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June 10, 2014

File:L020

Simon Toogood
Environmental Assessment Officer
Mackenzie Valley Review Board
Box 938, #200 Scotia Centre 5102-50th Avenue
Yellowknife, NT, X1A 2N7

Dear Mr. Toogood

Re: De Beers Canada Inc.'s Response to Hearing Undertakings for the Snap Lake Water Licence Amendment Environmental Assessment (EA1314-02)

De Beers Canada Inc. ("De Beers") provides the following responses to undertakings arising from the Environmental Assessment Hearings on June 5 and 6th, 2014. The undertaking responses are listed in the order that they were received during the proceedings.

1. De Beers to provide the Review Board with chapters six and seven of the Aquatic Effect Monitoring Program (AEMP) Design report.

A copy of the AEMP redesign from January 2014 is attached separately to this submission.

DE BEERS CANADA INC.
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2. De Beers to provide the Review Board with a complete list of commitments made by De Beers during this environmental assessment.

#	Commitment	Reference
1	De Beers will continue to monitor the areas downstream of the project and report annually in the AEMP and Environmental Agreement reports on the water quality results.	De Beers response to technical submissions, April 30 2014 See Environmental Assessment (EA) hearings commitments 3 and 7 for additional information.
2	De Beers will document community visits particularly information on the perception of Snap Lake and water quality, and submit to the Boards.	De Beers response to technical submissions, April 30 2014
3	De Beers will continue to conduct regional water quality monitoring as it has since 1999, and to report on the regional water quality three times a year reports to the MVLWB, a summary annual water license report to the MVLWB, and the annual AEMP report, as well as reporting to Aboriginal groups in the annual Environmental Agreement report. De Beers will also share data with the GNWT and Aboriginal Affairs and Northern Development Canada and communities as part of regional cumulative effects monitoring.	De Beers response to technical submissions, April 2014. See commitments 1 and 7 for additional information.
4	De Beers is committed to protecting aquatic ecosystem function within Snap Lake.	April 15 2014 Technical Session
5	De Beers commits to developing a site specific water quality objective (SSWQO) that is achievable and protective of the aquatic environment.	April 15 2014 Technical Session
6	De Beers commits to staying below an approved SSWQO and adopting appropriate mitigation to achieve this value.	April 16, 2014 Technical Session

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#	Commitment	Reference
7	De Beers will continue to define the range of natural variability within the impacted area of the Snap Lake Watershed through the AEMP.	June 5, 2014 EA Hearing See commitments 1 and 3 for additional information.
8	De Beers will undertake monitoring downstream at the inlet of MacKay Lake as a component of the AEMP.	June 5, 2014 EA Hearing
9	De Beers will provide draft summaries of community meetings held during May, by June 23, 2014.	June 5, 2014 EA Hearing
10	De Beers will hold meetings as appropriate to update stakeholders on progress toward mitigation measure development and implementation.	June 6, 2014 EA Hearing

3. De Beers to provide the Review Board with a graph of total dissolved solids in Snap Lake for closure and post closure for the scenario that the water quality objective is set at 684 mg/L.

The Snap Lake Site Model was used to predict long-term concentrations of total dissolved solids (TDS) in Snap Lake after Mine closure for "mitigated" scenarios (i.e., the end-of-pipe TDS concentration was set equal to a constant value of 684 milligrams per litre [mg/L] from January 1, 2015 to January 1, 2029) (Figure 1). Concentrations of TDS in Snap Lake were modelled conservatively, which means they were assumed not to undergo chemical reactions or physical processes other than dilution. Modelling TDS as a conservative parameter was demonstrated to be appropriate based on model calibration (i.e., a comparison of model results to monitored data from 2004 to 2012; De Beers 2013). After Mine closure, TDS concentrations in Snap Lake were predicted to rapidly decrease, with a 90 percent (%) reduction in concentration within approximately 30 years. By 2032 and 2071, TDS concentrations in Snap Lake were predicted to be less than or equal to 500 and 50 mg/L in both scenarios, respectively (Figure 1). By 2130, the end of the model simulation period, TDS concentrations in Snap Lake were predicted to be less than 25 mg/L.

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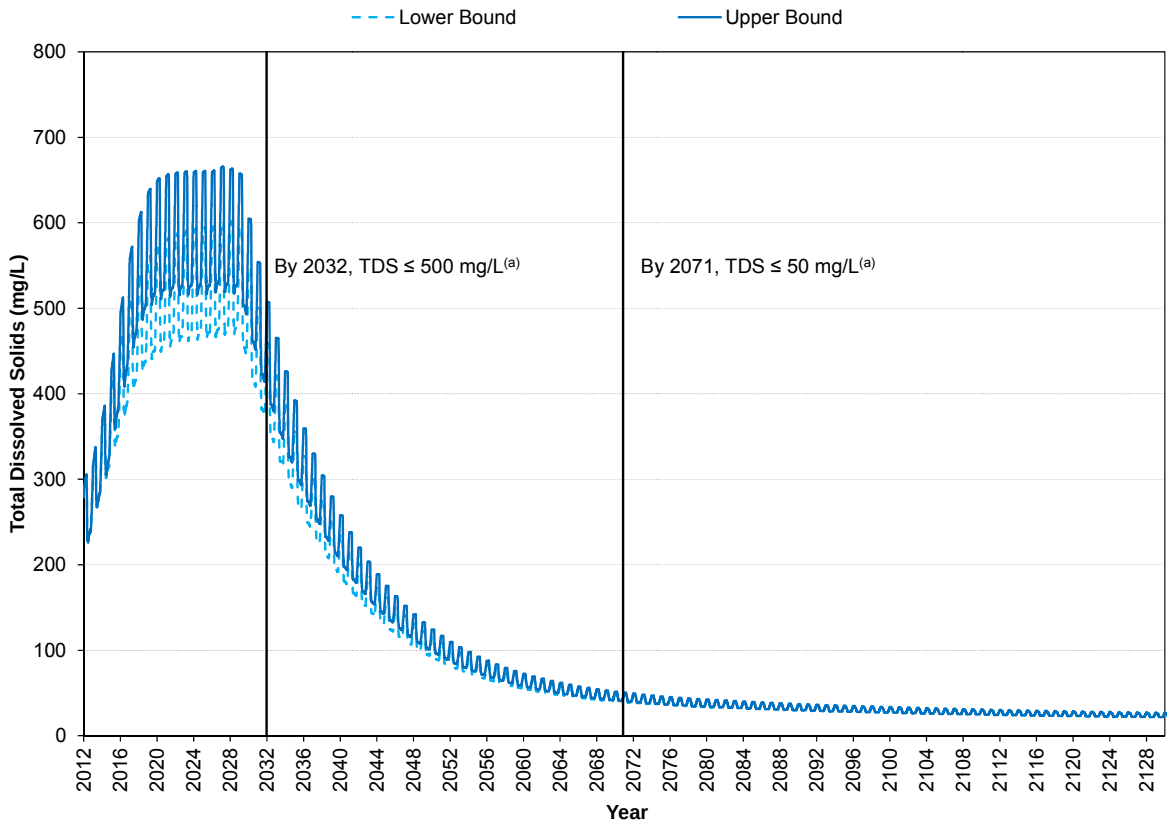
Figure 1. Predicted Whole-lake Average Total Dissolved Solids Concentrations in Snap Lake, 2012 to 2130, "Mitigated" Scenarios



Reference

De Beers. (De Beers Canada Inc.). 2013. Snap Lake Hydrodynamic and Water Quality Model Report. Submitted to the Mackenzie Valley Land and Water Board. Yellowknife, NWT, Canada.

4. De Beers to provide the Review Board with the report of copepod toxicity testing and the report of the Daphnia magna toxicity testing, results three to five.

Please see attached the laboratory reports of toxicity testing for three tests of *Daphnia magna* and one copepod, *Cyclops vernalis* as well as interpretation of these results as it relates to an appropriate site-specific water quality objective for Snap Lake.

The new results as reported by the laboratory are added to the results of previous studies in Figure 2.

Figure 2. Results of additional toxicity testing of *D.magna and C.vernalis.*

Test Species	Endpoint	[TDS]	
Ceriodaphnia dubia (water flea)*	IC10/IC20	560/778	
Daphnia magna (water flea)	IC20 (geomean, n=5)	>1,099	NEW
Chironomus dilutus (insect larvae)	IC10	>1,379	
Pseudokirchneriella subcapitata (alga)	IC10	>1,474	
Cyclops vernalis (copepod)*	IC20	>1,508	NEW
Brachionus calyciflorus (rotifer)	IC20	>1,474	
Navicula pelliculosa (diatom)	IC10	>1,487	
Lake Trout	Dry fertilization LC20 fry survival IC20 fry weight and length (growth) Wet fertilization LC20 fry survival IC20 fry weight and length	991 >1,490 >1,484 >1,484	
Arctic Grayling	Dry fertilization LC20 fry survival IC20 fry weight and length (growth) Wet fertilization LC20 fry survival IC20 fry weight and length	>1,419 >1,419 >1,414 >1,414	

*Species not in Snap Lake

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In closing De Beers thanks the Review Board for the opportunity to participate in the environmental assessment process. De Beers appreciates the Review Board's efforts to undertake the review process for this water licence amendment in an efficient and timely manner.

Sincerely,

DE BEERS CANADA INC.

Erica Bonhomme
Environment Manager
Snap Lake Mine

Attachments

DE BEERS CANADA INC.
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TECHNICAL MEMORANDUM

DATE June 10, 2014 **PROJECT No.** 14-1349-0003/1500/1503

TO Erica Bonhomme, Snap Lake Environmental Manager
De Beers Canada Inc.(DBCI)

CC Tasha Hall and Alison Snow (Golder); Alexandra Hood (DBCI)

FROM Peter M. Chapman **EMAIL** pmchapman@golder.com

ADDITIONAL *DAPHNIA MAGNA* 21-DAY TDS TOXICITY TEST RESULTS

1.0 BACKGROUND AND INTRODUCTION

Golder Associates Ltd (Golder 2013) developed a total dissolved solids (TDS) benchmark for aquatic life for Snap Lake based on a literature review, problem formulation, and site-specific toxicity tests with phytoplankton, zooplankton, benthic invertebrates, and fish species representative of aquatic receptors in Snap Lake. Most species tested showed no adverse effects at TDS concentrations greater than (>) 1,400 milligrams per litre (mg/L); however, two daphnid species were more sensitive to TDS and showed adverse effects at lower TDS concentrations. Although daphnids comprise an average of approximately 2 percent (%) of the zooplankton community in Snap Lake, a conservative site-specific water quality objective (SSWQO) of 684 mg/L was proposed based on the IC20 (20% inhibition concentration) from a single *Daphnia magna* 21-day (d) toxicity test performed by Nautilus Environmental (Burnaby, BC) and reported in Golder (2013).

The results of the TDS testing, including the proposed TDS SSWQO, were presented to interested parties, including regulatory agencies and representatives of Aboriginal communities, on January 6, 2014 in Yellowknife, Northwest Territories (NWT). There was discussion following the presentation regarding the repeatability of the tests.

As a result of the discussion regarding test repeatability, De Beers Canada Inc (De Beers) requested that Golder repeat the 21-day *D. magna* test that provides the basis for the proposed TDS SSWQO. A previous technical memorandum (Golder 2014) provided the methods and results from this repeat testing (Test 2 performed by Nautilus Environmental), which resulted in an IC20 of > 1,477 mg/L, and discussed the results relative to the proposed SSWQO.

Given the very different results from these two tests, it was suggested by reviewing parties at the Technical Session for the Snap Lake Water Licence Amendment (April 15 to 16, 2014 in Yellowknife) that an additional test should be conducted for a total of three, one of which should be conducted by a different toxicity testing laboratory. In response, De Beers requested Golder to commission three additional 21-day *D. magna* tests (two tests to be performed by Nautilus Environmental and one by HydroQual Laboratories [Calgary, AB]), for a total of five tests.

The present technical memorandum provides the methods and results from this repeat testing and discusses the results relative to the proposed SSWQO.

2.0 METHODS

Synthetic lake water samples were prepared, with the same ratio of major ions in Snap Lake but at a nominal TDS concentration of 1,500 mg/L. The samples were prepared by Nautilus Environmental, the same laboratory that prepared samples for previous TDS testing reported in Golder (2013, 2014); a portion of sample was shipped to HydroQual for testing. The synthetic lake water was analysed for its ionic composition to assess concentrations of the major ions and to calculate TDS concentrations. Results of those analyses determined that the calculated TDS concentrations for the three synthetic lake water samples were very close to the target nominal concentration of 1,500 mg/L: 1,510 mg/L for Test 3; 1,435 mg/L for Test 4; and, 1,460 mg/L for Test 5.

