPDES #FL0043591

Sampled 8/19/02

December 2002

Biology Section

Division of Resource Assessment & Management

Comprehensive Quality Assurance Plan #870346G

Bioassays of

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Introduction

Julington Creek WWRF, 1638 Davis Pond Boulevard, Jacksonville, St. John's County, Florida, NPDES #FL0043591, test performed on 20 to 22 August 2002.

This sequential batch reactor wastewater reclaimation facility has a design flow of 1.5 MGD and an average annual flow of 0.536 MGD (August, 2001-July, 2002). The facility uses the intermittent extended-aeration system (SBR-ICEAS) process. The system consists of two automatic cleaned-bar screens, two 3,000 gallon alum storage tanks, a 1.5 million gallon reclaimed-water storage tank, four SBR basins, six tertiary filter cells, a chlorine-contact chamber, an aerobic digester, a reject-water storage tank, a reclaimed water high service pumping station, a gravity belt residuals thickener, a SBR basin, and a 0.5 million gallon addition to the reject-water storage tank. Water is filtered and chlorinated for disinfection, pumped into a storage tank, and then sent to Golf Course Lake number 4 (Champions Club Golf Course). A limited wet weather APRICOT Act discharge to the Class III fresh waters of the St. Johns River exists, limited to a maximum annual volume of 142.1 MG (facility information provided by Brian Kelsay, FDEP, Jacksonville).

The toxicity tests discussed in this report were performed in accordance with methods described by Weber, 1993, *Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms*, 4th Edition, EPA/600/4-90/027F.

Results and Discussion

The FDEP Biology Section performed two 48-hour acute screening toxicity bioassays on a sample of effluent collected from the outfall of this facility. Two additional bioassays were performed on an aliquot of sample that was dechlorinated by the addition of 0.025N sodium thiosulfate at the rate of 3.5 mL/L of sample. The controls for the dechlorinated sample bioassays were treated similarly. The test species used for these bioassays were the waterflea, *Ceriodaphnia dubia*, and the bannerfin shiner, *Cyprinella leedsi*. The test results showed that the 100% sample was acutely toxic to the test organisms, producing 100% mortality in both test species within 20 minutes of test initiation. The dechlorinated sample tests did not show toxicity to either test species within 48 hours (Table 1).

The total residual chlorine (TRC) was measured in the field at a concentration of 5.0 mg/L and in the laboratory bioassay sample at a concentration of 3.3 mg/L. TRC concentrations as low as 0.028 mg/L have been found to be acutely toxic to some freshwater fish and invertebrates (EPA *Quality Criteria for Water* 1986, EPA 44015-86-001, 1986). Total and unionized ammonia were detected in the bioassay sample at concentrations of 6.04 and 0.085, respectively. Unionized ammonia levels as low as 0.08 mg/L and 0.5 mg/L have been found to be acutely toxic to some freshwater fish and invertebrates, respectively (EPA *Quality Criteria for Water 1986,* EPA 44015-86-001, 1986).

Additional samples of effluent were collected from this facility and analyzed for herbicides, pesticides, nutrients, metals, and organic compounds. Several metals, nutrients, and two pesticides were identified (Table 2). Although the majority of wastewater is reclaimed, the following constituents of the effluent were detected at concentrations that are in violation of

Class III Freshwater quality criteria: Unionized ammonia, criterion ≤ 0.02 mg/L, concentration 0.085 mg/L; Chlorine, criterion ≤ 0.01 mg/L, concentration 3.13 mg/L; and silver, criterion ≤ 0.07 mg/L, concentration 0.13 mg/L.

Conclusion

The sample of effluent collected from this facility on August 19, 2002, was acutely toxic to test organisms of both species within 20 minutes of test initiation. We attribute the cause of toxicity primarily to total residual chlorine, although ammonia and other constituents in the sample may also have contributed to the observed toxicity.

Table 1. Data recorded during the 48-hour acute screening bioassays of a sample of effluent from Julington Creek WWRF, 1638 Davis Pond Boulevard, Jacksonville, St. Johns County, Florida, performed from 20 to 22 August 2002.

