

**2023**

**WHOLE EFFLUENT  
TOXICITY (WET) TEST  
RESULTS**

**2023**

**SPRING/SUMMER**

**(JUNE) CHRONIC WET**

**TEST RESULTS**

*Pimephales promelas* (Fathead  
minnow)



**Whole Effluent Toxicity Test Report:  
City of Yakima**

July 2023 Chronic Testing

Report date: July 25, 2023

Submitted to:

**City of Yakima**  
2220 E. Viola  
Yakima, WA 98901

*Rainier Environmental*  
5013 Pacific Hwy East  
Suite 20  
Tacoma, WA 98424

## 1.0 INTRODUCTION

A chronic toxicity test was conducted using effluent samples collected from City of Yakima Wastewater Treatment Plant in July 2023. The bioassay was conducted using the test organism *Pimephales promelas* (fathead minnow). Testing was performed at Rainier Environmental Laboratory located in Tacoma, Washington.

## 2.0 METHODS

### 2.1 Sample Collection and Transport

Three 24-hr. composite effluent samples were collected into 10-liter (L) LDPE cubitainers by City of Yakima personnel. The samples were packed in a cooler containing ice and shipped overnight to Rainier Environmental. Appropriate chain-of-custody procedures were employed during collection and transport.

### 2.2 Sample Receipt

Upon arrival at Rainier Environmental, the coolers were opened, samples inspected, and the contents verified against information provided on the chain-of-custody forms. Receipt temperature was measured and recorded on the chain-of-custody form for each sample. Standard water quality parameters were measured and recorded on a sample check-in sheet (Appendix C). Samples were stored at 4°C in the dark until used for testing.

### 2.3 Test Methods

A chronic toxicity test was conducted according to procedures presented by USEPA (2002). The method is summarized in Table 1. This test involved a 7-day exposure and was evaluated for survival and growth.

**Table 1. Summary of methods for the fathead minnow 7-day survival and growth test.**

Test initiation date and time	7/11/2023; 1230h
Test termination date and time	7/18/2023; 1215h
Test organism	<i>Pimephales promelas</i>
Test organism source	Aquatic BioSystems; Fort Collins, CO
Test organism age	< 24 hours
Test type	Static renewal
Feeding	<i>Artemia</i> nauplii, twice daily
Test chamber	500 mL plastic cup
Test solution volume	250 mL
Test temperature	25 ± 1°C
Dilution water	Moderately hard synthetic water
Test concentrations (mg/L sample)	100, 53.8, 25, 12.5, 9.88, control
Number of organisms/chamber	10
Number of replicates	4
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test protocol	EPA-821-R-02-013
Test acceptability criteria for controls	≥ 80% survival; average dry weight ≥ 0.25 mg
Reference toxicant	Sodium chloride

### 3.0 RESULTS

Details of standard water quality measurements conducted upon receipt of samples are provided in Table 2.

**Table 2. Sample information.**

Sample ID	WET#1	WET#2	WET#3
Log-in Number	23-054	23-057	23-058
Collection date and time	7/10/2023; 0800h	7/12/2023; 0800h	7/14/2023; 0800h
Receipt date and time	7/11/2023; 1015h	7/13/2023; 1000h	7/15/2023; 0925h
Receipt temperature (°C)	4.5	4.2	3.9
Dissolved oxygen (mg/L)	9.1	8.1	8.4
pH	7.14	7.49	7.51
Conductivity (µS/cm)	548	510	514
Hardness (mg/L CaCO <sub>3</sub> )	112	96	88
Alkalinity (mg/L CaCO <sub>3</sub> )	92	84	84
Total Chlorine (mg/L)	<0.03	<0.03	<0.03
Total Ammonia (mg/L)	2.5	2.0	<1.0

Results for the chronic toxicity test are summarized in Table 3. The highest concentration with no observed effect (NOEC) was 100 percent effluent for both survival and growth (evaluated on the basis of dry weight divided by initial count for biomass and final count for dry weight) at the end of the exposure. There was no statistically significant difference between the control and the acute critical effluent concentration (ACEC) of 53.8 percent effluent or the chronic critical effluent concentration (CCEC) of 9.88 percent effluent. Statistical summaries for the test, copies of the laboratory bench sheets, control quality control plots, sample check-in sheets, and chain-of-custody forms, are provided in Appendices A through D.

**Table 3. Summary of chronic test results.**

Species	Endpoint	NOEC <sup>a</sup> (% effluent)	LOEC <sup>b</sup> (% effluent)
Fathead minnow	Survival	100	>100
	Biomass	100	>100
	Dry Weight	100	>100

<sup>a</sup> No Observed Effect Concentration, <sup>b</sup> Lowest Observed Effect Concentration

#### 4.0 QA/QC

Samples were received in good condition and within the temperature range specified by WDOE (2016). There were no deviations from the protocol and water quality parameters remained within the ranges specified in the test method throughout the test.

Results for the reference toxicant test used to monitor laboratory performance and test organism sensitivity are summarized in Table 4. The results for the reference toxicant test fell within the acceptable range of mean  $\pm$  two standard deviations of historical test results. The coefficients of variation (CVs) for the test are also shown in the table. Dilution water control mean and control CV for biomass were also within two standard deviations of the historical mean (Appendix B). Based on the reference toxicant and control results, test organisms appeared to be of an appropriate degree of sensitivity.

**Table 4. Reference toxicant test results.**

Species	Endpoint	Date initiated	EC <sub>50</sub>	Acceptable range (mean $\pm$ 2 SD)	CV (%)
Fathead minnow	7d survival	7/11/2023	3.87 g/L NaCl	0.20 – 6.35	136
	7d growth	7/11/2023	3.00 g/L NaCl	0.19 – 4.39	118

## REFERENCES

- Tidepool Scientific Software. 2000-2010. CETIS Comprehensive Environmental Toxicity Information System Software, Version 1.8.4.6.
- USEPA. 2002. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition. EPA-821-R-02-013, pp. 141-196.
- WDOE. 2016. Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria. Washington State Department of Ecology. Water Quality Program. Publication number: WQ-R-95-80, Revised June 2016.

**Appendix A**  
**Fathead minnow Chronic Toxicity Test**  
**Statistical Summaries and Raw Bench Sheets**



# CETIS Summary Report

Report Date: 25 Jul-23 12:32 (p 1 of 2)  
Test Code: 2307-011 | 05-2686-3547

Fathead Minnow 7-d Larval Survival and Growth Test				Rainier Environmental Laboratory	
Batch ID:	16-5091-7486	Test Type:	Growth-Survival (7d)	Analyst:	Eric Tollefson
Start Date:	11 Jul-23 12:30	Protocol:	EPA/821/R-02-013 (2002)	Diluent:	Mod-Hard Synthetic Water
Ending Date:	18 Jul-23 12:15	Species:	Pimephales promelas	Brine:	
Duration:	7d	Source:	Aquatic Biosystems, CO	Age:	<24h
Sample ID:	04-7608-1046	Code:	23-054	Client:	Yakima
Sample Date:	10 Jul-23 08:00	Material:	POTW Effluent	Project:	
Receive Date:	11 Jul-23 10:15	Source:	Yakima (WA0024023)		
Sample Age:	28h (4.5 °C)	Station:			

Comparison Summary							
Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
07-4779-2777	7d Survival Rate	100	>100	NA	4.57%	1	Steel Many-One Rank Sum Test
20-7264-2546	Mean Dry Biomass-mg	100	>100	NA	23.0%	1	Dunnett Multiple Comparison Test
06-6579-0153	Mean Dry Weight-mg	100	>100	NA	24.5%	1	Dunnett Multiple Comparison Test

Test Acceptability						
Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision
07-4779-2777	7d Survival Rate	Control Resp	1	0.8 - NL	Yes	Passes Acceptability Criteria
20-7264-2546	Mean Dry Biomass-mg	Control Resp	0.4865	0.25 - NL	Yes	Passes Acceptability Criteria
20-7264-2546	Mean Dry Biomass-mg	PMSD	0.23	0.12 - 0.3	Yes	Passes Acceptability Criteria