21-d *D. magna* survival and reproduction toxicity tests were conducted by Nautilus Environmental (Tests 3 and 4) and HydroQual Laboratories (Test 5) following ASTM (2004) procedures. The Nautilus Environmental data reports are provided as Attachments 1 (Test 3) and 2 (Test 4). The HydroQual Laboratories data report is provided as Attachment 3 (Test 5). All data reports include the chemical analyses for TDS in the synthetic lake water samples.

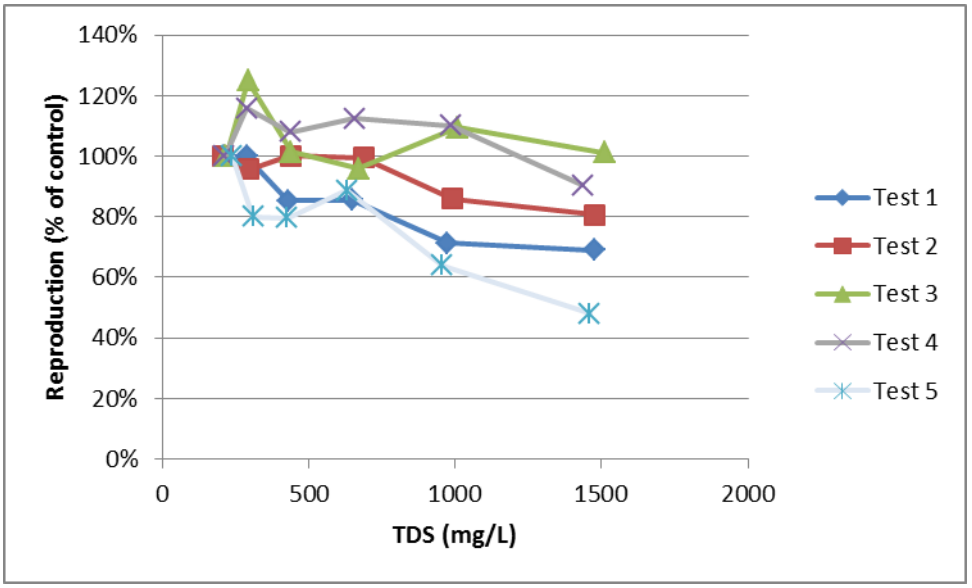
3.0 RESULTS

As is apparent from Figure 1, all five *D. magna* toxicity tests produced a similar dose-response. However, the 20% inhibition concentration (IC20) differed as follows:

- Test 1 IC20 684 mg/L TDS;
- Test 2 IC20 >1,477 mg/L TDS;
- Test 3 IC20 >1,510 mg/L TDS;
- Test 4 IC20 >1,435 mg/L TDS;
- Test 5 IC20 > 733 mg/L TDS.

As noted in the previous Technical Memorandum (Golder 2014) regarding Tests 1 and 2, the flatness of the dose-response explains these differences, which are not unreasonably large (Cherr et al. 1994).

Figure 1 Concentration-Response for Five Daphnia magna Snap Lake TDS Toxicity Tests



TDS= total dissolved solids; mg/L= milligrams per litre.

4.0 RELEVANCE TO THE SNAP LAKE TDS SSWQO

The Canadian Council of Ministers of the Environment (CCME 2007; Part II, Section 1-10 and 1-11) states "Multiple comparable records for the same endpoint are to be combined by the geometric mean of these records to represent the averaged species effects endpoint." CCME (2007, Part II, Section 3.1-2) similarly states, twice, "If there is more than one comparable record for a preferred endpoint, then the species effects endpoint is to be represented by the geometric mean of these records."

Previous SSWQOs developed for the Ekati Diamond Mine followed the above approach. Specifically, in cases where more than one acceptable value was available for an individual species endpoint, the values were combined using the geometric mean to produce a single value for each species (Elphick et al. 2011; Ekati 2012a,b,c). This approach was specifically applied to daphnid toxicity data in Elphick et al. (2011) and Ekati (2012c)

The geometric mean of the five IC20 values (Tests 1 to 5) for *D. magna* is >1,099 mg/L TDS. Based on CCME (2007) and previous precedent in the NWT, the value of 1,099 mg/L could reasonably be considered as a Snap Lake TDS SSWQO.

5.0 CLOSURE

We trust that this technical memorandum provides you with the information you require at this time. Should you have any questions, or require further information, please contact the undersigned.

GOLDER ASSOCIATES LTD.

Prepared by:

Peter M Chapman, PhD
Principal, Senior Environmental Scientist

Reviewed by:

Cathy A McPherson, BSc
Senior Environmental Scientist

PMC/CAM/me

Att.

6.0 REFERENCES CITED

ASTM (American Society for Testing and Materials). 2004. Standard Guide for Conducting *Daphnia magna* Life-Cycle Toxicity Tests. Method: E1193 - 97 (Reapproved 2012). In: Annual Book of ASTM Standards. Volume 11.06. Biological Effects and Environmental Fate; Biotechnology, Water and Environmental Technology. Philadelphia, PA, USA.

CCME (Canadian Council of Ministers of the Environment). 2007. A Protocol for the Derivation of Water Quality Guidelines for the Protection of Aquatic Life. Winnipeg, MB, Canada.

Cherr G, Dinnel P, Caldwell R, Cardwell R, Chapman PM. 1994. West Coast Marine Species Chronic Protocol Variability Study: Criteria for Acceptable Variability of Marine Chronic Toxicity Test Methods. Washington State Biomonitoring Science Advisory Board Report No. 1. Washington Department of Ecology, Olympia, WA, USA.

Ekati (Ekati Diamond Mine). 2012a. Ekati Diamond Mine Site Specific Water Quality Objective for Molybdenum. Yellowknife, NWT, Canada.

Ekati. 2012b. Ekati Diamond Mine Site Specific Water Quality Objective for Potassium. Yellowknife, NWT, Canada.

Ekati. 2012c. Ekati Diamond Mine Site Specific Water Quality Objective for Nitrate. Yellowknife, NWT, Canada.

Elphick JRF, Bergh KD, Bailey HC. 2011. Chronic toxicity of chloride to freshwater species: effects of hardness and implications for water quality guidelines. Environ Toxicol Chem 30: 239-246.

Golder (Golder Associates Ltd). 2013. Development of Total Dissolved Solids (TDS) Benchmark for Aquatic Life for Snap Lake. Prepared for De Beers Canada Inc, Yellowknife, NWT, Canada.

Golder. 2014. Second *Daphnia magna* 21-day TDS Toxicity Test Results. Prepared for De Beers Canada Inc, Yellowknife, NWT, Canada. April 11, 2014.

ATTACHMENT 1

NAUTILUS ENVIRONMENTAL DATA REPORT: Test 3

Nautilus Environmental

Golder Associates Ltd.
ATTN: Dr. Peter Chapman
200 – 420 West Hastings Street
Vancouver, BC
V6B 1L1

Report Date: April 7, 2014
Work Order: 14122

Data report

Species: *Daphnia magna*
Protocol: **ASTM E1193 - 97**

Table 1. Results for the 21-d *Daphnia magna* life-cycle toxicity test.

Sample ID	Sample Date	21-d IC20 mg/L TDS
TDS blend	Laboratory prepared	>1510

The tests met performance criteria and there were no deviations from the test methods. The results presented here relate only to the sample tested.

Jeslin Wijaya, B.Sc.
Laboratory Biologist

Reviewed By:
James Elphick, R.P.Bio
Senior Reviewer

Daphnia magna Summary Sheet

Client: Golder
Work Order No.: 14122

Start Date/Time: March 14, 2014 @ 1400h
Test Species: *Daphnia magna*
Set up by: JW

Sample Information:

Sample ID: TDS
Sample Date: March 12/14 (Made in-house)
Date Received: March 12/14 (Made in-house)
Sample Volume: ~~20L~~ JW 40L

Test Validity Criteria:
≥70% survival in the control treatment(s)
Average of ≥60 young/adult produced in the control
No ephippia were produced in the control treatment(s)
WQ Ranges:
T (°C) = 20 ± 2; DO (mg/L) = 3.0 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 021214
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 18
Mortality (%) in previous 7 d: 0
Days to first brood: 10

NaCl Reference Toxicant Results:

Reference Toxicant ID: DM 116
Stock Solution ID: 13 Na 03
Date Initiated: March 12/14
48-h LC50 (95% CL): 4.2 (3.7 - 4.8) g/L NaCL

Reference Toxicant Mean and Historical Range: 4.0 (3.7 - 4.4) g/L NaCL
Reference Toxicant CV (%): 4

Test Results: The 21-d LC50 is > 1516 mg/L TDS.
The 21-d IC 20 is > 1516 mg/L TDS.

Reviewed by: JW
Date reviewed: Apr. 7/14

Summary of test conditions for the *Daphnia magna* life-cycle toxicity test.

Test organism	*Daphnia magna*
Test organism source	In-house culture
Test organism age	<24-h old neonates
Test type	Static-renewal
Test duration	21 days
Test chamber	250-mL glass beaker
Test solution volume	100 mL
Test concentrations (mg/L TDS)	Five concentrations, plus laboratory control
Number of replicates	10
Control/dilution water	Moderately hard water (hardness 80-100 mg/L $CaCO_3$)
Test solution renewal	Three times weekly
Test temperature	20 ± 2°C
Number of organisms/chamber	1
Feeding	Daily, with *Pseudokirchneriella subcapitata* and digested yeast, cerophyll and trout chow
Light intensity	400 to 800 lux
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test protocol	ASTM E1193 - 97
Test endpoints	Survival and reproduction
Test acceptability criterion for controls	≥70% survival; average of ≥60 young per surviving control female
Reference Toxicant	Sodium Chloride
Test Start/End Date	March 14, 2014/ April 4, 2014

References

ASTM. 2004. Standard Guide for Conducting *Daphnia magna* Life-Cycle Toxicity Tests. Method: E1193 - 97 (Reapproved 2004). In: Annual Book of ASTM Standards. Volume 11.06. Biological Effects and Environmental Fate; Biotechnology, Water and Environmental Technology, American Society for Testing and Materials. Philadelphia, PA.

21-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: 14122

Start Date & Time: March 14/14 @ 1400h.
Stop Date & Time: April 4/14 @ 1330h
Test Species: *Daphnia magna*

Concentration: control

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	20.0	21.0	20.0	21.0	20.0	21.0	19.0	20.0	20.0	21.0	20.0	22.0	20.0	21.5	20.0	21.0	20.0			20.0
DO (mg/L)	8.7	8.6	8.4	8.1	8.5	9.0	8.5	8.1	8.7	8.5	8.6	8.2	9.1	8.3	8.7	8.5	8.8			8.2
pH	7.8	7.9	7.8	7.8	7.7	7.5	7.5	7.5	7.6	7.7	8.0	7.4	7.6	7.4	7.6	7.7	7.7		JW	7.4
Cond. (µS)	356	346		350		361		351		346		355		352		349				366
Initials	JW	JW		JW		JW		JW		JW		JW		JW		JW				BTL

①	Control	
Hardness*		
Alkalinity*		

* mg/L as CaCO3

Concentration: 296 mg/L TDS

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	20.5	21.0	21.5	21.0	19.0	21.0	20.5	20.0	21.0	21.0	22.0	22.0	20.0	21.5	21.0	21.0	20.0		JW	20.0
DO (mg/L)	8.5	8.6	8.0	8.2	8.9	9.1	8.9	7.9	8.5	8.4	8.8	8.2	9.1	8.4	8.1	8.6	8.5			8.4
pH	7.5	7.6	7.6	7.6	7.5	7.4	7.3	7.3	7.3	7.5	7.2	7.2	7.2	7.2	7.4	7.3	7.3			7.2
Cond. (µS)	597	602		599		604		597		614		601		615		604				612
Initials	JW	JW		JW		JW		JW		JW		JW		JW		JW				BTL

Sample Description: 1500 mg/L TDS made in-house March 12/14

Concentration: 444 mg/L TDS

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	21.0	21.0	22.0	21.0	19.0	21.0	21.0	20.0	21.5	21.0	22.0	22.0	20.0	21.5	21.0	21.0	21.0			20.0
DO (mg/L)	8.5	8.5	8.9	8.2	9.0	9.1	9.0	7.9	8.2	8.2	8.8	8.3	9.0	8.4	8.0	8.6	8.5		JW	8.4
pH	7.5	7.6	7.5	7.5	7.4	7.3	7.3	7.3	7.2	7.3	7.2	7.2	7.2	7.3	7.3	7.3	7.3			7.4
Cond. (µS)	875	882		875		879		873		890		881		893		880				918
Initials	JW	JW		JW		JW		JW		JW		JW		JW		JW				BTL