Facility:	**Julington Creek WWRF**	**NPDES #:**	**FL0043591**	Facility Type:	**WWTP**	**Analysts:** Jacquelyn Brynda
Location:	1638 Davis Pond Boulevard, Jacksonville	Contact/District:	O'Conner/NE			Joshua Ayres
County:	St. Johns	Test type:	static acute screen			Christa Pierini
Sample Collection Date:	8/19/2002 Time: 1055	# tests:	2	Receiving Water:	St. John's River	Marshall Faircloth
Test Beginning Date:	8/20/2002 Time: 1400	Chlorination Type:	chlorinated		Class III Fresh water	
Test Ending Date:	8/22/2002 Time: 1350				**Page 1 of 2**	**Reviewer:** David Whiting

Organism: ***Ceriodaphnia dubia*** Life stage: <24 hours

	Sample/Diluent	**SURVIVAL # Alive**			pH			Temperature[A]			Dissolved Oxygen			Conductivity Uncorrected µmhos/cm	
Concentrations	Volume(mL)	0 hr	24 hr	48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control A	0/20	5	5	5	8.0	-	8.2	25.2	-	24.8	7.6	-	7.5	160	240
Control B	0/20	5	5	5	-	-	8.3	-	-	24.5	-	-	7.5	-	235
Control C	0/20	5	5	5	-	-	8.3	-	-	24.4	-	-	7.5	-	225
Control D	0/20	5	5	5	-	-	8.3	-	-	24.4	-	-	7.4	-	250
Dechlor Cntl A	0/20	5	5	5	8.0	-	8.2	24.7	-	24.5	7.8	-	7.4	175	245
Dechlor Cntl B	0/20	5	5	5	-	-	8.2	-	-	24.5	-	-	7.4	-	220
Dechlor Cntl C	0/20	5	5	5	-	-	8.2	-	-	24.5	-	-	7.4	-	220
Dechlor Cntl D	0/20	5	5	5	-	-	8.2	-	-	24.5	-	-	7.5	-	225
100% Dechlor A	20/0	5	5	5	7.2	-	8.4	24.8	-	24.6	6.5	-	7.4	1060	1370
100% Dechlor B	20/0	5	5	5	-	-	8.4	-	-	24.6	-	-	7.4	-	1360
100% Dechlor C	20/0	5	5	5	-	-	8.4	-	-	24.5	-	-	7.4	-	1325
100% Dechlor D	20/0	5	5	5	-	-	8.4	-	-	24.7	-	-	7.4	-	1215
100% A[B]	20/0	5	0	-	7.2	-	-	24.6	-	-	6.1	-	-	980	-
100% B	20/0	5	0	-	-	-	-	-	-	-	-	-	-	-	-
100% C	20/0	5	0	-	-	-	-	-	-	-	-	-	-	-	-
100% D	20/0	5	0	-	-	-	-	-	-	-	-	-	-	-	-

[A] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.
Room Temperature range for the test period was 25.0-27.5°C.
Incubator #3 temperature range for the test period was 24.5-26.5°C.

[B] Organisms in the 100% effluent were dead within 20 minutes.

LIMS	
Job number:	TLH-2002-08-20-12
sample number:	615606

Data Transcription Verification	
date:	11/14/2002
by:	Joshua Ayres
	Christa Pierini

Total Residual CL2	mg/L	Method
Field:	5.00	-
Lab:	3.13	Hach
Dechlorinated Lab:	0.03	Hach

Ammonia	Total (mg/L)	Unionized (mg/L)
Control water (water flea):	<0.017	<0.017
100% Sample:	6.04	0.085

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control water (water flea):	80	81
100% Sample:	160	140

Continued

Table 1. Concluded

Data recorded during the 48-hour acute screening bioassays of a sample of effluent from Julington Creek WWRF, 1638 Davis Pond Boulevard, Jacksonville, St. Johns County, Florida, performed from 20 to 22 August 2002.