7d Survival Rate Summary											
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	1	1	1	1	1	0	0	0.0%	0.0%
9.88		4	1	1	1	1	1	0	0	0.0%	0.0%
12.5		4	0.975	0.9563	0.9937	0.9	1	0.025	0.05	5.13%	2.5%
25		4	1	1	1	1	1	0	0	0.0%	0.0%
53.8		4	1	1	1	1	1	0	0	0.0%	0.0%
100		4	1	1	1	1	1	0	0	0.0%	0.0%

Mean Dry Biomass-mg Summary											
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.4865	0.464	0.509	0.423	0.561	0.03013	0.06026	12.39%	0.0%
9.88		4	0.458	0.4314	0.4846	0.367	0.54	0.03567	0.07134	15.58%	5.86%
12.5		4	0.4515	0.4334	0.4696	0.411	0.522	0.0243	0.0486	10.76%	7.19%
25		4	0.4395	0.414	0.465	0.363	0.51	0.03411	0.06822	15.52%	9.66%
53.8		4	0.4577	0.4316	0.4839	0.362	0.525	0.03505	0.07011	15.32%	5.91%
100		4	0.4727	0.4456	0.4999	0.43	0.581	0.03635	0.07269	15.38%	2.83%

Mean Dry Weight-mg Summary											
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	4	0.4865	0.464	0.509	0.423	0.561	0.03013	0.06026	12.39%	0.0%
9.88		4	0.458	0.4314	0.4846	0.367	0.54	0.03567	0.07134	15.58%	5.86%
12.5		4	0.466	0.4372	0.4948	0.411	0.58	0.0385	0.077	16.52%	4.21%
25		4	0.4395	0.414	0.465	0.363	0.51	0.03411	0.06822	15.52%	9.66%
53.8		4	0.4577	0.4316	0.4839	0.362	0.525	0.03505	0.07011	15.32%	5.91%
100		4	0.4727	0.4456	0.4999	0.43	0.581	0.03635	0.07269	15.38%	2.83%

# CETIS Summary Report

Report Date: 25 Jul-23 12:32 (p 2 of 2)

Test Code: 2307-011 | 05-2686-3547

## Fathead Minnow 7-d Larval Survival and Growth Test

Rainier Environmental Laboratory

### 7d Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	1	1	1	1
9.88		1	1	1	1
12.5		1	1	1	0.9
25		1	1	1	1
53.8		1	1	1	1
100		1	1	1	1

### Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.456	0.506	0.423	0.561
9.88		0.473	0.452	0.367	0.54
12.5		0.44	0.411	0.433	0.522
25		0.51	0.363	0.403	0.482
53.8		0.525	0.362	0.454	0.49
100		0.581	0.43	0.449	0.431

### Mean Dry Weight-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	0.456	0.506	0.423	0.561
9.88		0.473	0.452	0.367	0.54
12.5		0.44	0.411	0.433	0.58
25		0.51	0.363	0.403	0.482
53.8		0.525	0.362	0.454	0.49
100		0.581	0.43	0.449	0.431

### 7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Dilution Water	10/10	10/10	10/10	10/10
9.88		10/10	10/10	10/10	10/10
12.5		10/10	10/10	10/10	9/10
25		10/10	10/10	10/10	10/10
53.8		10/10	10/10	10/10	10/10
100		10/10	10/10	10/10	10/10

Rainier Environmental  
Washington Laboratory

Client:

Sample ID:

Test No:

Log-In#:

Yakima

WET 1

2307-011

23-054

23-057

Initial and Final Chemistries

Seven Day Chronic Freshwater Bioassay

Start Date & Time:

7/11/2023 1230

Stop Date & Time:

7/18/2023 1215

Test Species:

Pimephales promelas

23-058

Conc. or % CON	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.24	8.05	8.20	8.04	8.17	8.01	8.10	7.98	8.02	7.87	7.98	7.82	7.95	7.78
DO (mg/l)	7.6	7.2	7.7	7.1	7.8	7.0	7.6	7.1	7.5	6.5	7.1	6.4	7.7	6.2
Cond. (µmhos-cm)	341	340	345	340	340	344	320	331	312	320	308	309	310	314
Temperature (°C)	24.9	25.1	25.1	25.3	25.2	25.2	25.3	25.2	25.3	25.2	24.9	25.2	25.1	25.0
9.88	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.16	8.04	8.14	8.04	8.11	8.04	8.09	7.99	8.05	7.95	8.01	7.81	7.96	7.79
DO (mg/l)	7.8	7.3	7.7	7.2	7.8	7.2	7.6	6.8	7.6	6.1	7.4	6.0	7.5	6.1
Cond. (µmhos-cm)	344	365	347	342	344	349	325	334	334	335	327	325	325	330
Temperature (°C)	24.9	25.0	25.1	25.3	25.1	25.0	25.3	25.2	25.2	25.3	24.9	25.1	25.1	25.1
125	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.13	8.08	8.10	8.07	8.09	8.05	8.07	7.94	8.06	7.82	7.95	7.80	7.97	7.77
DO (mg/l)	7.7	7.3	7.7	7.2	7.7	7.3	7.7	7.1	7.5	6.3	7.7	6.0	7.5	6.1
Cond. (µmhos-cm)	348	353	350	347	352	359	347	345	345	347	344	340	342	347
Temperature (°C)	24.8	25.1	25.0	25.1	25.1	25.0	25.4	25.1	25.3	25.3	25.0	25.3	25.2	25.0
25	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.00	8.06	7.99	8.04	8.00	8.02	7.95	7.92	8.01	7.83	7.95	7.79	7.94	7.76
DO (mg/l)	7.9	7.3	7.9	7.1	7.8	7.3	7.9	6.7	7.6	6.4	7.8	6.1	7.8	6.2
Cond. (µmhos-cm)	366	370	369	373	371	384	365	372	370	372	368	365	372	380
Temperature (°C)	24.9	25.0	25.0	25.1	25.0	25.1	25.3	25.1	25.3	25.3	25.1	25.2	25.2	25.0
53.8 <del>50.8</del>	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	7.76	8.03	7.74	8.00	7.75	7.99	7.78	7.90	7.91	7.80	7.89	7.77	7.86	7.74
DO (mg/l)	8.0	7.3	8.0	7.3	8.1	7.4	8.0	6.8	7.7	6.3	7.7	6.1	7.9	6.3
Cond. (µmhos-cm)	404	413	412	415	415	427	410	413	422	427	421	419	425	427
Temperature (°C)	24.7	25.1	25.1	25.1	25.1	25.1	25.4	25.1	25.1	25.3	25.4	25.3	25.3	25.1
100	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	7.40	7.99	7.41	8.00	7.42	7.97	7.54	7.92	7.60	7.79	7.64	7.75	7.60	7.70
DO (mg/l)	8.2	7.3	8.2	7.0	8.2	7.4	8.2	6.9	7.9	6.5	7.9	6.0	8.1	6.5
Cond. (µmhos-cm)	478	483	480	490	487	492	479	484	484	491	481	477	490	492
Temperature (°C)	24.6	25.1	25.1	25.2	25.1	25.1	25.4	25.1	25.3	25.3	25.7	25.2	25.3	25.2
Tech. Initials	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>	<u>JS</u>

Dilution Water Batch #: MHSW 059

Test Chamber: VWR

QA Check: JS

Sample Description:

Animal Source:

Comments:

ABS

Date Received: 7/11/23

Date of Hatch: 7/10/23



Rainier Environmental  
Washington Laboratory  
5013 Pacific Hwy. E., Suite 20  
Tacoma, WA 98424