Comments: ① Please refer to Hardness & alkalinity datasheet

Concentration: 667 mg/L TDS

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	21.0	21.0	22.0	21.0	19.0	21.0	21.0	20.0	22.0	21.0	22.0	22.0	20.0	21.5	21.0	21.0	21.0			20.0
DO (mg/L)	8.5	8.4	9.0	8.3	9.1	9.0	9.1	7.9	8.2	8.2	8.7	8.3	9.0	8.4	8.0	8.6	8.5		JW	8.5
pH	7.5	7.6	7.6	7.5	7.5	7.5	7.4	7.3	7.2	7.4	7.4	7.2	7.3	7.5	7.3	7.4	7.4			7.5
Cond. (µS)	1293	1296		1285		1290		1283		1324		1298		1320		1308				1334
Initials	JW	JW		JW		JW		JW		JW		JW		JW		JW				BTL

Analysts: AWD, JW, BTL
Reviewed by: JBL
Date reviewed: Apr. 4/14

21-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: 14122

Start Date & Time: March 14/14 @ 1400h
Stop Date & Time: April 4/14 @ 1330h
Test Species: *Daphnia magna*

Concentration 1000 mg/L TDS	Days 0 init.	3 old	3 new	5 old	5 new	7 old	7 new	JW 12 10 old	10 new	12 old	12 new	14 old	14 new	17 old	17 new	19 old	19 new	old	new	21 final
Temp (°C)	21.0	21.0	22.0	21.0	19.0	21.0	21.0	20.0	22.0	21.0	22.0	22.0	20.0	21.5	21.0	21.0	21.0			20.0
DO (mg/L)	8.5	8.4	8.9	8.3	9.1	9.1	8.9	7.9	8.2	8.2	8.9	8.3	9.0	8.4	8.1	8.7	8.6			8.5
pH	7.8	7.7	7.8	7.6	7.7	7.7	7.5	7.4	7.3	7.5	7.5	7.4	7.5	7.6	7.5	7.6	7.5		JW	7.6
Cond. (µS)	1899	1905		1887		1896		1879		1919		1891		1920		1910				1970
Initials	JW	JW		JW		JW		JW		JW		JW		JW		JW				BTL

①	Control	
Hardness*		
Alkalinity*		

* mg/L as CaCO3

Concentration 1500 mg/L TDS	Days 0 init.	3 old	3 new	5 old	5 new	7 old	7 new	10 old	10 new	12 old	12 new	14 old	14 new	17 old	17 new	19 old	19 new	old	new	21 final
Temp (°C)	21.0	21.0	22.0	21.0	19.0	21.0	21.0	20.0	22.0	21.0	22.0	22.0	20.0	21.5	22.0	21.0	21.0			20.0
DO (mg/L)	8.5	8.5	9.0	8.3	9.1	9.1	9.1	8.0	8.0	8.1	9.0	8.3	9.1	8.4	8.1	8.6	8.9			8.5
pH	7.9	7.8	7.8	7.8	7.7	7.7	7.6	7.4	7.4	7.6	7.6	7.4	7.6	7.6	7.7	7.6	7.6	JW		7.7
Cond. (µS)	2750	2770		2780		2760		2740		2800		2740		2800		2770				2810
Initials	JW	JW		JW		JW		JW		JW		JW		JW		JW				BTL

Sample Description: 1500 mg/L TDS made in-house March 12/14

Concentration	Days 0 init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)																				
DO (mg/L)																				
pH																				
Cond. (µS)																				
Initials																				

Comments: ① Please refer to Hardness & alkalinity datasheet.

Concentration	Days 0 init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)																				
DO (mg/L)																				
pH																				
Cond. (µS)																				
Initials																				

Analysts: JW, AWD, BTL
Reviewed by: JCh
Date reviewed: Apr. 4/14

21-d Chronic Freshwater Toxicity Test
Daphnia magna Reproduction Data

Client: Golder
Sample ID: TDS
Work Order: 14122

Start Date & Time: March 14/14 @ 1400h
Stop Date & Time: April 4/14 @ 1330h
Analysts: JW, AWD

Days	Concentration: Control											Concentration: 296 mg/L TDS										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1																						
2																						
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
8																						
9	JW ✓																					
10	~~23~~4	26	22	22	17	12	JW ~~19~~20	19	19	24	JW	18	17	21	21	21	16	18	20	22	24	JW
11	✓	✓	✓	✓	✓	9	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
12	✓	✓	✓	✓	✓	22	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
13	14	20	27	23	28	✓	27	29	24	26	JW	29	24	22	28	28	23	27	25	29	28	JW
14	10	✓		✓	X	✓	✓	✓	1		JW	✓	1	✓	✓	✓	4	✓	✓	✓	✓	JW
15																						
16						7						26	21								25	
17	26	14	15	X		22	✓	14	19	17	JW	2	✓	19	24	25	27	22	25	22	✓	JW
18	✓	✓	✓			✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
19	✓	✓	✓			28	✓	✓	✓	✓	JW	29	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
20	25	16	11			✓	28	15	18	21	JW	✓	27	28	28	26	26	30	32	24	30	JW
21	✓	✓	✓			27	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
Total	99	76	75	45 X	45 X	127	JW ~~45~~ 75	77	81	~~81~~ JW 88	JW	104	90	90	101	100	96	97	102	97	107	JW

Notes: X = mortality.

Previous Brood Avg. young/daphnid: 18

Previous 7-d % mortality: 0

Brood Source: 021214 A

 # Days to 1st Brood: 10

Sample Description: 1500 mg/L TDS made in-house March 12/14.

Comments:

Reviewed by: JW

Date reviewed: Apr. 7/14

21-d Chronic Freshwater Toxicity Test
Daphnia magna Reproduction Data

Client: Golder
Sample ID: TDS
Work Order: 14122

Start Date & Time: March 14/14 @ 1400h
Stop Date & Time: April 4/14 @ 1330h
Analysts: JW, AWD

Days	Concentration: 444 mg/L TDS											Concentration: 667 mg/L TDS										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	/	/	/	/	/	/	/	/	/	/	~	/	/	/	/	/	/	/	/	/	/	~
2	/	/	/	/	/	/	/	/	/	/	~	/	/	/	/	/	/	/	/	/	/	~
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	JW
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	JW
7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	|	✓	✓	✓	✓	✓	✓	JW
8	/	/	/	/	/	/	/	/	/	/	~	/	/	/	|	/	/	/	/	/	/	~
9	/	/	/	/	/	/	/	/	/	/	~	/	/	/	|	/	/	/	/	/	/	~
10	19	5	✓	10	23	9	✓	23	20	17	JW	24	25	21	|	27	25	19	17	24	✓	JW
11	✓	11	19	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	|	✓	✓	✓	✓	✓	✓	JW
12	✓	10	✓	✓	✓	✓	13	✓	✓	✓	JW	✓	✓	✓	|	✓	✓	✓	✓ JW	✓	✓	JW
13	31	✓	✓	20	29	✓	✓	✓	23	27	JW	29	31	28	|	28	✓	✓	29/26	✓	16	JW
14	✓	✓	13	✓	✓	✓	✓	27	✓	✓	JW	✓	✓	✓	|	✓	21	✓	✓	24	✓	JW
15	/	/	/	/	/	X	/	/	/	/	~	/	/	/	|	/	/	/	/	/	/	~
16	25	22	/	/	/	|	16	/	/	20	~	/	/	26	|	24	/	/	24	/	16	~
17	✓	✓	21	18	21	|	✓	28	24	✓	JW	30	7 X	✓	|	✓	12	X	✓	20	✓	JW
18	✓	✓	✓	✓	✓	|	✓	✓	✓	✓	JW	✓	|	✓	|	✓	✓	|	✓	✓	✓	JW
19	✓	26	✓	✓	✓	|	23	✓	✓	27	JW	✓	|	✓	|	✓	✓	|	✓	✓	27	JW
20	32	✓	33	26	30	|	✓	32	26	✓	JW	28	|	34	|	33	31	|	30	29	✓	JW
21	✓	✓	✓	✓	✓	|	✓	✓	✓	✓	JW	✓	|	✓	|	✓	✓	|	✓	✓	✓	JW
Total	107	74	86	74	103	9 X	52	110	93	91	JW	111	63 X	109	0 X	112	89	19 X	97	97	59	JW

Notes: X = mortality.

Previous Brood Avg. young/daphnid: 18

Previous 7-d % mortality: 0

Brood Source: 021214 A

 # Days to 1st Brood: 10

Sample Description: 1500 mg/L TDS made in-house March 12/14

Comments:

Reviewed by: JOh

Date reviewed: Apr. 4/14

21-d Chronic Freshwater Toxicity Test
Daphnia magna Reproduction Data

Client: Golder
Sample ID: TDS
Work Order: 14122

Start Date & Time: March 14/14 @ 1400h
Stop Date & Time: April 4 / 14 @ 1330h
Analysts: JW / AWD

Days	Concentration: 1000 mg/L TDS											Concentration: 1500 mg/L TDS										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]
9	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]
10	22	20	19	✓	24	✓	22	17	22	20	JW	13	18	20	20	13	18	22	21	14	22	JW
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
12	✓	✓	1	16	✓	11	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
13	30	20	23	✓	24	✓	19	28	30	23	JW	23	19	28	18	21	20	15	29	22	22	JW
14		5	✓	✓	✓	21	✓	✓	✓	✓	JW	✓	1	✓	✓	✓	✓	✓	✓	✓	1	JW
15	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	[illegible]	✓	✓	✓	X	✓	✓	✓	✓	✓	✓	[illegible]
16	|	✓	✓	28	✓	✓	✓	✓	22	17	[illegible]	✓	✓	✓	|	✓	✓	✓	✓	23	✓	[illegible]
17	|	18	26	✓	27	20	✓	19	✓	✓	JW	13	14	21	|	22	20	✓	20	✓	26	JW
18	|	✓	✓	✓	✓	✓	X	✓	✓	✓	JW	✓	✓	✓	|	✓	✓	✓	✓	✓	✓	JW
19	|	✓	✓	24	✓	✓	|	✓	✓	✓	JW	✓	✓	✓	|	✓	✓	✓	✓	33	✓	JW
20	|	27	38	✓	32	27	|	28	34	33	JW	22	27	35	|	32	28	✓	32	✓	31	JW
21	|	✓	✓	25	✓	✓	|	✓	✓	✓	JW	✓	✓	✓	|	✓	✓	✓	✓	✓	✓	JW
Total	52[X]	90	107	93	107	79	41[X]	92	108	93	JW	71	79	104	38[X]	88	86	37	102	91	102	JW

Notes: X = mortality.

Previous Brood Avg. young/daphnid: 18

Previous 7-d % mortality: 0

Brood Source: 021214 A

 # Days to 1st Brood: 10

Sample Description: 1500 mg/L TDS made in-house March 12/14

Comments:

Reviewed by: JGW

Date reviewed: Apr. 4/14

CETIS Analytical Report

Daphnia Magna 21-Day Life Cycle Test — **Nautilus Environmental**

Analysis ID:	17-0774-0673	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	04 Apr-14 14:28	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	19-3235-7899	**Test Type:**	Survival-Reproduction	**Analyst:**	Jeslin Wijaya
Start Date:	14 Mar-14 14:00	**Protocol:**	ASTM E1193-97 (1997)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-14 13:30	**Species:**	Daphnia magna	**Brine:**	
Duration:	20d 23h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	12-6453-6091	**Code:**	4B5F4A1B	**Client:**	Golder
Sample Date:	12 Mar-14	**Material:**	Total Dissolved Solids	**Project:**	
Receive Date:	12 Mar-14	**Source:**	Golder		
Sample Age:	62h	**Station:**	TDS		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	500192	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
LC5	527.1	325.4	N/A
LC10	638.6	362.3	N/A
LC15	>1516	N/A	N/A
LC20	>1516	N/A	N/A
LC25	>1516	N/A	N/A
LC40	>1516	N/A	N/A
LC50	>1516	N/A	N/A

LC20 and LC50 are >1510 based on average of measured TDS at initiation and termination

Survival Rate Summary

			Calculated Variate(A/B)								
C-mg/L ①	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
217.5	Negative Control	10	0.8	0	1	0.1333	0.4216	52.7%	0.0%	8	10
292.3		10	1	1	1	0	0	0.0%	-25.0%	10	10
435		10	0.9	0	1	0.1	0.3162	35.14%	-12.5%	9	10
666.4		10	0.7	0	1	0.1528	0.483	69.01%	12.5%	7	10
1002.6		10	0.8	0	1	0.1333	0.4216	52.7%	0.0%	8	10
1516		10	0.9	0	1	0.1	0.3162	35.14%	-12.5%	9	10

Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
217.5	Negative Control	1	1	1	0	0	1	1	1	1	1
292.3		1	1	1	1	1	1	1	1	1	1
435		1	1	1	1	1	0	1	1	1	1
666.4		1	0	1	0	1	1	0	1	1	1
1002.6		0	1	1	1	1	1	0	1	1	1
1516		1	1	1	0	1	1	1	1	1	1

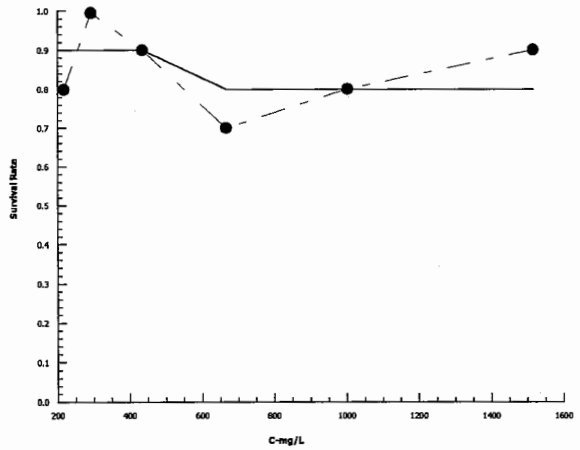
Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
217.5	Negative Control	1/1	1/1	1/1	0/1	0/1	1/1	1/1	1/1	1/1	1/1
292.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
435		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
666.4		1/1	0/1	1/1	0/1	1/1	1/1	0/1	1/1	1/1	1/1
1002.6		0/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
1516		1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1

① TDS measurements are based on Day 0 chemistry.