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Location:	1638 Davis Pond Blvd., Jacksonville		Contact/District:	O'Conner/NE			Joshua Ayres
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Test Beginning Date:	8/20/2002	Time: 1400	Chlorination Type:	chlorinated	Class III Fresh water		
Test Ending Date:	8/22/2002	Time: 1350			**Page 2 of 2**	**Reviewer:**	David Whiting

Organism: ***Cyprinella leedsi*** Life stage: 6 days

	Sample/Diluent	SURVIVAL # Alive			pH			Temperature[A]			Dissolved Oxygen			Conductivity Uncorrected µmhos/cm	
Concentrations	Volume(mL)	0 hr	24 hr	48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control A	0/500	5	5	5	7.7	8.2	8.4	25.3	25.1	27.0	7.4	7.5	6.6	260	290
Control B	0/500	5	5	5	7.7	8.2	8.4	25.3	24.7	26.9	7.5	7.4	6.7	270	290
Control C	0/500	5	5	5	7.8	8.2	8.4	25.3	24.7	26.4	7.2	7.6	6.9	270	280
Control D	0/500	5	5	5	7.8	8.2	8.4	25.3	24.7	25.7	7.3	7.5	7.0	270	280
Dechlor Cntl A	0/500	5	5	5	7.7	8.2	8.4	25.3	24.7	25.8	7.5	7.6	7.1	280	300
Dechlor Cntl B	0/500	5	5	5	7.8	8.2	8.4	25.4	24.6	25.3	7.6	7.4	7.0	290	300
Dechlor Cntl C	0/500	5	5	5	7.8	8.2	8.4	25.4	24.6	25.9	7.3	7.5	7.0	290	310
Dechlor Cntl D	0/500	5	5	5	7.8	8.2	8.4	25.3	24.9	25.6	7.5	7.5	7.0	290	300
100% Dechlor A	500/0	5	5	5	7.2	8.0	8.2	25.4	24.9	25.8	6.0	7.4	6.9	1160	1220
100% Dechlor B	500/0	5	5	5	7.2	8.0	8.2	25.5	24.8	25.8	6.1	7.2	6.8	1160	1210
100% Dechlor C	500/0	5	5	5	7.2	8.0	8.2	25.5	24.8	26.4	5.8	7.2	6.5	1160	1260
100% Dechlor D	500/0	5	5	5	7.2	8.0	8.2	25.4	24.7	26.3	6.0	7.2	6.4	1160	1230
100% A[B]	500/0	5	0	-	7.3	-	-	25.4	-	-	6.4	-	-	1080	-
100% B	500/0	5	0	-	7.3	-	-	25.5	-	-	6.4	-	-	1150	-
100% C	500/0	5	0	-	7.3	-	-	25.5	-	-	6.1	-	-	1170	-
100% D	500/0	5	0	-	7.3	-	-	25.4	-	-	6.3	-	-	1160	-

[A] Temperatures of room and test incubator were continuously recorded on a strip chart recorder.
Room Temperature range for the test period was 25.0-27.5°C.
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Ammonia	Total (mg/L)	Unionized (mg/L)
Control water	<0.017	<0.017
100% Sample:	6.04	0.085

Alk & Hardness	Alkalinity (mg/L)	Hardness (mg/L)
Control water:	142	131
100% Sample:	160	140

Table 2. Results of chemical analyses on the effluent from Julington Creek sampled on August 19, 2002.

Metals

Aluminum	28	ug/L	
Cadmium	0.14	ug/L	
Calcium	51.7	mg/L	
Copper	1.9	ug/L	I
Iron	69	ug/L	
Lead	0.24	ug/L	I
Magnesium	27.8	mg/L	
Nickel	6.6	ug/L	
Silver	0.13	ug/L	
Zinc	28.6	ug/L	

Pesticides and Herbicides

Atrazine	1.1	ug/L	
Diazinon	0.11	ug/L	I

Nutrients

Ammonia	0.12	mg N/L	
Nitrates and Nitrites	1.9	mg N/L	J
Total Kjeldahl Nitrogen	5.5	mg N/L	
Ortho-Phosphate	1.1	mg P/L	
Total Phosphorous	1.1	mg P/L	

Base, Neutral, & Acid Extractable Organics

None detected

[J] The reported value is an estimated value.
[I] The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

The Bioassay of Julington Creek WWRF effluent sampled on August 19, 2002, NPDES #FL0043591.

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 F L 0 0 4 3 5 9 1 #	#	0 2 0 8 1 9	#	**B**	# **S**	# 1

Remarks

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The Priority Pollutants Analysis for Bioassay of Julington Creek WWRF effluent sampled on August 19, 2002, NPDES #FL0043591.

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 F L 0 0 4 3 5 9 1 #	#	0 2 0 8 1 9	#	**B**	# **S**	# 1

Remarks

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