Raw Data Sheet  
Fathead Minnow  
(*Pimephales promelas*)  
Larval Survival

Client Name: Yakima

Test No.: 2307-011

Sample ID: WET 1

Rep.	Conc. or (%)	Cont.	Days								Mean % Survival
			0	1	2	3	4	5	6	7	
1	CON	13	10	10	10	10	10	10	10	10	
2		22	10	10	10	10	10	10	10	10	
3		6	10	10	10	10	10	10	10	10	
4		16	10	10	10	10	10	10	10	10	
1	9.98	17	10	10	10	10	10	10	10	10	
2		4	10	10	10	10	10	10	10	10	
3		12	10	10	10	10	10	10	10	10	
4		15	10	10	10	10	10	10	10	10	
1	12.5	2	10	10	10	10	10	10	10	10	
2		5	10	10	10	10	10	10	10	10	
3		19	10	10	10	10	10	10	10	10	
4		21	10	10	10	9	9	9	9	9	
1	25	3	10	10	10	10	10	10	10	10	
2		11	10	10	10	10	10	10	10	10	
3		18	10	10	10	10	10	10	10	10	
4		7	10	10	10	10	10	10	10	10	
1	50-53%	23	10	10	10	10	10	10	10	10	
2		8	10	10	10	10	10	10	10	10	
3		20	10	10	10	10	10	10	10	10	
4		10	10	10	10	10	10	10	10	10	
1	100	4	10	10	10	10	10	10	10	10	
2		1	10	10	10	10	10	10	10	10	
3		14	10	10	10	10	10	10	10	10	
4		24	10	10	10	10	10	10	10	10	
1											
2											
3											
4											
1											
2											
3											
4											
Tech Initials			JS	JS	JS	JS	JS	JS	JS	JS	

Feeding Times: 0 1500 1 0900 2 0800 3 0800 4 0800 5 0930 6 0900  
1600 1545 1545 1545 1600 1530 1645

Comments: \_\_\_\_\_ QA Check: Y

Rainier Environmental  
Washington Laboratory  
5013 Pacific Hwy. E., Suite 20  
Tacoma, WA 98424

Raw Data Sheet  
Fish Weights  
Seven Day Chronic Bioassay

Client: Yakima

Test No: 2307-011

Sample ID: WET 1

Species: Pimephales promelas

rep #	Conc. or (%)	cont #	pan wt. (gm)	pan + fish (gm)	fish wt. (mg)	# fish	avg. per fish (mg)	avg. per conc. (mg)
1	CON	13	0.04538	0.04994		10		
2		22	0.04293	0.04799		10		
3		6	0.04359	0.04182		10		
4		16	0.04395	0.04956		10		
1	9.88	17	0.04484	0.04957		10		
2		4	0.04251	0.04703		10		
3		12	0.04681	0.05048		10		
4		15	0.04300	0.04840		10		
1	125	2	0.04326	0.04766		10		
2		5	0.04383	0.04794		10		
3		19	0.04440	0.04873		10		
4		21	0.04648	0.05170		9		
1	25	3	0.04305	0.04815		10		
2		11	0.04544	0.04907		10		
3		18	0.04419	0.04822		10		
4		7	0.04546	0.05028		10		
1	50	23	0.04141	0.04666		10		
2		8	0.04305	0.04667		10		
3		20	0.04256	0.04710		10		
4		10	0.04650	0.05140		10		
1	100	9	0.04615	0.05196		10		
2		1	0.04359	0.04789		10		
3		14	0.04292	0.04741		10		
4		24	0.04129	0.04560		10		
1								
2								
3								
4								
Technician Initials:			AL	AL				

Date/Time in: 7/18/2023 1215 Oven temp. (°C): 62.0  
Date/Time out: 7/20/2023 1230 Oven temp. (°C): 61.5

QA Check: et

**Appendix B**  
**Control Quality Assurance Plots**

## Fathead Minnow 7-d Larval Survival and Growth Test

Rainier Environmental Laboratory

Test Type: Growth-Survival (7d)

Organism: Pimephales promelas (Fathead Minn

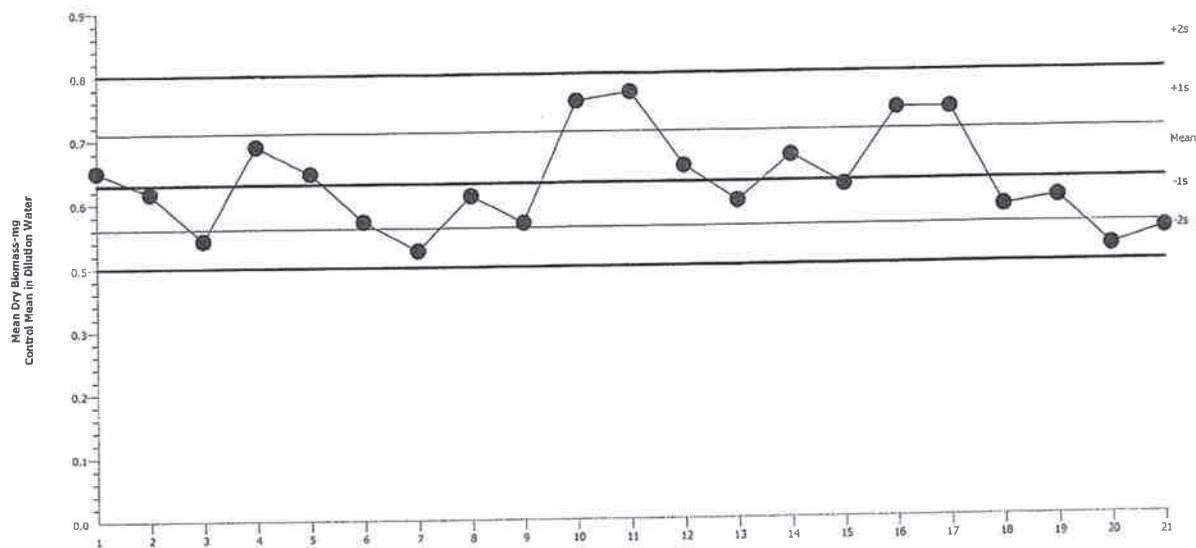
Material: All Materials

Protocol: EPA/821/R-02-013 (2002)

Endpoint: Mean Dry Biomass-mg

Source: All SampleID Sources

Fathead Minnow 7-d Larval Survival and Growth Test



Mean: 0.6073

Count: 20

-1s Warning Limit: 0.5278

-2s Action Limit: 0.4588

Sigma: NA

CV: 15.10%

+1s Warning Limit: 0.6987

+2s Action Limit: 0.8038

## Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2022	Jun	7	0.6305	0.02324	0.2679			18-7299-4727	
2			14	0.5922	-0.01506	-0.1791			19-7105-1596	
3		Aug	2	0.508	-0.09926	-1.273	(-)		15-7254-3249	
4			9	0.6755	0.06824	0.7596			06-5284-2440	
5			9	0.626	0.01874	0.2168			07-7123-6557	
6			16	0.5397	-0.06756	-0.8412			10-5853-9298	
7			16	0.4878	-0.1195	-1.562	(-)		01-9751-1142	
8		Sep	13	0.5845	-0.02276	-0.2725			18-6248-3610	
9			13	0.5362	-0.07106	-0.8876			09-7213-3038	
10		Oct	4	0.754	0.1467	1.544	(+)		14-9855-7560	
11			4	0.7702	0.1629	1.695	(+)		00-6496-2283	
12		Nov	1	0.6363	0.02904	0.3332			03-5847-5256	
13			1	0.5722	-0.03506	-0.4242			05-4159-6625	
14	2023	Jan	31	0.6533	0.04604	0.5213			12-0113-9678	
15			31	0.5995	-0.007759	-0.09172			17-5334-6096	
16		Mar	7	0.7368	0.1295	1.379	(+)		16-6378-5109	
17			7	0.7368	0.1295	1.379	(+)		18-4486-9370	
18			14	0.5588	-0.04846	-0.5932			10-3215-0640	
19		Jun	6	0.5745	-0.03276	-0.3955			03-9476-2563	
20		Jul	11	0.4865	-0.1208	-1.581	(-)		05-2686-3547	
21			11	0.517	-0.09026	-1.148	(-)		13-2575-9875	



## Fathead Minnow 7-d Larval Survival and Growth Test

Rainier Environmental Laboratory

Test Type: Growth-Survival (7d)