Analysis ID:	17-0774-0673	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	04 Apr-14 14:28	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



CETIS Analytical Report

Daphnia Magna 21-Day Life Cycle Test — **Nautilus Environmental**

Analysis ID:	06-0581-7059	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	07 Apr-14 9:02	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	19-3235-7899	**Test Type:**	Survival-Reproduction	**Analyst:**	Jeslin Wijaya
Start Date:	14 Mar-14 14:00	**Protocol:**	ASTM E1193-97 (1997)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	04 Apr-14 13:30	**Species:**	Daphnia magna	**Brine:**	
Duration:	20d 23h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	12-6453-6091	**Code:**	4B5F4A1B	**Client:**	Golder
Sample Date:	12 Mar-14	**Material:**	Total Dissolved Solids	**Project:**	
Receive Date:	12 Mar-14	**Source:**	Golder		
Sample Age:	62h	**Station:**	TDS		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	403923	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	364	324	N/A
IC10	>1516	N/A	N/A
IC15	>1516	N/A	N/A
IC20	>1516	N/A	N/A
IC25	>1516	N/A	N/A
IC40	>1516	N/A	N/A
IC50	>1516	N/A	N/A

IC20 and IC50 values are >1510 mg/L based on average measured TDS at test initiation and termination

Reproduction Summary

			Calculated Variate						
C-mg/L ①	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
217.5	Negative Control	10	78.8	45	127	7.561	23.91	30.34%	0.0%
292.3		10	98.4	90	107	1.759	5.562	5.65%	-24.87%
435		10	79.9	9	110	9.65	30.52	38.19%	-1.4%
666.4		10	75.6	0	112	12.54	39.64	52.43%	4.06%
1002.6		10	86.2	41	108	7.261	22.96	26.64%	-9.39%
1516		10	79.8	37	104	7.789	24.63	30.86%	-1.27%

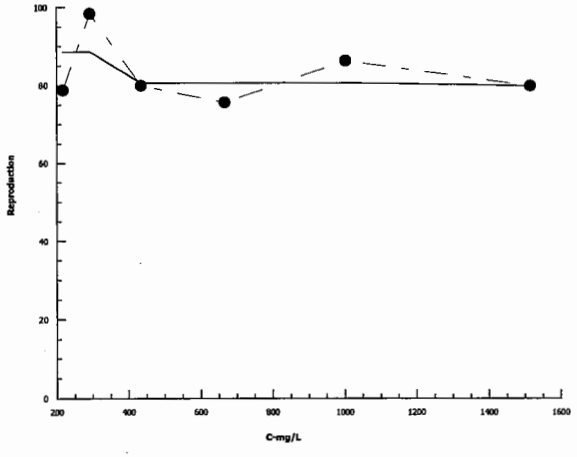
Reproduction Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
217.5	Negative Control	99	76	75	45	45	127	75	77	81	88
292.3		104	90	90	101	100	96	97	102	97	107
435		107	74	86	74	103	9	52	110	93	91
666.4		111	63	109	0	112	89	19	97	97	59
1002.6		52	90	107	93	107	79	41	92	108	93
1516		71	79	104	38	88	86	37	102	91	102

① TDS measurements are based on Day 0 chemistry.

Analysis ID:	06-0581-7059	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	07 Apr-14 9:02	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Client: Golder

W.O.#: 14122

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
MHW	March 12/14 JW	50	3.5	3.6	68		50	5.0	100	JW
MHW	March 17/14 JW	50	3.5	3.6	68		50	5.0	100	JW
MHW	March 19/14	50	3.6	3.7	70		50	5.0	100	JW
MHW	March 21/14	50	3.7	3.8	72		50	5.0	100	JW
MHW	March 27/14	50	3.7	3.8	72		50	5.0	100	JW
MHW	March 29/14	50	3.6	3.7	70		50	5.0	100	JW
1500 mg/L TDS	March 14/14	50	5.0	5.1	98		10 ①	8.9	890	JW

Notes: ① Diluted to 100 mL w/ DI H_2O.

Reviewed by: JGL

Date Reviewed: Apr. 4/14

Chemistry at test initiation

NAUTILUS ENVIRONMENTAL
ATTN: Jeslin Wijaya
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 14-MAR-14
Report Date: 21-MAR-14 17:26 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1432679

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 1
Legal Site Desc:

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1432679-1 Water 14-MAR-14 CONTROL	L1432679-2 Water 14-MAR-14 296 MG/L TDS	L1432679-3 Water 14-MAR-14 444 MG/L TDS	L1432679-4 Water 14-MAR-14 667 MG/L TDS	L1432679-5 Water 14-MAR-14 1000 MG/L TDS
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	209	361	529	783	1140
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	76.9	21.7	32.1	45.6	73.7
	Chloride (Cl) (mg/L)	2.25	147	218	339	515
	Sulfate (SO4) (mg/L)	97.6	26.3	38.2	58.8	84
Total Metals	Calcium (Ca)-Total (mg/L)	16.6	61.6	91.8	138	204
	Magnesium (Mg)-Total (mg/L)	13.7	7.08	10.7	15.8	23.6
	Potassium (K)-Total (mg/L)	2.8	3.0	4.5	6.5	9.8
	Sodium (Na)-Total (mg/L)	38.4	34.3	52.5	80.9	122

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1432679-6				
	Description	Water				
	Sampled Date	14-MAR-14				
	Sampled Time					
	Client ID	1500 MG/L TDS				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1790				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	111				
	Chloride (Cl) (mg/L)	772				
	Sulfate (SO4) (mg/L)	135				
Total Metals	Calcium (Ca)-Total (mg/L)	304				
	Magnesium (Mg)-Total (mg/L)	37.4				
	Potassium (K)-Total (mg/L)	15.0				
	Sodium (Na)-Total (mg/L)	186				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1432679-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

TESTING LOCATION (Please Circle)

Nautilus Environmental

L1432679-COFC

Chain of Custody

British Columbia
8664 Commerce Court
Burnaby, British Columbia, Canada V5A 4N3
Phone 604.420.8773

Date_____Page___of___

Sample Collection

Report to:

Company	Nautilus Environmental
Address	8664 Commerce Court
City/State/Zip	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya
Phone	604-420-8773
Email	jeslin@nautilusenvironmental.com

Invoice To:

Company	Nautilus Environmental
Address	8664 Commerce Court
City/State/Zip	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya
Phone	604-420-8773
Email	jeslin@nautilusenvironmental.com

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	ANALYSES REQUIRED: Total Calcium	Total Magnesium	Total Sodium	Total Potassium	Total Chloride	Total Sulphate	Alkalinity	TDS			Receipt Temperature (°C)
1	Control	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
2	296 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
3	444 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
4	667 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
5	1000 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
6	1500 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
7																		
8																		
9																		
10																		

PROJECT INFORMATION		SAMPLE RECEIPT	
Client:		**Total No. of Containers**	
PO No.:		**Received Good Condition?**	
Shipped Via:		**Matches Test Schedule?**	

SPECIAL COMMENTS/INSTRUCTIONS : 21-d *D. magna* chronic test. Day 0. All samples are not preserved.

RELINQUISHED BY (CLIENT)

(Signature) (Time): 1600h
(Printed Name) (Date): Jeslin Wijaya March 14/14
(Company): Nautilus Environmental Company Inc.

RELINQUISHED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) (Time): 18:40
(Printed Name) (Date): Mar14
(Company): 21.3°C

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

Chemistry at test termination

NAUTILUS ENVIRONMENTAL
ATTN: Jeslin Wijaya
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 04-APR-14
Report Date: 10-APR-14 14:31 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1440078

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1440078-1	L1440078-2	L1440078-3	L1440078-4	L1440078-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	04-APR-14	04-APR-14	04-APR-14	04-APR-14	04-APR-14
	Sampled Time					
	Client ID	CONTROL MHW	296 MG/L TDS	444 MG/L TDS	667 MG/L TDS	1000 MG/L TDS
Grouping	**Analyte**					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	209	444	626	897	1250
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	80.8	22.1	33.7	47.5	80.2
	Chloride (Cl) (mg/L)	2.20	149	227	343	518
	Sulfate (SO4) (mg/L)	97.7	26.8	39.5	60.2	90
Total Metals	Calcium (Ca)-Total (mg/L)	16.8	59.5	89.7	136	205
	Magnesium (Mg)-Total (mg/L)	13.7	7.28	11.0	16.8	25.2
	Potassium (K)-Total (mg/L)	2.4	2.8	4.3	6.5	9.8
	Sodium (Na)-Total (mg/L)	33.8	34.5	51.9	78.2	119

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1440078-6				
	Description	Water				
	Sampled Date	04-APR-14				
	Sampled Time					
	Client ID	1500 MG/L TDS				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1950				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	111				
	Chloride (Cl) (mg/L)	774				
	Sulfate (SO4) (mg/L)	134				
Total Metals	Calcium (Ca)-Total (mg/L)	299				
	Magnesium (Mg)-Total (mg/L)	37.1				
	Potassium (K)-Total (mg/L)	14.8				
	Sodium (Na)-Total (mg/L)	179				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1440078-1, -2, -3, -4, -5, -6
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1440078-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

TESTING LOCATION (Please Circle)

Chain of Custody

Short Holding Time

Rush Processing L1440078

British Columbia
8664 Commerce Court
Burnaby, British Columbia, Canada V5A 4N3
Phone 604.420.8773

Date Apr 4/14 Page 1 of 1

Sample Collection By:

Report to:		**Invoice To:**	
Company	Nautilus Environmental	**Company**	Nautilus Environmental
Address	8664 commerce court	**Address**	8664 commerce court
City/State/Zip	Burnaby, BC V5A 4N7	**City/State/Zip**	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya	**Contact**	Jeslin Wijaya
Phone	604 - 420 - 8773	**Phone**	604 - 420 - 8773
Email	jeslin @ nautilusenvironmental.com	**Email**	jeslin @ nautilusenvironmental.com

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	Total calcium	Total Magnesium	Total Sodium	Total Potassium	Total Chloride	Total Sulphate	Alkalinity	TDS			Receipt Temperature (°C)
1	control MHW	April 4/14		water	125 mL & 1L	2		x	x	x	x	x	x	x	x			
2	296 mg/L TDS	April 4/14		water	125 mL & 1L	2		x	x	x	x	x	x	x	x			
3	444 mg/L TDS	April 4/14		water	125 mL & 1L	2		x	x	x	x	x	x	x	x			
4	667 mg/L TDS	April 4/4		water	125 mL & 1L	2		x	x	x	x	x	x	x	x			
5	1000 mg/L TDS	April 4/14		water	125 mL & 1L	2		x	x	x	x	x	x	x	x			
6	1500 mg/L TDS	April 4/14		water	125 mL & 1L	2		x	x	x	x	x	x	x	x			
7																		
8																		
9																		
10																		

L1440078-COFC

PROJECT INFORMATION

Client:	
PO No.:	
Shipped Via:	

SAMPLE RECEIPT

Total No. of Containers	
Received Good Condition?	
Matches Test Schedule?	

Special comments: 21-d D.magna chronic test. All samples are not preserved.

RELINQUISHED BY (CLIENT)

(Signature)	(Time)
	1500h
(Printed Name)	(Date)
Jeslin Wijaya	April 4/14
(Company)	
Nautilus Environmental.	