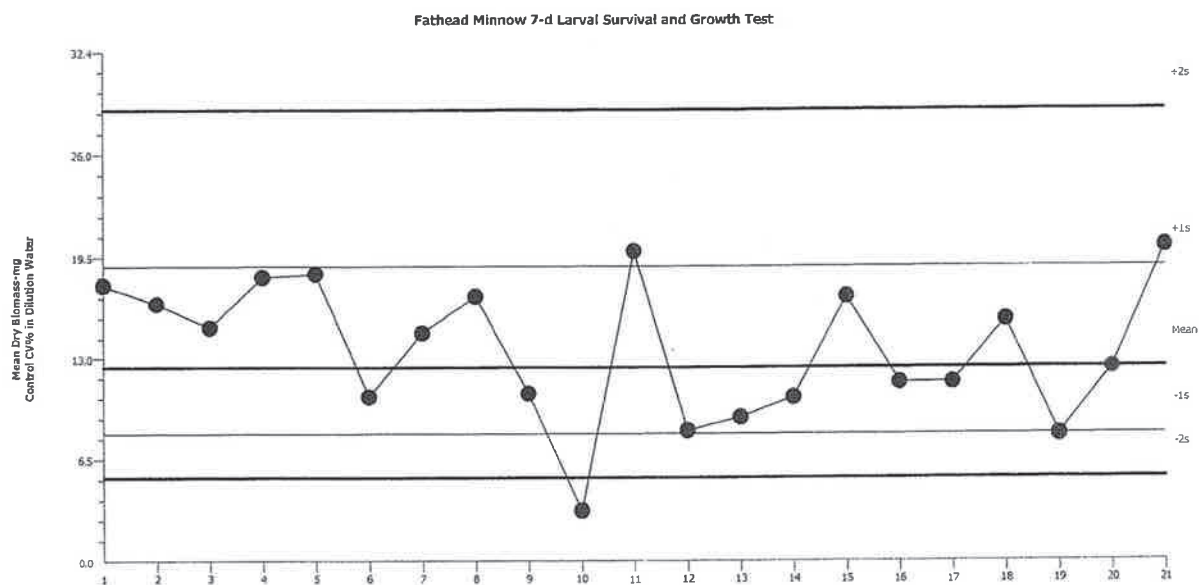
Organism: Pimephales promelas (Fathead Minn

Material: All Materials

Protocol: EPA/821/R-02-013 (2002)

Endpoint: Mean Dry Biomass-mg

Source: All SampleID Sources



Mean: 12.39

Count: 20

-1s Warning Limit: 8.134

-2s Action Limit: 5.34

Sigma: NA

CV: 52.30%

+1s Warning Limit: 18.88

+2s Action Limit: 28.75

## Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2022	Jun	7	17.68	5.289	0.8445			18-7299-4727	
2			14	16.5	4.109	0.6804			19-7105-1596	
3		Aug	2	14.98	2.589	0.4507			15-7254-3249	
4			9	18.2	5.809	0.9133			06-5284-2440	
5			9	18.42	6.029	0.9419			07-7123-6557	
6			16	10.51	-1.881	-0.3912			10-5853-9298	
7			16	14.62	2.229	0.3929			01-9751-1142	
8		Sep	13	16.99	4.599	0.7499			18-6248-3610	
9			13	10.71	-1.681	-0.3465			09-7213-3038	
10		Oct	4	3.243	-9.148	-3.185	(-)	(-)	14-9855-7560	
11			4	19.86	7.469	1.121	(+)		00-6496-2283	
12		Nov	1	8.325	-4.066	-0.945			03-5847-5256	
13			1	9.172	-3.219	-0.7148			05-4159-6625	
14	2023	Jan	31	10.46	-1.931	-0.4026			12-0113-9678	
15			31	16.97	4.579	0.7471			17-5334-6096	
16		Mar	7	11.42	-0.9714	-0.194			16-6378-5109	
17			7	11.42	-0.9714	-0.194			18-4486-9370	
18			14	15.47	3.079	0.5272			10-3215-0640	
19		Jun	6	8.078	-4.313	-1.017	(-)		03-9476-2563	
20		Jul	11	12.39	-0.001367	-0.000262			05-2686-3547	
21			11	20.14	7.749	1.154	(+)		13-2575-9875	



**Appendix C**  
**Sample Check-In Sheet**

Rainier Environmental  
5013 Pacific Hwy East, Ste. 20  
Tacoma, WA 98424

Client: City of Yakima

Tests Performed: Pp-C  
Test ID No(s): 2307-011

### Sample Check-In Information

Sample Description:

COC Complete? Y or N  
1 Y 2 Y 3 Y

Filtration? Y N

Pore Size: \_\_\_\_\_

Organisms or Debris \_\_\_\_\_

Aeration? Y N

Length of Time: \_\_\_\_\_

Final DO: \_\_\_\_\_

Final pH: \_\_\_\_\_

Hardness Adjustment? Y N

If adjusted, please see worksheet  
for details.

Sub-samples for additional chemistry:

Sample ID:	WET 1	WET #2	WET #3	
Log-in No. (20-xxxx):	23-054	23-051	23-058	
Sample Collection Date & Time:	7/10/23 0800	7/12/23 0800	7/14/23 0800	
Sample Receipt Date & Time:	7/11/23 1015	7/13/23 1000	7/15/23 0925	
Check-in Temperature (°C)	4.5	4.2	3.9	
Temperature OK?	<input checked="" type="radio"/> Y <input type="radio"/> N	<input checked="" type="radio"/> Y <input type="radio"/> N	<input checked="" type="radio"/> Y <input type="radio"/> N	
DO (mg/L)	9.1	8.1	8.4	
pH (units)	7.14	7.49	7.51	
Conductivity (µS/cm)	548	510	514	
Salinity (ppt)	0.3	0.3	0.3	
Tit. Vol / Sam. Vol. / Alkalinity (mg/L)*	2.3 / 125 / 192	2.1 / 125 / 184	2.1 / 125 / 184	1 1
Tit. Vol. / Sam. Vol. / Hardness (mg/L)* <sup>a</sup>	2.8 / 125 / 112	2.4 / 125 / 194	2.2 / 125 / 188	1 1
Total Chlorine (mg/L)	<0.03	<0.03	<0.03	
Total Ammonia Nitrogen (mg/L)	8.38 / 2.5	3.0	<1.0	
Technician Initials	gfl	gfl	gfl	

\* = mg/L as CaCO<sub>3</sub>, <sup>a</sup> = Measured for freshwater samples only, NA = Not Applicable.

NM = Not Measured

### Freshwater Tests:

Control/Dilution Water Source: test type: PPC 8:2 (DMW) MHW Other: -059

Control/Dilution Water Source: test type: \_\_\_\_\_ 8:2 (DMW) MHW Other: \_\_\_\_\_

Additional Control? Y N = \_\_\_\_\_

### Marine Tests:

Control/Dilution Water Source: test type: \_\_\_\_\_ ART SW NAT SW

Control/Dilution Water Source: test type: \_\_\_\_\_ ART SW NAT SW

Additional Control? Y N = \_\_\_\_\_

Sample Salted w/ artificial salt? Y N If yes, what ppt? \_\_\_\_\_ test type: \_\_\_\_\_

Sample salted w/brine? Y N If yes, what ppt? \_\_\_\_\_ test type: \_\_\_\_\_

Comments: Temperature for grab sample must be 0-20°C if received within 1 hour of collection time, 0-12°C if effluent received within

4 hours of collection time, and 0-6°C for all other samples.