RECEIVED BY (COURIER)

(Signature)	(Time)
(Printed Name)	(Date)
(Company)	

(Signature)	(Time)
(Printed Name)	(Date)
(Company)	

RECEIVED BY (LABORATORY)

(Signature)	(Time)
VC	Apr 4 16:15 : 15.8°C
(Printed Name)	(Date)
(Company)	

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

Day 0 - March 14, 2014

Nominal TDS	mg/L	Control	296	444	667	1000	1500
Alkalinity	mg/L	76.9	21.7	32.1	45.6	73.7	111
Cl	mg/L	2.25	147	218	339	515	772
SO4	mg/L	97.6	26.3	38.2	58.8	84	135
Ca	mg/L	16.6	61.6	91.8	138	204	304
Mg	mg/L	13.7	7.08	10.7	15.8	23.6	37.4
K	mg/L	2.8	3	4.5	6.5	9.8	15
Na	mg/L	38.4	34.3	52.5	80.9	122	186
Calculated TDS	mg/L	217.5	292.3	435.0	666.4	1002.6	1516.0

Day 21 - April 4, 2014

Nominal TDS	mg/L	Control	296	444	667	1000	1500
Alkalinity	mg/L	80.8	22.1	33.7	47.5	80.2	111
Cl	mg/L	2.2	149	227	343	518	774
SO4	mg/L	97.7	26.8	39.5	60.2	90	134
Ca	mg/L	16.8	59.5	89.7	136	205	299
Mg	mg/L	13.7	7.28	11	16.8	25.2	37.1
K	mg/L	2.4	2.8	4.3	6.5	9.8	14.8
Na	mg/L	33.8	34.5	51.9	78.2	119	179
Calculated TDS	mg/L	215.1	293.1	443.6	669.2	1015.1	1504.5
Average TDS	mg/L	216.3	292.7	439.3	667.8	1008.9	1510.3

ATTACHMENT 2

NAUTILUS ENVIRONMENTAL DATA REPORT: Test 4

Nautilus Environmental

Golder Associates Ltd.
ATTN: Peter Chapman
200 – 420 West Hastings Street
Vancouver, BC
V6B 1L1

Report Date: May 2, 2014
Work Order: 14123

Data report

Species: *Daphnia magna*
Protocol: **ASTM E1193 - 97**

Table 1. Results for the 21-d *Daphnia magna* life-cycle toxicity test.

Sample ID	Sample Date	21-d IC20 mg/L TDS
TDS	Laboratory prepared	>1435

The test met performance criteria and there were no deviations from the test methods. The results presented here relate only to the sample tested.

Jeslin Wijaya, B.Sc.
Laboratory Biologist

Reviewed By:
James Elphick, R.P.Bio
Senior Reviewer

Daphnia magna Summary Sheet

Client: Golder
Work Order No.: 14123

Start Date/Time: March 28 / 14 @ 1200h
Test Species: *Daphnia magna*
Set up by: JN

Sample Information:

Sample ID: TDS
Sample Date: March 24 / 14 (Made in-house)
Date Received: March 24 / 14 (Made in-house)
Sample Volume: 1 x 20 L

Test Validity Criteria:
≥70% survival in the control treatment(s)
Average of ≥60 young/adult produced in the control
No ephippia were produced in the control treatment(s)
WQ Ranges:
T (°C) = 20 ± 2; DO (mg/L) = 3.0 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 031214 A
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 19
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: Dm 117
Stock Solution ID: 14 NaCl 01
Date Initiated: April 3, 2014
48-h LC50 (95% CL): 3.9 (2.8 - 5.5) g/LNaCL

Reference Toxicant Mean and Historical Range: 4.0 (3.7 - 4.4) g/L NaCL
Reference Toxicant CV (%): 4

Test Results: The 21-d LC 50 is > 1435 mg/L TDS.
The 21-d IC 20 is > 1435 mg/L TDS.

Reviewed by: JCL

Date reviewed: May 1 / 14

Summary of test conditions for the *Daphnia magna* life-cycle toxicity test.

Test organism	*Daphnia magna*
Test organism source	In-house culture
Test organism age	<24-h old neonates
Test type	Static-renewal
Test duration	21 days
Test chamber	250-mL glass beaker
Test solution volume	100 mL
Test concentrations (mg/L TDS)	Five concentrations, plus laboratory control
Number of replicates	10
Control/dilution water	Moderately hard water (hardness 80-100 mg/L $CaCO_3$)
Test solution renewal	Three times weekly
Test temperature	20 ± 2°C
Number of organisms/chamber	1
Feeding	Daily, with *Pseudokirchneriella subcapitata* and digested yeast, cerophyll and trout chow
Light intensity	400 to 800 lux
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test protocol	ASTM E1193 - 97
Test endpoints	Survival and reproduction
Test acceptability criterion for controls	≥70% survival; average of ≥60 young per surviving control female
Reference Toxicant	Sodium Chloride
Test Start/End Date	March 28, 2014/ April 18, 2014

References

ASTM. 2004. Standard Guide for Conducting *Daphnia magna* Life-Cycle Toxicity Tests. Method: E1193 - 97 (Reapproved 2004). In: Annual Book of ASTM Standards. Volume 11.06. Biological Effects and Environmental Fate; Biotechnology, Water and Environmental Technology, American Society for Testing and Materials. Philadelphia, PA.

21-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: 14123

Start Date & Time: March 28 / 14 @ 1200h
Stop Date & Time: April 18 / 14 @ 1230h
Test Species: *Daphnia magna*

Concentration: control

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	19.0	20.0	20.0	21.0	20.0	20.0	19.0	20.0	20.0	20.0	19.5	20.0	21.0	20.0	19.5	20.0	20.0			18.5
DO (mg/L)	9.1	8.5	8.7	9.2	8.8	8.6	8.7	8.3	8.7	8.1	8.6	8.4	8.6	7.7	8.5	8.1	8.7			8.8
pH	7.6	7.4	7.6	7.5	7.7	7.7	7.6	7.7	7.8	7.6	7.7	7.5	7.5	7.4	7.6	7.4	7.5		JW	7.6
Cond. (µS)	355	352		349		352		356		356		349		351		356				361
Initials	JW	JW		JW		JW		JW		YYL		JW		JW		JW				

① Control

Hardness*		
Alkalinity*		

* mg/L as CaCO3

Concentration: 296 mg/L TDS

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	19.0	20.0	19.5	21.0	21.0	20.0	20.0	20.0	22.0	20.0	19.5	20.0	21.0	20.0	21.0	20.0	21.0			18.5
DO (mg/L)	9.3	8.4	8.4	9.0	8.6	8.7	8.6	8.5	8.2	8.2	8.8	8.5	9.0	7.9	8.4	8.1	8.8		JW	8.9
pH	7.3	7.0	7.2	7.2	7.1	7.3	7.2	7.4	7.2	7.2	7.3	7.2	7.2	7.1	7.2	7.2	7.2			7.4
Cond. (µS)	604	613		602		608		608		609		611		606		615				617
Initials	JW	JW		JW		JW		JW		YYL		JW		JW		JW				

Sample Description: 1500 mg/L TDS made in-house on March 24 / 14

Concentration: 444 mg/L TDS

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	19.0	20.0	20.0	21.0	21.0	20.0	20.0	20.0	22.0	20.0	19.5	20.0	22.0	20.0	21.0	20.0	21.0			18.5
DO (mg/L)	9.3	8.4	8.4	9.0	8.6	8.7	8.7	8.5	8.2	8.2	9.0	8.4	8.9	8.0	8.5	8.1	9.1		JW	8.9
pH	7.2	7.0	7.2	7.2	7.2	7.3	7.2	7.3	7.3	7.2	7.3	7.2	7.2	7.1	7.2	7.2	7.2			7.3
Cond. (µS)	875	878		872		875		884		880		878		879		887				912
Initials	JW	JW		JW		JW		JW		YYL		JW		JW		JW				

Comments: ① Please refer to Hardness & alkalinity datasheet.

Concentration: 667 mg/L TDS

	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	19.0	20.0	20.0	21.0	21.0	20.0	20.0	20.0	22.0	20.0	19.5	20.0	21.0	20.0	21.0	20.0	21.0			18.5
DO (mg/L)	9.3	8.5	8.5	8.9	8.6	8.7	9.0	8.6	8.2	8.3	9.0	8.4	8.8	7.9	8.7	8.2	8.9		JW	8.9
pH	7.3	7.2	7.4	7.3	7.4	7.4	7.4	7.4	7.4	7.5	7.4	7.3	7.4	7.3	7.3	7.5	7.4			7.3
Cond. (µS)	1292	1300		1296		1293		1302		1305		1294		1273		1286				1309
Initials	JW	JW		JW		JW		JW		YYL		JW		JW		JW				

Analysts: JW, YYL, AWD
Reviewed by: JGL
Date reviewed: May 1/14

21-d Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: 14123

Start Date & Time: March 28/14 @ 1200h
Stop Date & Time: April 18/14 @ 1230h
Test Species: *Daphnia magna*

Concentration: 1000 mg/L TDS	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	19.0	20.0	20.0	21.0	21.0	20.0	19.0	20.0	20.0	20.0	19.5	20.0	21.0	20.0	21.0	20.0	21.0			19.5
DO (mg/L)	9.3	8.5	8.5	9.0	8.7	8.7	9.0	8.6	8.3	8.3	8.9	8.5	8.8	7.9	8.7	8.2	8.9		JW	8.9
pH	7.5	7.3	7.5	7.6	7.5	7.5	7.5	7.6	7.5	7.5	7.6	7.4	7.5	7.4	7.4	7.5	7.4			7.7
Cond. (µS)	1890	1899		1880		1885		1895		1901		1888		1885		1916				1915
Initials	JW	JW		JW		JW		JW		YML		JW		JW		JW				A

①	Control	
Hardness*		
Alkalinity*		

* mg/L as CaCO3

Concentration: 1500 mg/L TDS	Days																				
	0	3		5		7		10		12		14		17		19				21
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)	19.0	20.0	20.0	21.0	21.0	20.0	19.0	20.0	22.0	20.0	20.0	20.0	21.0	20.0	21.0	20.0	21.0			19.5
DO (mg/L)	9.3	8.5	8.5	8.9	8.7	8.7	8.9	8.6	8.2	8.3	8.8	8.5	8.8	8.1	8.9	8.2	8.9		JW	8.9
pH	7.5	7.3	7.5	7.6	7.5	7.6	7.6	7.7	7.6	7.7	7.6	7.4	7.5	7.4	7.4	7.5	7.5			7.3
Cond. (µS)	2730	2740		2740		2720		2760		2750		2730		2730		2740				2820
Initials	JW	JW		JW		JW		JW		YML		JW		JW		JW				A

Sample Description: 1500 mg/L TDS made in-house on March 24/14

Concentration	Days																				
	0																				
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)																				
DO (mg/L)																				
pH																				
Cond. (µS)																				
Initials																				

Comments: ① Please refer to Hardness & Alkalinity datasheet.

Concentration	Days																				
	0																				
	init.	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	old	new	final
Temp (°C)																				
DO (mg/L)																				
pH																				
Cond. (µS)																				
Initials																				

Analysts: JW, YYL, AWP
Reviewed by: JGL
Date reviewed: May 1/14

21-d Chronic Freshwater Toxicity Test
Daphnia magna Reproduction Data

Client: Golder
Sample ID: TDS
Work Order: 14123

Start Date & Time: March 28 / 14 @ 1200h
Stop Date & Time: April 18 / 14 @ 1230h
Analysts: JW, AWD, YYL

Days	Concentration: control										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
6											YYL
7										—	YYL
8											
9											
10	14	15	14	15	13	12	12	13	14	12	JW
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
12											YYL
13	23	28	24	21	24	22	15	23	✓	23	JW
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
15											
16	30	19	22	15	31	27	18	25	30	25	
17	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
18	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
19	35	28	31	✓	31	28	26	15	28	✓	JW
20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
21											
Total	102	90	91	51	99	89	71	76	79	60	JW

Days	Concentration: 296 mg/L TDS										
	A	B	C	D	E	F	G	H	I	J	Init
1											
2											
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
6											YYL
7											YYL
8											
9											
10	15	9	17	13	9	15	14	12	13	14	JW
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
12									19	19	YYL
13	22	25	28	23	19	24	22	25	✓	✓	JW
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
15											
16	35	40	36	25	X	27	29	30	34	36	
17	✓	✓	✓	✓		✓	✓	✓	✓	✓	JW
18	✓	✓	✓	✓		✓	✓	9	✓	37	JW
19	31	40	37	31		36	18	10	37	✓	JW
20	✓	✓	✓	✓		✓	✓	✓	✓	✓	JW
21											
Total	103	114	118	92	28	102	83	86	103	106	JW

Notes: X = mortality.