QC Check: gfl

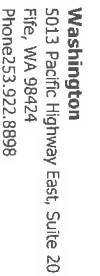
**Appendix D**  
**Chain-of-Custody Forms**

**Washington**  
5013 Pacific Highway East, Suite 20  
Fife, WA 98424  
Phone 253.922.8898

Date 7/10/23 Page 1 of 1

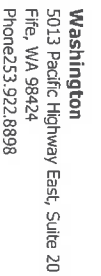
[illegible]





Date 7/12/23 Page 1 of 1

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Sample Collection Form										ANALYSES REQUIRED									
<b>Report to:</b> City of Yakima – WWTP 2220 E Viola Ave Yakima, WA 98901 <b>Company Address</b> City/State/ <b>Contact</b> Phone Email										<b>Invoice To:</b> Company Address City/State/zip Contact Phone Email									
<b>Sample ID</b> WET #3 DATE 7/13/23 TIME 8:00 AM MATRIX water CONTAINER TYPE plastic NO. OF CONTAINERS 1 COMMENTS WET #3 24° Comp Chronic										Receipt Temperature (°C) 3.9									
<b>PROJECT INFORMATION</b>										<b>SAMPLE RECEIPT</b>									
<b>Client:</b> City of Yakima										<b>Total No. of Containers</b> 1									
<b>PO No.:</b> 23-101										<b>Received Good Condition?</b> Y									
<b>Shipped Via:</b> Fed Ex										<b>Matches Test Schedule?</b> Y									
<b>SPECIAL INSTRUCTIONS/COMMENTS:</b> NPDES # WA0024023										<b>RELINQUISHED BY (CLIENT)</b> (Signature) (Date) 8:00 AM (Printed Name) Dario Lora S City of Yakima 7/14/2023									
<b>RECEIVED BY (LABORATORY)</b> (Signature) (Date) Luc Tolpelt FRIC TOLPESON 7/15/23 (Log in #) 23-058										<b>RELINQUISHED BY (COURIER)</b> (Signature) (Date) (Printed Name) (Company)									

**2023**

**SUMMER/FALL**

**(OCTOBER) CHRONIC**

**WET TEST RESULTS**

***Ceriodaphnia dubia (water flea)***



**Whole Effluent Toxicity Test Report:  
City of Yakima**

**October 2023 Chronic Testing**

Report date: October 13, 2023

Submitted to:

**City of Yakima**  
2220 E. Viola  
Yakima, WA 98901

*Rainier Environmental*  
5013 Pacific Hwy East  
Suite 20  
Tacoma, WA 98424



## 1.0 INTRODUCTION

A chronic toxicity test was conducted using effluent samples collected from City of Yakima Wastewater Treatment Plant in October 2023. The bioassay was conducted using the test organism *Ceriodaphnia dubia*. Testing was performed Rainier Environmental Laboratory located in Tacoma, Washington.

## 2.0 METHODS

### 2.1 Sample Collection and Transport

Three 24-hr. composite effluent samples were collected into 4-liter (L) LDPE cubitainers by City of Yakima personnel. The samples were packed in coolers containing ice and transported to Rainier Environmental the next day. Appropriate chain-of-custody procedures were employed during collection and transport.

### 2.2 Sample Receipt

Upon arrival at Rainier Environmental, the coolers were opened, samples inspected, and the contents verified against information provided on the chain-of-custody forms. Receipt temperature was measured and recorded on the chain-of-custody form for each sample. Standard water quality parameters were measured and recorded on a sample check-in sheet (Appendix C). Samples were stored at 4°C in the dark until used for testing.

### 2.3 Test Methods

A chronic toxicity test was conducted according to procedures presented by USEPA (2002). The method is summarized in Table 1. The procedure involved a 7-day static-renewal exposure to the effluent. The endpoints for this test were *Ceriodaphnia* survival and reproduction at the end of the 7-day exposure.

**Table 1. Summary of methods for the *Ceriodaphnia* 7-day survival and reproduction test.**

Test initiation date and time	10/3/2023; 1325h
Test termination date and time	10/10/2023; 1315h
Test organism	<i>Ceriodaphnia dubia</i>
Test organism source	In house cultures
Test organism age	< 24 hours
Test type	Static renewal
Endpoint	Survival, production of three broods in 60% of controls
Feeding	1:1 mixture YTC:algal suspension daily
Test chamber	30 mL plastic cup
Test solution volume	15 mL
Test temperature	25 ± 1°C
Dilution water	Diluted mineral water
Test concentrations (% sample)	100, 53.8, 25, 12.5, 9.88, laboratory control
Number of organisms/chamber	1
Number of replicates	10
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test protocol	EPA-821-R-02-013
Test acceptability criteria for controls	≥ 80% survival; ≥15 neonates/survival adult
Reference toxicant	Sodium chloride

### 3.0 RESULTS

Details of standard water quality measurements conducted upon receipt of samples are provided in Table 2.

**Table 2. Sample information.**

Sample ID	WET I	WET II	WET III
Log-in Number	23-089	23-093	23-095
Collection date and time	10/2/2023; 0808h	10/4/2023; 0800h	10/6/2023; 0800h
Receipt date and time	10/3/2023; 0800h	10/5/2023; 0930h	10/7/2023; 0815h
Receipt temperature (°C)	0.5	0.7	1.2
Dissolved oxygen (mg/L)	9.5	9.5	9.4
pH	7.43	7.55	7.52
Conductivity (µS/cm)	697	709	692
Hardness (mg/L CaCO <sub>3</sub> )	144	136	132
Alkalinity (mg/L CaCO <sub>3</sub> )	124	116	120
Total Chlorine (mg/L)	<0.03	<0.03	<0.03
Total Ammonia (mg/L)	<1.0	<1.0	<1.0

Results for the chronic toxicity test are summarized in Table 3. The highest concentration with no observed effect (NOEC) was 100 percent effluent for survival and reproduction. There was no statistically significant difference between the control and the acute critical effluent concentration (ACEC) of 53.8 percent effluent or the chronic critical effluent concentration (CCEC) of 9.88 percent effluent. Statistical summaries for the test, copies of the laboratory bench sheets, control quality control plots, sample check-in sheets, and chain-of-custody forms, are provided in Appendices A through D.

**Table 3. Summary of chronic test results.**

Species	Endpoint	NOEC <sup>a</sup> (% effluent)	LOEC <sup>b</sup> (% effluent)
<i>Ceriodaphnia</i>	Survival	100	>100
	Reproduction	100	>100

<sup>a</sup> No Observed Effect Concentration, <sup>b</sup> Lowest Observed Effect Concentration

#### 4.0 QA/QC

Samples were received in good condition and within the temperature range specified by WDOE (2016). There were no deviations from the protocol and water quality parameters remained within the ranges specified in the test method throughout the test.

Results for the reference toxicant test used to monitor laboratory performance and test organism sensitivity are summarized in Table 4. The results for the reference toxicant test fell within the acceptable range of mean  $\pm$  two standard deviations of historical test results. The coefficient of variations (CVs) for the test is also shown in the table. Based on the reference toxicant test organisms appeared to be of an appropriate degree of sensitivity.

**Table 4. Reference toxicant test results.**

Species	Endpoint	Date initiated	EC <sub>50</sub>	Acceptable range (mean $\pm$ 2 SD)	CV (%)
<i>Ceriodaphnia</i>	7d survival	10/3/2023	1.75 g/L NaCl	1.09 – 2.26	19.9
	7d reproduction	10/3/2023	1.42 g/L NaCl	1.18 – 1.54	7.05

## REFERENCES

- Tidepool Scientific Software. 2001-2011. CETIS Comprehensive Environmental Toxicity Information System Software, Version 1.8.4.6.
- USEPA. 2002. Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Fourth Edition. EPA-821-R-02-013, pp. 141-196.
- WDOE. 2016. Laboratory Guidance and Whole Effluent Toxicity Test Review Criteria. Washington State Department of Ecology. Water Quality Program. Publication number: WQ-R-95-80, Revised December 2016.