Previous Brood Avg. young/daphnid: 19

Previous 7-d % mortality: 0

Brood Source: 031214 A

 # Days to 1st Brood: 9

Sample Description: 1500 mg/L TDS made in-house on March 24, 2014

Comments:

Reviewed by: JGh

Date reviewed: May 1/14

21-d Chronic Freshwater Toxicity Test
Daphnia magna Reproduction Data

Client: Golder
Sample ID: TDS
Work Order: 14123

Start Date & Time: March 28/14 @ 1200h
Stop Date & Time: April 18/14 @ 1230h
Analysts: JW, AWD, YYL

Days	Concentration: 444 mg/L TDS											Concentration: 667 mg/L TDS										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1																						
2																						
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
6											YYL											YYL
7											YYL											YYL
8											AD											AD
9											AD											AD
10	8	10	16	✓	✓	12	14	12	12	8	JW	13	JW 9	11	12	10	12	✓	✓	10	10	JW
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
12	19	✓	✓	9	10	✓	✓	✓	✓	22	YYL	✓	✓	✓	✓	✓	✓	10	16	✓	15	YYL
13	✓	22	15	✓	✓	21	23	15	21	✓	JW	24	24	20	21	21	23	✓	✓	JW 21 19	✓	JW
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	JW 23 ✓	✓	✓	✓	✓	JW
15											AD											AD
16	34	36	31	8		28	34	28	27	35	AD	34	32	34	26	28	32	16	29	14	25	AD
17	✓	✓	✓	✓	16	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
18	27	✓	✓	✓	24	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	26	28	✓	✓	JW
19	✓	36	35	25	✓	36	35	35	38	35	JW	37	35	37	26	37	27	✓	✓	30	30	JW
20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
21											AD							19	27			AD
Total	88	104	97	42	50	97	106	90	98	100	JW	108	100	102	85	96	94	71	100	73	80	JW

Notes: X = mortality.

Previous Brood Avg. young/daphnid: 19

Previous 7-d % mortality: 0

Brood Source: 031214 A

 # Days to 1st Brood: 9

Sample Description: 1500 mg/L TDS made in-house on March 24, 2014

Comments:

Reviewed by: JGh

Date reviewed: May 1/14

21-d Chronic Freshwater Toxicity Test
Daphnia magna Reproduction Data

Client: Golder
Sample ID: TDS
Work Order: 14123

Start Date & Time: March 28 / 14 @ 1200h
Stop Date & Time: April 18 / 14 @ 1230h
Analysts: JW, AWD, YYL

Days	Concentration: 1000 mg/L TDS											Concentration: 1500 mg/L TDS										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1																						
2																						
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW
6											YYL											YYL
7											YYL											YYL
8																						
9																						
10	✓	13	12	11	13	12	11	9	9	11	JW	11	13	13	✓	✓	✓	✓	✓	✓	14	JW
11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	✓	13	✓	✓	✓	JW
12	18	✓	✓	✓	✓	✓	✓	✓	✓	✓	YYL	✓	✓	✓	5	✓	16	✓	✓	✓	25	YYL
13	✓	18	25	25	24	26	24	18	22	20	JW	21	26	28	✓	8	✓	28	✓	5	✓	JW
14	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	20	✓	✓	✓	✓	✓	✓	JW
15																						
16	33	28	35	32	30	25	26	28	35	23		26	31	39	✓	11	32	30	21	7	23	
17	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	32	✓	✓	✓	✓	✓	✓	JW
18	30	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	✓	✓	✓	✓	27	✓	22	✓	✓	JW
19	✓	37	42	16	29	15	22	36	✓	19	JW	30	21 X	26	✓	✓	✓	37	✓	7	26	JW
20	~~✓~~	✓	✓	✓	✓	✓	✓	✓	✓	✓	JW	✓	|	✓	~~✓~~	✓	✓	✓	✓	✓	✓	JW
21	22	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	26	✓	✓	✓	✓	✓	✓	
Total	108	96	114	84	96	78	83	91	66	73	JW	88	91	106	93	19	75	108	43	19	88	JW

Notes: X = mortality.

Previous Brood Avg. young/daphnid: 19

Previous 7-d % mortality: 0

Brood Source: 031214 A

 # Days to 1st Brood: 9

Sample Description: 1500 mg/L TDS made in-house on March 24, 2014

Comments:

Reviewed by: JOh

Date reviewed: May 1/14

Daphnia Magna 21-Day Life Cycle Test — **Nautilus Environmental**

Analysis ID:	08-7858-8833	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	30 Apr-14 10:25	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	19-5330-0029	**Test Type:**	Survival-Reproduction	**Analyst:**	Jeslin Wijaya
Start Date:	28 Mar-14 12:00	**Protocol:**	ASTM E1193-97 (1997)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	18 Apr-14 12:30	**Species:**	Daphnia magna	**Brine:**	
Duration:	21d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-7452-0752	**Code:**	51ED85B0	**Client:**	Golder
Sample Date:	24 Mar-14	**Material:**	Total Dissolved Solids	**Project:**	
Receive Date:	24 Mar-14	**Source:**	Golder		
Sample Age:	4d 12h	**Station:**	TDS		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	853492	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
LC5	1118	259.6	N/A
LC10	1436	1064	N/A
LC15	>1435	N/A	N/A
LC20	>1435	N/A	N/A
LC25	>1435	N/A	N/A
LC40	>1435	N/A	N/A
LC50	>1435	N/A	N/A

Survival Rate Summary

			Calculated Variate(A/B)								
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
210.1	Negative Control	10	1	1	1	0	0	0.0%	0.0%	10	10
288.5		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10
435.9		10	1	1	1	0	0	0.0%	0.0%	10	10
655.8		10	1	1	1	0	0	0.0%	0.0%	10	10
987.2		10	1	1	1	0	0	0.0%	0.0%	10	10
1435.5		10	0.9	0	1	0.1	0.3162	35.14%	10.0%	9	10

Survival Rate Detail

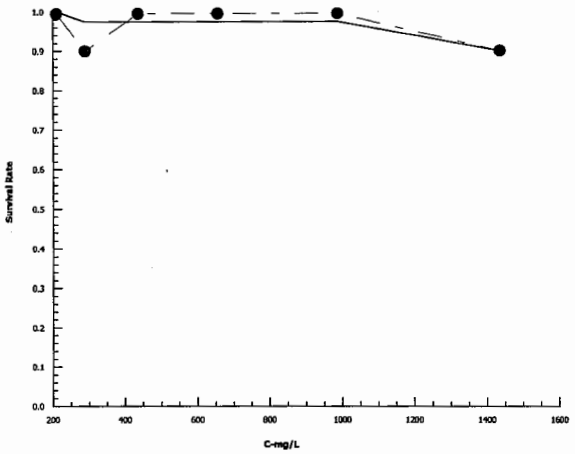
C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
210.1	Negative Control	1	1	1	1	1	1	1	1	1	1
288.5		1	1	1	1	0	1	1	1	1	1
435.9		1	1	1	1	1	1	1	1	1	1
655.8		1	1	1	1	1	1	1	1	1	1
987.2		1	1	1	1	1	1	1	1	1	1
1435.5		1	0	1	1	1	1	1	1	1	1

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
210.1	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
288.5		1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1	1/1
435.9		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
655.8		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
987.2		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1435.5		1/1	0/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Analysis ID:	08-7858-8833	**Endpoint:**	Survival Rate	**CETIS Version:**	CETISv1.8.7
Analyzed:	30 Apr-14 10:25	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Daphnia Magna 21-Day Life Cycle Test — **Nautilus Environmental**

Analysis ID:	03-3877-5780	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	30 Apr-14 10:26	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Batch ID:	19-5330-0029	**Test Type:**	Survival-Reproduction	**Analyst:**	Jeslin Wijaya
Start Date:	28 Mar-14 12:00	**Protocol:**	ASTM E1193-97 (1997)	**Diluent:**	Mod-Hard Synthetic Water
Ending Date:	18 Apr-14 12:30	**Species:**	Daphnia magna	**Brine:**	
Duration:	21d 1h	**Source:**	In-House Culture	**Age:**	<24h
Sample ID:	13-7452-0752	**Code:**	51ED85B0	**Client:**	Golder
Sample Date:	24 Mar-14	**Material:**	Total Dissolved Solids	**Project:**	
Receive Date:	24 Mar-14	**Source:**	Golder		
Sample Age:	4d 12h	**Station:**	TDS		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	983847	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	1100	369.8	N/A
IC10	1226	832.6	N/A
IC15	1366	1051	N/A
IC20	>1435	N/A	N/A
IC25	>1435	N/A	N/A
IC40	>1435	N/A	N/A
IC50	>1435	N/A	N/A

Reproduction Summary

			Calculated Variate						
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
210.1 ✓	Negative Control	10	80.8	51	102	5.249	16.6	20.54%	0.0%
288.5 ✓		10	93.5	28	118	8.089	25.58	27.36%	-15.72%
435.9 ✓		10	87.2	42	106	7.105	22.47	25.77%	-7.92%
655.8 ✓		10	90.9	71	108	4.065	12.85	14.14%	-12.5%
987.2 ✓		10	88.9	66	114	4.778	15.11	17.0%	-10.02%
1435.5 ✓		10	73	19	108	10.66	33.7	46.17%	9.65%

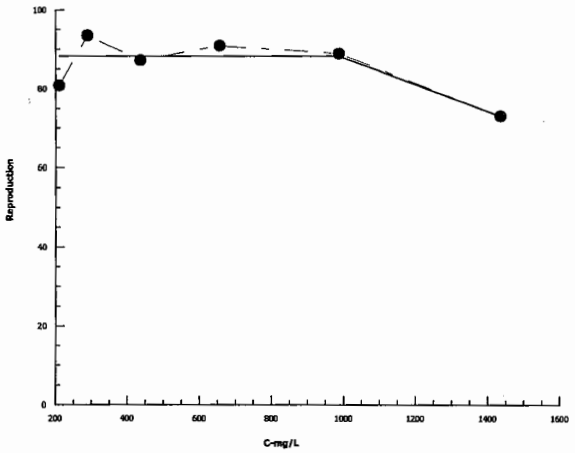
Reproduction Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
210.1 ✓	Negative Control	102	90	91	51	99	89	71	76	79	60
288.5		103	114	118	92	28	102	83	86	103	106
435.9		88	104	97	42	50	97	106	90	98	100
655.8		108	100	102	85	96	94	71	100	73	80
987.2		108	96	114	84	96	78	83	91	66	73
1435.5		88	91	106	93	19	75	108	43	19	88

Daphnia Magna 21-Day Life Cycle Test **Nautilus Environmental**

Analysis ID:	03-3877-5780	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	30 Apr-14 10:26	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Graphics



Client: Golder

W.O.#: 14123

Hardness and Alkalinity Datasheet

	Alkalinity						Hardness			
Sample ID	Sample Date	Sample Volume (mL)	(mL) 0.02N HCL/H_2SO_4 used to pH 4.5	(mL) of 0.02N HCL/H_2SO_4 used to pH 4.2	Total Alkalinity ($mg/LCaCO_3$)		Sample Volume (mL)	Volume of 0.01M EDTA Used (mL)	Total Hardness ($mg/L\ CaCO_3$)	Technician
1500 mg/L TDS	March 24/14	50	3.1	3.2	60		10①	10.8	1080	JW
MHW	March 27/14	50	3.7	3.8	72		50	5.0	100	
	March 29/14	50	3.5	3.6	68		50	5.0	100	
	April 2/14	50	3.6	3.7	70		50	5.0	100	
	April 7/14	50	3.7	3.8	72		50	5.0	100	
	April 10/14	50	3.7	3.8	72		50	5.0	100	
	April 14/14	50	3.6	3.7	70		50	5.0	100	

Notes: ① Diluted to 100mL w/ DI water

Reviewed by: JGL

Date Reviewed: May 1/14

Chemistry measured at test initiation

NAUTILUS ENVIRONMENTAL
ATTN: Jeslin Wijaya
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 28-MAR-14
Report Date: 03-APR-14 13:29 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1437653

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 1
Legal Site Desc:

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1437653-1 Water 28-MAR-14 CONTROL	L1437653-2 Water 28-MAR-14 296 MG/L TDS	L1437653-3 Water 28-MAR-14 444 MG/L TDS	L1437653-4 Water 28-MAR-14 667 MG/L TDS	L1437653-5 Water 28-MAR-14 1000 MG/L TDS
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	199	361	531	790	1000
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	74.0	19.5	29.0	41.3	65.6
	Chloride (Cl) (mg/L)	2.2	142	225	344	507
	Sulfate (SO4) (mg/L)	96.6	25.7	35.3	57.0	88.2
Total Metals	Calcium (Ca)-Total (mg/L)	17.0	62.0	92.3	137	202
	Magnesium (Mg)-Total (mg/L)	14.1	7.56	11.3	17.0	25.0
	Potassium (K)-Total (mg/L)	2.4	2.8	4.1	6.1	9.0
	Sodium (Na)-Total (mg/L)	32.5	33.2	49.2	74.9	110

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1437653-6				
	Description	Water				
	Sampled Date	28-MAR-14				
	Sampled Time					
	Client ID	1500 MG/L TDS				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1740				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	64.9				
	Chloride (Cl) (mg/L)	741				
	Sulfate (SO4) (mg/L)	131				
Total Metals	Calcium (Ca)-Total (mg/L)	285				
	Magnesium (Mg)-Total (mg/L)	37.3				
	Potassium (K)-Total (mg/L)	13.4				
	Sodium (Na)-Total (mg/L)	163				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Chloride (Cl)	MS-B	L1437653-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

CL-COL-VA	Water	Chloride by Colorimetric	APHA 4500 E. CHLORIDE

This analysis is carried out using procedures adapted from APHA Method 4500 E "Chloride". Chloride is determined using the ferricyanide colourimetric method.

MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

SO4-TUR-VA	Water	Sulfate(SO4) by Turbidity	APHA 4500-SO4 E. SULFATE

This analysis is carried out using procedures adapted from APHA Method 4500-SO4 "Sulfate". Sulfate is determined using the turbidimetric method.

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

TESTING LOCATION (Please Circle)

Short Holding Time

Rush Processing

L1437653-COFC

Chain of Custody

ish Columbia
: Commerce Court
aby, British Columbia, Canada V5A 4N3
e 604.420.8773

Date 03/28/14 Page 1 of 1

Sample Collection By: L1437653

Report to:		Invoice To:	
Company	Nautilus Environmental	**Company**	Nautilus Environmental
Address	8664 Commerce Court	**Address**	8664 Commerce Court
City/State/Zip	Burnaby, BC V5A 4N7	**City/State/Zip**	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya	**Contact**	Jeslin Wijaya
Phone	604-420-8773	**Phone**	604-420-8773
Email	jeslin@nautilusenvironmental.com	**Email**	jeslin@nautilusenvironmental.com

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	ANALYSES REQUIRED: Total Calcium	Total Magnesium	Total Sodium	Total Potassium	Total Chloride	Total Sulphate	Alkalinity	TDS			Receipt Temperature (°C)
1	Control	28-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
2	296 mg/L TDS	28-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
3	444 mg/L TDS	28-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
4	667 mg/L TDS	28-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
5	1000 mg/L TDS	28-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
6	1500 mg/L TDS	28-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
7																		
8																		
9																		
10																		

PROJECT INFORMATION		SAMPLE RECEIPT	
Client:		**Total No. of Containers**	
PO No.:		**Received Good Condition?**	
Shipped Via:		**Matches Test Schedule?**	

SPECIAL COMMENTS/INSTRUCTIONS : 21-d *D. magna* chronic test. Day 0. All samples are not preserved.

RELINQUISHED BY (CLIENT)

(Signature) (Time): 1700h
(Printed Name) Jeslin Wijaya (Date): Mar 28/14
(Company) Nautilus Environmental Company Inc.

RELINQUISHED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) YC Mar28 16:55 (Time)
(Printed Name) 18.9°C (Date)
(Company)

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

Chemistry measured at test termination

NAUTILUS ENVIRONMENTAL
ATTN: Jeslin Wijaya
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 23-APR-14
Report Date: 29-APR-14 14:02 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1446494

Project P.O. #: 10204 OAM10
Job Reference:
C of C Numbers: 1
Legal Site Desc:

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1446494-1	L1446494-2	L1446494-3	L1446494-4	L1446494-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	18-APR-14	18-APR-14	18-APR-14	18-APR-14	18-APR-14
	Sampled Time					
	Client ID	CONTROL	296 MG/L TDS	444 MG/L TDS	667 MG/L TDS	1000 MG/L TDS
Grouping	**Analyte**					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	210	381	560	775	1120
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	80.5	19.8	30.8	43.1	66.3
	Chloride (Cl) (mg/L)	2.77	150	228	334	514
	Sulfate (SO4) (mg/L)	96.5	27.3	40.1	59.3	89
Total Metals	Calcium (Ca)-Total (mg/L)	15.9	60.8	89.1	135	203
	Magnesium (Mg)-Total (mg/L)	13.0	6.98	10.3	15.6	23.9
	Potassium (K)-Total (mg/L)	2.9	2.7	3.9	6.0	9.2
	Sodium (Na)-Total (mg/L)	31.6	32.4	47.3	75.0	115

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1446494-6				
	Description	Water				
	Sampled Date	18-APR-14				
	Sampled Time					
	Client ID	1500 MG/L TDS				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1750				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	63.8				
	Chloride (Cl) (mg/L)	772				
	Sulfate (SO4) (mg/L)	138				
Total Metals	Calcium (Ca)-Total (mg/L)	289				
	Magnesium (Mg)-Total (mg/L)	36.2				
	Potassium (K)-Total (mg/L)	13.9				
	Sodium (Na)-Total (mg/L)	174				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC
This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

TESTING LOCATION (Please Circle)

Nautilus Environmental

L1446494-COFC

Short Holding Time

Rush Processing

British Columbia
8664 Commerce Court
Burnaby, British Columbia, Canada V5A 4N3
Phone 604.420.8773
Fax 604.357.1361

Chain of Custody

Date Apr 23/14 Page 1 of 1

Sa

Report to:

Company	Nautilus Environmental
Address	8664 Commerce Court
City/State/Zip	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya
Phone	604-420-8773
Email	jeslin@nautilusenvironmental.com

Invoice To:

Company	Nautilus Environmental
Address	8664 Commerce Court
City/State/Zip	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya
Phone	604-420-8773
Email	jeslin@nautilusenvironmental.com

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	ANALYSES REQUIRED: Total Calcium	Total Magnesium	Total Sodium	Total Potassium	Total Chloride	Total Sulphate	Alkalinity	TDS			Receipt Temperature (°C)
1	Control	18-Apr-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
2	296 mg/L TDS	18-Apr-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
3	444 mg/L TDS	18-Apr-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
4	667 mg/L TDS	18-Apr-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
5	1000 mg/L TDS	18-Apr-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
6	1500 mg/L TDS	18-Apr-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
7																		
8							All samples are preserved											
9																		
10																		

PROJECT INFORMATION	
Client:	**421**
PO No.:	**10204 OAM10**
Shipped Via:	

SAMPLE RECEIPT	
Total No. of Containers	
Received Good Condition?	
Matches Test Schedule?	

SPECIAL COMMENTS/INSTRUCTIONS : 21-d *D. magna* chronic test. Day 21. All samples are not preserved.

RELINQUISHED BY (CLIENT)

(Signature) (Time): 1700h
(Printed Name) (Date): Jeslin Wijaya April 23/14
(Company): Nautilus Environmental.

RELINQUISHED BY (COURIER)

(Signature) (Time):
(Printed Name) (Date):
(Company):

RECEIVED BY (COURIER)

(Signature) (Time):
(Printed Name) (Date):
(Company):

RECEIVED BY (LABORATORY)

(Signature) (Time): 19:15
(Printed Name) (Date): Apr 23
(Company): 12.3°C

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

Day 0 - March 28, 2014

	Control	296	444	667	1000	1500
Alkalinity	74	19.5	29	41.3	65.6	64.9
Cl	2.2	142	225	344	507	741
SO4	96.6	25.7	35.3	57	88.2	131
Ca	17	62	92.3	137	202	285
Mg	14.1	7.56	11.3	17	25	37.3
K	2.4	2.8	4.1	6.1	9	13.4
Na	32.5	33.2	49.2	74.9	110	163
TDS	209.2	284.96	434.6	660.78	980.56	1409.64

Day 21 - April 18, 2014

	Control	296	444	667	1000	1500
Alkalinity	80.5	19.8	30.8	43.1	66.3	63.8
Cl	2.77	150	228	334	514	772
SO4	96.5	27.3	40.1	59.3	89	138
Ca	15.9	60.8	89.1	135	203	289
Mg	13	6.98	10.3	15.6	23.9	36.2
K	2.9	2.7	3.9	6	9.2	13.9
Na	31.6	32.4	47.3	75	115	174
TDS	210.97	292.06	437.18	650.76	993.88	1461.38
Average TDS	210.085 ✓	288.51 ✓	435.89 ✓	655.77 ✓	987.22 ✓	1435.51 ✓

JOL
May 1/14

ATTACHMENT 3

HYDROQUAL LABORATORIES DATA REPORT: Test 5

Nautilus Environmental

Golder Associates Ltd.
ATTN: Peter Chapman
200 – 420 West Hastings Street
Vancouver, BC
V6B 1L1

Report Date: May 31, 2014
Work Order: 14123

Data report

Species: *Daphnia magna*
Protocol: **ASTM E1193 - 97**

Table 1. Results for the 21-d *Daphnia magna* life-cycle toxicity test.

Sample ID	Sample Date	21-d IC20 mg/L TDS (95% CL)
TDS blend	Laboratory prepared	732.5 (381.7 – 1040)

This test was conducted by Hydroqual Ltd., Calgary, AB. The test met performance criteria and there were no deviations from the test methods. The results presented here relate only to the sample tested.

Jeslin Wijaya, B.Sc.
Laboratory Biologist

Reviewed By:
James Elphick, R.P.Bio
Senior Reviewer

HydroQual
Laboratories Ltd.

ATTN: James Elphick
Nautilus Environmental Company Inc.
8664 Commerce Court
Burnaby, BC
Canada V5A 4N7

Received: 2014/03/26, 1100
Report Date: 2014/05/08
Version: FINAL

HydroQual Test Report

Client: NAU104
Reference: 14-0395
Billing: not given

Technical Lead

Client: NAU104
Reference: 14-0395-01

Result Summary

Client: Nautilus Environmental Company Inc.

Sample: 1500 mg/L TDS

Collection: collected on 2014/03/24
Receipt: received on 2014/03/26 at 1100 by C. Quinteros
Containers: received 2 x 20L pails at 11 °C, in good condition with no seals and no initials
Description: type: water, collection method: not given

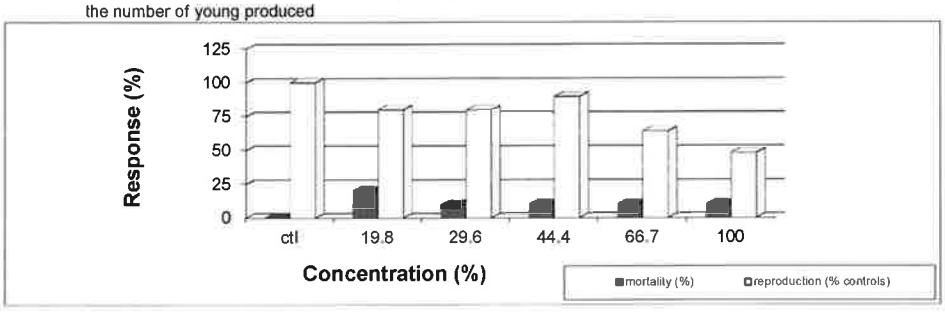
Test: started on 2014/03/28; ended on 2014/04/18

Contents

Result:

	Endpoint (21-day)	Value	Confidence Limits (95%) lower	upper	Units	Method Calculated
Acute:	LC25	>100			%	could not be calculated
(survival)	LC50	>100			%	could not be calculated
Chronic:	IC25	50	35	65	%	2P Linear
(fecundity)	IC50	100	71	>100	%	2P Linear

Notes: LCx & ICx, concentrations lethal or inhibitory to 'x' percent of the test population; fecundity, reproduction as the number of young produced



The test data and results are authorized and verified correct.