**Appendix A**  
***Ceriodaphnia* Chronic Toxicity Test**  
**Statistical Summaries and Raw Bench Sheets**

# CETIS Summary Report

Report Date: 13 Oct-23 10:07 (p 1 of 2)  
Test Code: 2310-089 | 09-1500-0673

Ceriodaphnia 7-d Survival and Reproduction Test					Rainier Environmental Laboratory	
Batch ID:	01-2543-0838	Test Type:	Reproduction-Survival (7d)	Analyst:	Eric Tollefson	
Start Date:	03 Oct-23 13:25	Protocol:	EPA/821/R-02-013 (2002)	Diluent:	Perrier Water	
Ending Date:	10 Oct-23 13:15	Species:	Ceriodaphnia dubia	Brine:		
Duration:	7d	Source:	In-House Culture	Age:	<24h	
Sample ID:	09-4230-1160	Code:	23-089	Client:	Yakima	
Sample Date:	02 Oct-23 08:08	Material:	POTW Effluent	Project:		
Receive Date:	03 Oct-23 08:00	Source:	Yakima (WA0024023)			
Sample Age:	29h (0.5 °C)	Station:				

Comparison Summary							
Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
12-5268-8212	7d Survival Rate	100	>100	NA	NA	1	Fisher Exact/Bonferroni-Holm Test
08-6361-6054	Reproduction	100	>100	NA	24.8%	1	Steel Many-One Rank Sum Test

Test Acceptability							
Analysis ID	Endpoint	Attribute	Test Stat	TAC Limits	Overlap	Decision	
12-5268-8212	7d Survival Rate	Control Resp	0.9	0.8 - NL	Yes	Passes Acceptability Criteria	
08-6361-6054	Reproduction	Control Resp	27.5	15 - NL	Yes	Passes Acceptability Criteria	
08-6361-6054	Reproduction	PMSD	0.2478	0.13 - 0.47	Yes	Passes Acceptability Criteria	

7d Survival Rate Summary											
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	0.9	0.7819	1	0	1	0.1	0.3162	35.14%	0.0%
9.88		10	1	1	1	1	1	0	0	0.0%	-11.11%
12.5		10	1	1	1	1	1	0	0	0.0%	-11.11%
25		10	1	1	1	1	1	0	0	0.0%	-11.11%
53.8		10	1	1	1	1	1	0	0	0.0%	-11.11%
100		10	1	1	1	1	1	0	0	0.0%	-11.11%

Reproduction Summary											
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Dilution Water	10	27.5	23.11	31.89	4	37	3.719	11.76	42.76%	0.0%
9.88		10	34.8	32.99	36.61	23	40	1.533	4.849	13.93%	-26.55%
12.5		10	32.5	30.98	34.02	26	38	1.285	4.062	12.5%	-18.18%
25		10	33.3	31.95	34.65	25	36	1.146	3.622	10.88%	-21.09%
53.8		10	34.8	31.81	37.79	18	41	2.529	7.997	22.98%	-26.55%
100		10	33.3	32.09	34.51	27	37	1.023	3.234	9.71%	-21.09%

7d Survival Rate Detail											
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1	0	1	1	1	1	1	1	1	1
9.88		1	1	1	1	1	1	1	1	1	1
12.5		1	1	1	1	1	1	1	1	1	1
25		1	1	1	1	1	1	1	1	1	1
53.8		1	1	1	1	1	1	1	1	1	1
100		1	1	1	1	1	1	1	1	1	1

Reproduction Detail											
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	37	4	20	11	30	34	37	34	36	32
9.88		39	35	23	40	35	32	35	39	36	34
12.5		38	31	34	38	28	29	32	26	34	35
25		33	33	35	36	35	35	25	29	36	36
53.8		41	24	41	32	41	35	18	41	37	38
100		33	31	32	27	33	36	37	31	36	37

CETIS Summary Report

Report Date: 13 Oct-23 10:07 (p 2 of 2)  
Test Code: 2310-089 | 09-1500-0673

Ceriodaphnia 7-d Survival and Reproduction Test Rainier Environmental Laboratory

7d Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	Dilution Water	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
9.88		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
53.8		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
100		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1



Rainier Environmental  
Washington Laboratory

Client: Yakima  
Sample ID: WET #1  
Test No: 2310-007  
Log-In#: 23-089 23-093

Initial and Final Chemistries

Seven Day Chronic Freshwater Bioassay  
Start Date & Time: 10/3/2023 1325  
Stop Date & Time: 10/10/2023 1315  
Test Species: Ceriodaphnia dubia  
23-095

Conc. or (%) CON	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.01	7.91	8.00	7.89	8.10	7.94	8.06	7.95	7.98	8.03	7.92	8.00	7.90	7.99
DO (mg/l)	7.2	7.0	7.3	7.1	7.4	7.1	7.2	7.5	7.4	7.7	7.5	7.9	7.4	7.2
Cond. (µmhos-cm)	212	209	210	208	211	215	210	228	208	213	207	209	206	204
Temperature (°C)	24.9	25.1	25.1	25.2	25.0	24.7	25.1	25.2	25.0	25.2	25.1	25.1	24.9	25.1
9.88	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.13	8.24	8.10	7.96	8.14	8.10	8.11	8.03	7.98	8.05	7.93	8.01	7.87	8.03
DO (mg/l)	7.2	7.0	7.2	7.1	7.4	7.0	7.1	7.7	7.7	7.8	7.6	7.7	7.4	7.2
Cond. (µmhos-cm)	215	223	211	207	209	214	211	225	211	227	213	216	211	214
Temperature (°C)	25.0	25.0	25.1	25.1	25.0	24.8	25.1	25.2	25.0	25.2	25.1	25.1	25.0	25.1
12.5	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.10	8.29	8.10	7.94	8.09	8.22	8.07	8.17	7.97	8.15	7.99	8.07	7.85	8.05
DO (mg/l)	7.2	6.9	7.2	7.0	7.4	7.0	7.1	7.8	7.8	7.7	7.7	7.6	7.5	7.3
Cond. (µmhos-cm)	221	240	224	227	226	229	224	237	227	234	218	219	215	213
Temperature (°C)	25.0	25.0	25.1	25.1	25.1	24.8	25.2	25.2	25.0	25.2	25.2	25.2	25.0	25.2
25	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	8.02	8.32	8.00	8.12	8.06	8.30	8.04	8.35	7.92	8.28	7.95	8.19	7.88	8.15
DO (mg/l)	7.3	7.0	7.3	6.9	7.3	6.9	7.2	7.2	7.4	7.9	7.8	7.4	7.7	7.4
Cond. (µmhos-cm)	245	265	249	259	254	262	250	261	254	258	247	254	239	237
Temperature (°C)	25.1	25.0	25.2	25.1	25.1	24.9	25.2	25.1	25.2	25.2	25.1	25.1	24.9	25.1
53.8	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	7.82	8.37	7.78	8.20	7.94	8.35	7.90	8.39	7.87	8.34	7.84	8.22	7.80	8.17
DO (mg/l)	7.2	7.1	7.4	7.0	7.3	6.8	7.3	7.8	7.5	8.0	7.9	7.9	7.9	7.6
Cond. (µmhos-cm)	353	378	350	370	370	390	367	374	371	383	349	357	342	344
Temperature (°C)	25.1	25.0	25.2	25.1	25.1	24.9	25.2	25.2	25.4	25.2	25.0	25.0	24.8	25.3
100	Days													
	0		1		2		3		4		5		6	
	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final	init.	final
pH	7.68	8.45	7.65	8.30	7.76	8.47	7.74	8.45	7.71	8.41	7.67	8.37	7.74	8.31
DO (mg/l)	7.4	7.1	7.4	7.0	7.6	7.1	7.6	7.6	7.5	7.9	8.0	7.9	8.0	7.8
Cond. (µmhos-cm)	502	547	507	530	549	554	542	551	538	545	508	514	505	510
Temperature (°C)	25.2	25.0	25.2	25.2	25.1	24.9	25.1	25.2	25.5	25.2	24.7	25.1	24.9	25.3
Tech. Initials	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT

Dilution Water Batch #: 8:2 010  
Test Chamber: VWR

QA Check: AT

Sample Description:

Animal Source: In-house cultures

Date Received:            Date of Hatch:           

Comments:



# Ceriodaphnia 7-Day Chronic Survival and Reproduction

Client/Sample ID: Y4 kind  
 Test Number: 2310-007

Start Date and Time: 10/3/2023 1325  
 Stop Date and Time: 10/10/2023 1315

Rep	Conc.	Cont	Daily Reproduction								Day 6 Total	Third Brood
			1	2	3	4	5	6	7	8		
1	C0N	56	—	—	—	5	—	13	19		19	37
2		15	—	—	—	4	X	14	—		4	4
3		23	—	—	—	—	6	—	—		20	20
4		53	—	—	—	3	6	—	—		11	11
5		4	—	—	—	4	6	—	20		10	30
6		34	—	—	—	6	11	—	17		17	34
7		13	—	—	—	6	11	—	20		17	37
8		35	—	—	—	3	—	12	19		15	34
9		27	—	—	—	6	—	12	18		19	36
10		1	—	—	—	4	10	—	18		14	32
Analyst		et	et	et	et	et	et	et	et			
Time		1325	1050	1125	1100	1225	1300	1320	1315			
Selen #		009	008	008	009	009	009	009	009			
Rep	Conc.	Cont	1	2	3	4	5	6	7	8	Day 6 Total	Third Brood
1	9.88	26	—	—	—	4	—	15	20		19	39
2		12	—	—	—	4	—	11	20		15	35
3		40	—	—	—	—	8	15	—		23	23
4		16	—	—	—	5	15	—	20		20	40
5		34	—	—	—	4	13	—	18		17	32
6		2	—	—	—	5	11	14	—		32	32
7		41	—	—	—	5	13	—	17		18	35
8		22	—	—	—	5	9	—	23		18	39
9		38	—	—	—	5	—	—	22		14	36
10		5	—	—	—	6	10	—	18		16	34

Rep	Conc.	Cont	Daily Reproduction								Day 6 Total	Third Brood
			1	2	3	4	5	6	7	8		
1	25	48	—	—	—	4	16	2	17		16	33
2		14	—	—	—	4	—	13	16		17	33
3		36	—	—	—	4	—	13	18		17	35
4		47	—	—	—	5	12	—	19		17	36
5		2	—	—	—	4	13	—	18		17	35
6		24	—	—	—	5	11	—	19		16	35
7		32	—	—	—	5	8	—	12		13	25
8		9	—	—	—	3	8	—	18		11	29
9		44	—	—	—	4	10	—	22		14	36
10		19	—	—	—	5	11	—	20		16	36

Rep	Conc.	Cont	Daily Reproduction								Day 6 Total	Third Brood
			1	2	3	4	5	6	7	8		
1	12.5	42	—	—	—	5	12	—	21		17	39
2		17	—	—	—	3	—	10	18		13	31
3		16	—	—	—	3	—	12	19		15	34
4		52	—	—	—	6	13	—	19		19	38
5		28	—	—	—	6	7	—	15		13	29
6		55	—	—	—	4	12	—	13		16	29
7		21	—	—	—	4	10	—	17		15	32
8		59	—	—	—	5	—	—	17		16	36
9		31	—	—	—	6	10	—	18		16	34
10		29	—	—	—	5	13	—	17		19	35

Rep	Conc.	Cont	Daily Reproduction								Day 6 Total	Third Brood
			1	2	3	4	5	6	7	8		
1	100	46	—	—	—	4	—	10	19		14	33
2		54	—	—	—	3	—	10	18		13	31
3		8	—	—	—	4	—	11	17		15	32
4		58	—	—	—	5	9	—	13		14	27
5		46	—	—	—	4	10	—	19		14	33
6		10	—	—	—	5	13	—	18		14	36
7		31	—	—	—	3	—	—	22		15	37
8		49	—	—	—	5	—	8	18		13	31
9		20	—	—	—	5	—	13	18		18	36
10		60	—	—	—	4	12	—	21		16	37

Comments: X=mortality

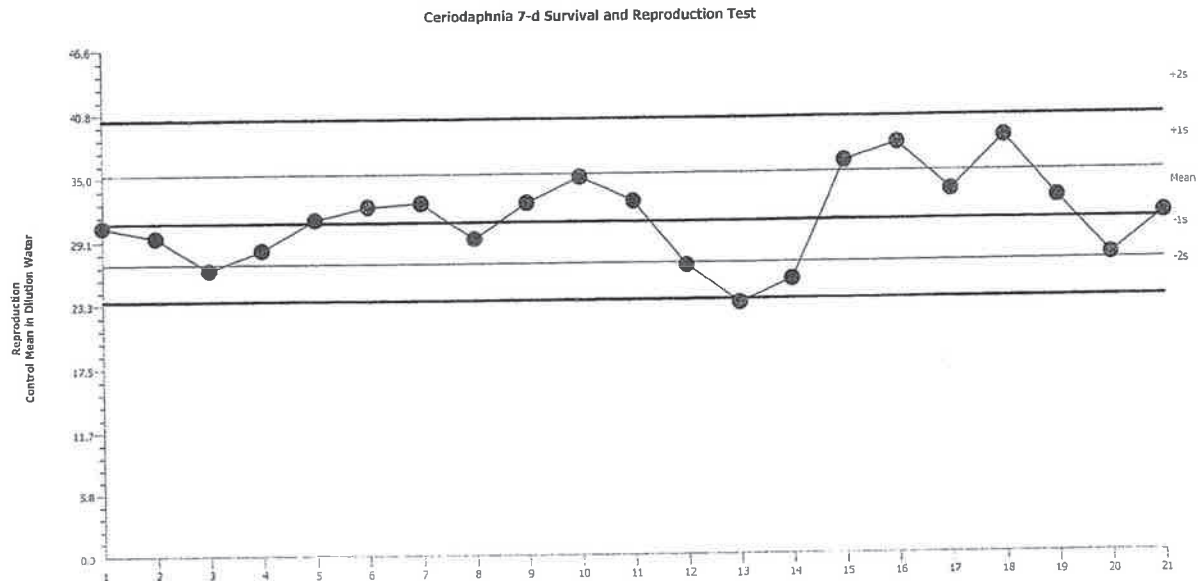
QA et

**Appendix B**  
**Control Quality Assurance Plots**

# CETIS QC Plot

Report Date: 13 Oct-23 10:07 ( 1 of 1)

Ceriodaphnia 7-d Survival and Reproduction Test				Rainier Environmental Laboratory	
Test Type: Reproduction-Survival (7d)		Organism: Ceriodaphnia dubia (Water Flea)		Material: All Materials	
Protocol: EPA/821/R-02-013 (2002)		Endpoint: Reproduction		Source: All SampleID Sources	



Mean: 30.85      Count: 20      -1s Warning Limit: 27      -2s Action Limit: 23.64  
 Sigma: NA      CV: 14.20%      +1s Warning Limit: 35.23      +2s Action Limit: 40.25

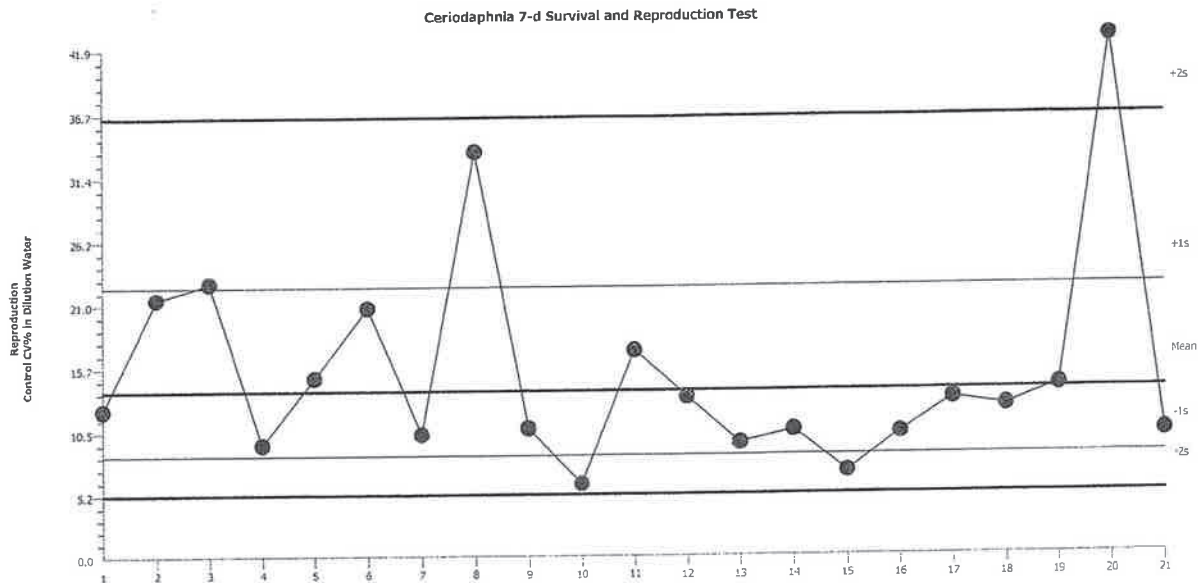
## Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2023	Jan	31	30.5	-0.3458	-0.08476			19-6730-7502	
2			31	29.5	-1.346	-0.3354			18-0595-6810	
3		Mar	7	26.5	-4.346	-1.142	(-)		03-7361-3136	
4			7	28.3	-2.546	-0.6477			07-0125-6014	
5			14	31.1	0.2542	0.06171			15-5027-8584	
6			20	32.3	1.454	0.3464			00-5815-7141	
7			21	32.6	1.754	0.4159			04-3260-2215	
8			21	29.3	-1.546	-0.3866			08-6817-2689	
9			28	32.6	1.754	0.4159			08-6112-7701	
10			28	34.9	4.054	0.9285			12-1613-0413	
11			28	32.7	1.854	0.4389			04-0199-7873	
12		May	16	26.8	-4.046	-1.057	(-)		13-8129-3160	
13		Jul	18	23.3	-7.546	-2.109	(-)	(-)	14-6082-0511	
14			18	25.4	-5.446	-1.461	(-)		19-8415-9254	
15		Aug	8	36.2	5.354	1.203	(+)		12-9170-9622	
16			8	37.8	6.954	1.529	(+)		01-9261-6977	
17			15	33.5	2.654	0.6206			05-0789-7359	
18			15	38.3	7.454	1.627	(+)		01-8551-4720	
19			15	32.8	1.954	0.4619			07-7017-2430	
20		Oct	3	27.5	-3.346	-0.8633			09-1500-0673	
21			3	31.3	0.4542	0.1099			16-9072-1994	

## CETIS QC Plot

Report Date: 13 Oct-23 10:07 ( 1 of 1)

Ceriodaphnia 7-d Survival and Reproduction Test				Rainier Environmental Laboratory	
Test Type: Reproduction-Survival (7d)		Organism: Ceriodaphnia dubia (Water Flea)		Material: All Materials	
Protocol: EPA/821/R-02-013 (2002)		Endpoint: Reproduction		Source: All Sample/D Sources	



Mean: 13.8  
Sigma: NA

Count: 20  
CV: 62.30%

-1s Warning Limit: 8.505  
+1s Warning Limit: 22.41

-2s Action Limit: 5.239  
+2s Action Limit: 36.37

## Quality Control Data

Point	Year	Month	Day	QC Data	Delta	Sigma	Warning	Action	Test ID	Analysis ID
1	2023	Jan	31	12.29	-1.515	-0.2399			19-6730-7502	
2			31	21.45	7.645	0.9098			18-0595-6810	
3		Mar	7	22.73	8.925	1.029	(+)		03-7361-3136	
4			7	9.43	-4.375	-0.7868			07-0125-6014	
5			14	14.89	1.085	0.1563			15-5027-8584	
6			20	20.69	6.885	0.8354			00-5815-7141	
7			21	10.25	-3.555	-0.6146			04-3260-2215	
8			21	33.56	19.76	1.834	(+)		08-6817-2689	
9			28	10.74	-3.065	-0.5182			08-6112-7701	
10			28	6.108	-7.697	-1.683	(-)		12-1613-0413	
11			28	17.12	3.315	0.4444			04-0199-7873	
12		May	16	13.26	-0.5446	-0.08309			13-8129-3160	
13		Jul	18	9.5	-4.305	-0.7715			14-6082-0511	
14			18	10.53	-3.275	-0.559			19-8415-9254	
15		Aug	8	7.109	-6.696	-1.37	(-)		12-9170-9622	
16			8	10.27	-3.535	-0.6106			01-9261-6977	
17			15	13.07	-0.7346	-0.1129			05-0789-7359	
18			15	12.43	-1.375	-0.2165			01-8551-4720	
19			15	14.07	0.2654	0.03932			07-7017-2430	
20		Oct	3	42.76	28.96	2.334	(+)	(+)	09-1500-0673	
21			3	10.22	-3.585	-0.6207			16-9072-1994	

**Appendix C**  
**Sample Check-In Sheet**



Rainier Environmental  
5013 Pacific Hwy East, Ste. 20  
Tacoma, WA 98424

Sample Check-In Information

Client:

City of Yakima - WWTTP

Tests Performed:

Test ID No(s):

Cd-C  
2310-007

Sample Description:

Sample ID:

WET #1

WET #II

WET #III

Log-in No. (20-xxxx):

23-089

23-093

23-095

Sample Collection Date & Time:

10/2/23 0808

10/4/23 0800

10/6/23 0800

Sample Receipt Date & Time:

10/3/23 0800

10/5/23 0930

10/7/23 0815

Check-in Temperature (°C)

0.5

0.7

1.2

Temperature OK?

(X) N

(X) N

(X) N

Y N

DO (mg/L)

9.5

9.5

9.4

pH (units)

7.43

7.55

7.52

Conductivity (µS/cm)

697

709

692

Salinity (ppt)

0.3

0.3

0.3

Tit. Vol / Sam. Vol. / Alkalinity (mg/L)\*

3.1 / 25 / 124

2.9 / 25 / 116

3.0 / 25 / 120

1

Tit. Vol. / Sam. Vol. / Hardness (mg/L)\*

3.6 / 25 / 144

3.4 / 25 / 136

3.3 / 25 / 132

1

Total Chlorine (mg/L)

<0.03

<0.03

<0.03

Total Ammonia Nitrogen (mg/L)

<1.0

<1.0

<1.0

Technician Initials

af

af

af

\* = mg/L as CaCO<sub>3</sub>, \* = Measured for freshwater samples only, NA = Not Applicable,

NM = Not Measured

Freshwater Tests:

Control/Dilution Water Source: test type:

Cd-C 8.2 (DMW)

010

MHW

Other:

Alkalinity:

64

Hardness:

92

Control/Dilution Water Source: test type:

8.2 (DMW)

MHW

Other:

Alkalinity:

Hardness:

Additional Control? Y N =

Y N =

MHW

Other:

Alkalinity:

Hardness:

Marine Tests:

Control/Dilution Water Source: test type:

ART SW

NAT SW

Alkalinity:

Salinity:

Control/Dilution Water Source: test type:

ART SW

NAT SW

Alkalinity:

Salinity:

Additional Control? Y N =

Y N =

MHW

Other:

Alkalinity:

Hardness:

Sample Salted w/ artificial salt? Y N

If yes, what ppt? \_\_\_\_\_

test type: \_\_\_\_\_

Alkalinity:

Hardness:

Sample salted w/brine? Y N

If yes, what ppt? \_\_\_\_\_

test type: \_\_\_\_\_

Alkalinity:

Hardness:

Comments: Temperature for grab sample must be 0-20°C if received within 1 hour of collection time, 0-12°C if effluent received within

4 hours of collection time, and 0-6°C for all other samples.

COC Complete? Y or N

1 Y 2 Y 3 Y

Filtration? Y (X)

Pore Size: \_\_\_\_\_

Organisms or Debris

Aeration? Y (X)

Length of Time: \_\_\_\_\_

Final DO: \_\_\_\_\_

Final pH: \_\_\_\_\_

Hardness Adjustment? Y (X)

If adjusted, please see worksheet for details.

Sub-samples for additional chemistry:

QC Check: 94

**Appendix D**  
**Chain-of-Custody Forms**

**Washington**  
5013 Pacific Highway East, Suite 20  
Fife, WA 98424  
Phone: 253-922-8898

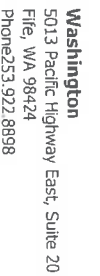
Receipt Temperature (°C)



**Washington**  
5013 Pacific Highway East, Suite 20  
Fife, WA 98424  
Phone: 253.922.8898

Date 10/4/23 Page 1 of 1

[illegible]



Receipt Temperature (°C)

Line Tollfree 0815 (Time)  
ERIC TOLLESON 10/17/23 (Date)  
23-095