Technical Lead

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Test Conditions

Client: NAU104
Reference: 14-0395-01

Method: Standard Guide for Conducting *Daphnia magna* Life-Cycle Toxicity Tests. ASTM International Standard E1193-97 (Reapproved 2012)

Test type: *Daphnia* Survival and Reproduction Static Renewal Test
Species: *Daphnia magna*
Age: <24 hours old
Organism source: in-house cultures
Stock Mortality: 0%
Culture Brood Data: 11 days to first brood
27 neonates per average brood
Organism observations: No unusual behavior, appearance or treatment of test organisms was noted prior to or during the test. All first-generation mortality was recorded on the day it was observed.
Sample initial chemistry: pH: 7.4; EC: 2650 (µS/cm); DO: 8.0 (mg/L); temperature: 11 °C
hardness (mg CaC03/L): 89; colour: colourless; odour: odourless
Sample storage: 4 ± 2°C in darkness

Test vessel: 120 mL plastic vessels
Test volume: 100 mL
Sample pre-treatment: The sample was not filtered or pH adjusted prior to or during testing
The sample was pre-aerated for 0 minutes (rate of 37.5 ± 12.5 mL/min.L-1)
The hardness of the sample was not adjusted (mg CaCO3/L) prior to or during testing
Control water: Moderately hard reconstituted water (1.92 g $NaHCO_3$, 1.20 g $CaSO_4{\cdot}2H_2O$, 1.20 g $MgSO_4$, 0.08 g KCl per 20L) supplemented with vitamin B_{12} (2 µg/L), Na_2SeO_3 (5 µg/L) and 10% (v/v) Perrier water.
Dilution water: Deionized reverse osmosis water
The average hardness of the control water was 112 mg $CaCO_3$/L
Test concentrations: 5 concentrations (19.8, 29.6, 44.4, 66.7, 100% (v/v) plus a negative control)
Test replicates: Ten replicates per treatment, 1 daphnid per replicate
Renewal: 3 times weekly
Feeding: Daily (a combination of yeast, alfalfa powder, fermented trout chow and the green alga *Pseudokirchneriella subcapitata*)
Aeration: None
Measurements: pH, conductivity, dissolved oxygen, temperature, hardness and alkalinity
Mg, Na, K, Ca, SO4, and Cl at test initiation and termination
Lighting: Cool white fluorescent lights; 400-800 lux at surface
Photoperiod: 16h light:8h dark
Test temperature: 20 ± 2°C

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Test Conditions

Endpoints: Survival, 21-d LC50 (with 95% confidence limits)
Reproduction, 21-d IC25 (with 95% confidence limits)
Test endpoints were bracketed by at least 1 test concentration
(except for <19.8% or >100 %)

Test validity: The control had 100% survival (must be ≥70%)
Number of young per adult in the control treatment in 21 days was 183 (must be ≥ 60).

Reference toxicant: 48-h test with NaCl initiated March 24, 2014; current results
(48-h LC50 and 95% confidence limits) = 0.74 (0.71 - 0.77) log (g/L NaCl)

Note: Outlined sections are protocol deviations explained on the comment page

HydroQual Laboratories Ltd., #4, 6125 12th Street SE, Calgary, Alberta, Canada T2H 2K1
Tel (403) 253-7121 fax (403) 252-9363 www.hydroqual.ca

Test Data

Client: NAU104
Reference: 14-0395-01

Test Log:

Date	Day	Time	Technicians
2014/03/28	0	1030	H. Stewart
2014/03/29	1	1115	C. Quinteros/A. Pounden
2014/03/30	2	0940	J. Poole
2014/03/31	3	1015	N. Fernie
2014/04/01	4	1100	C. Bryant
2014/04/02	5	0810	A. Pounden
2014/04/03	6	1145	A. Pounden
2014/04/04	7	0950	C. Quinteros
2014/04/05	8	1100	C. Quinteros
2014/04/06	9	1500	J. Rodriguez
2014/04/07	10	1130	C. Bryant
2014/04/08	11	0930	C. Quinteros
2014/04/09	12	1500	C. Bryant
2014/04/10	13	1600	C. Quinteros
2014/04/11	14	1200	C. Bryant
2014/04/12	15	1610	A. Pounden
2014/04/13	16	1240	N. Fernie
2014/04/14	17	1330	C. Bryant
2014/04/15	18	1140	C. Quinteros
2014/04/16	19	1445	C. Quinteros
2014/04/17	20	1200	N. Fernie
2014/04/18	21	1400	J. Rodriguez

Chemistry Summary Tables:

New Solutions

Conc. %	ctl	19.8	29.6	44.4	66.7	100
Average Values						
pH	7.9	7.7	7.5	7.5	7.7	7.7
cond.	383	595	855	1230	1763	2734
DO	8.1	8.2	8.1	8.1	8.1	8.1
temp.	18.9	18.8	18.7	18.8	18.8	18.8
Coefficients of Variation						
pH	3	2	2	2	2	2
cond.	8	4	1	1	2	2
DO	3	3	2	3	2	3
temp.	3	2	3	2	2	2

Old Solutions

ctl	19.8	29.6	44.4	66.7	100
Average Values					
7.9	7.7	7.6	7.6	7.8	7.9
481	677	934	1334	1974	3242
8.1	8.0	8.0	7.9	7.8	7.8
18.0	18.3	18.6	18.6	18.4	18.7
Coefficients of Variation					
3	5	3	2	2	2
12	5	6	6	9	11
6	4	4	4	4	4
0	3	4	4	3	3

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Test Data

Client: NAU104
Reference: 14-0395-01

Biology (number of young produced):

Biology (#, young produced; 0, no young; "-", dead; bold #, number of young the organism had on the day it died)

0	ctl	19.8	29.6	44.4	66.7	100
replicate	day 1					
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
	day 2					
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
	day 3					
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
	day 4					
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0

ctl	19.8	29.6	44.4	66.7	100
day 5					
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
day 6					
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
day 7					
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
day 8					
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	12	0	0	0
0	0	0	18	0	0
0	0	0	0	0	0
0	11	0	0	0	0
0	0	0	27	0	0
0	0	0	0	0	0
0	0	0	0	0	0

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Test Data

Client: NAU104
Reference: 14-0395-01

Biology (#, young produced; 0, no young; '-', dead; bold #, number of young the organism had on the day it died)

dose (%)	ctl	19.8	29.6	44.4	66.7	100	ctl	19.8	29.6	44.4	66.7	100
replicate	day 9						day 13					
1	0	0	0	12	0	0	0	0	36	0	19	49
2	0	0	10	24	0	0	0	46	0	0	40	0
3	15	0	32	33	13	0	38	55	-	0	0	-
4	0	21	0	41	21	0	0	46	39	0	0	0
5	0	0	18	0	36	0	0	49	0	0	0	20
6	0	0	35	28	38	0	0	54	0	0	0	42
7	0	0	26	36	32	19	0	0	0	0	0	39
8	0	0	18	0	39	15	0	48	0	0	0	13
9	0	0	31	29	24	0	0	42	30	0	0	0
10	0	0	21	14	0	0	0	0	26	29	41	0
	day 10						day 14					
1	0	0	30	0	0	18	59	47	0	0	0	0
2	0	25	0	0	30	20	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	-	0	0	-
4	26	27	35	0	0	5	58	0	0	0	0	0
5	0	21	0	0	0	19	57	0	0	32	0	22
6	0	33	0	0	0	25	44	0	36	0	0	0
7	25	0	0	0	0	3	49	0	0	0	0	0
8	0	21	0	0	0	0	47	0	0	0	0	0
9	25	21	0	0	0	28	50	0	0	0	0	49
10	0	0	0	23	24	0	0	0	0	0	0	0
	day 11						day 15					
1	18	33	0	0	0	0	0	0	0	26	0	0
2	30	0	0	0	0	0	0	0	0	29	0	0
3	0	0	0	0	0	**0**	61	0	-	34	31	-
4	0	0	0	0	0	0	0	0	0	39	33	0
5	23	0	0	41	0	0	0	0	31	0	32	0
6	31	0	2	0	0	0	0	0	0	44	0	0
7	0	0	0	0	0	0	0	45	0	30	22	0
8	24	0	0	0	0	0	0	0	28	38	36	0
9	0	0	0	0	0	0	0	0	0	32	0	0
10	34	0	0	0	0	0	63	0	0	0	0	0
	day 12						day 16					
1	0	0	0	49	0	0	0	0	0	0	22	0
2	0	0	35	41	0	0	0	0	48	**0**	34	0
3	0	0	**37**	33	38	-	54	2	-	0	2	-
4	0	0	0	49	39	0	0	0	4	0	0	0
5	0	0	36	0	41	0	0	60	0	0	0	0
6	0	0	46	46	0	0	0	0	0	0	0	0
7	0	37	30	40	40	0	0	0	32	0	11	0
8	0	0	40	45	39	0	0	0	0	0	0	30
9	0	0	0	43	37	0	0	0	40	0	27	0
10	0	0	0	0	0	0	0	0	37	0	2	0

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Client: NAU104
Reference: 14-0395-01

Test Data

Biology (#, young produced; 0, no young; '-', dead; bold #, number of young the organism had on the day it died)

dose (%)	ctl	19.8	29.6	44.4	66.7	100
replicate	day 17					
1	0	41	27	0	0	31
2	0	36	0	-	0	0
3	0	**5**	-	0	0	-
4	53	0	31	0	0	0
5	54	0	0	44	0	36
6	0	42	48	0	**0**	44
7	53	0	0	0	0	9
8	0	46	0	0	0	0
9	61	45	0	0	0	47
10	0	24	0	40	38	0
	day 18					
1	48	0	0	0	0	0
2	53	0	0	-	0	8
3	0	-	-	46	0	-
4	0	0	0	49	43	0
5	0	0	51	0	0	0
6	45	0	0	31	-	0
7	0	41	0	42	0	0
8	49	0	0	45	0	0
9	0	0	0	0	0	0
10	37	0	0	0	0	0
	day 19					
1	0	0	0	38	0	0
2	0	0	43	-	0	0
3	0	-	-	0	34	-
4	0	32	58	0	0	0
5	0	27	0	0	0	0
6	0	0	0	0	-	0
7	0	0	47	0	37	0
8	0	0	44	0	41	0
9	0	0	55	34	0	0
10	0	0	0	0	0	0
	day 20					
1	0	0	44	0	17	52
2	0	57	0	-	40	0
3	36	-	-	0	0	-
4	0	0	0	0	0	26
5	0	0	0	36	0	0
6	0	54	45	0	-	0
7	0	0	0	0	0	0
8	0	60	0	0	0	23
9	0	58	0	0	30	0
10	0	0	43	0	0	0

ctl	19.8	29.6	44.4	66.7	100
day 21					
0	55	0	39	0	0
71	0	0	-	0	0
68	-	-	36	0	-
91	47	0	27	0	0
72	0	2	0	0	48
65	0	38	41	0	47
102	**0**	0	22	0	29
0	0	0	29	0	0
0	0	0	0	0	63
43	51	0	37	49	0

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HydroQual Laboratories Ltd.

Daphnia magna (21-d LC50/IC25) Test Report

Client: NAU104
Reference: 14-0395-01

Biology Summary Tables:

dose (%)	ctl	19.8	29.6	44.4	66.7	100
replicate						
Day	Number of Organisms Alive					
0	10	10	10	10	10	10
1	10	10	10	10	10	10
2	10	10	10	10	10	10
3	10	10	10	10	10	10
4	10	10	10	10	10	10
5	10	10	10	10	10	10
6	10	10	10	10	10	10
7	10	10	10	10	10	10
8	10	10	10	10	10	10
9	10	10	10	10	10	10
10	10	10	10	10	10	10
11	10	10	10	10	10	9
12	10	10	9	10	10	9
13	10	10	9	10	10	9
14	10	10	9	10	10	9
15	10	10	9	10	10	9
16	10	10	9	9	10	9
17	10	9	9	9	9	9
18	10	9	9	9	9	9
19	10	9	9	9	9	9
20	10	9	9	9	9	9
21	10	8	9	9	9	9

dose (%)	ctl	19.8	29.6	44.4	66.7	100
replicate						
Day	Daily Young Production					
0	0	0	0	0	0	0
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	11	12	45	0	0
9	15	21	191	217	203	34
10	76	148	65	23	54	118
11	160	33	2	41	0	0
12	0	37	224	346	234	0
13	38	340	131	29	100	163
14	364	47	36	32	0	71
15	124	45	59	272	154	0
16	54	62	161	0	98	30
17	221	239	106	84	38	167
18	232	41	51	213	43	8
19	0	59	247	72	112	0
20	36	229	132	36	87	101
21	512	153	40	231	49	187
Total	1832	1465	1457	1641	1172	879

	Percent Mortality (%)					
mean	0	20	10	10	10	10

Replicate	Total Young Produced by Each Adult					
1	125	176	137	164	58	150
2	154	164	136	94	144	28
3	272	62	69	182	118	0
4	228	173	167	205	136	31
5	206	157	138	153	109	145
6	185	183	250	190	38	158
7	229	123	135	170	142	99
8	120	175	130	157	155	81
9	136	166	156	138	118	187
10	177	75	127	143	154	0

	Young Per Adult					
mean	183	147	146	164	117	88
sd	50.567	43.851	45.027	31.11	39.883	70.16
cv(%)	27.602	29.933	30.904	18.958	34.03	79.82

Young Production as a Percent of Controls					
100	80	80	90	64	48

Hardness

Day	ctl	100
0	128	725
21	127	821

Alkalinity

Day	ctl	19.8	29.6	44.4	66.7	100
0	111	44	55	63	78	89
21	129	28	39	48	63	73

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HydroQual Laboratories Ltd.

Daphnia magna (21-d LC50/IC25) Test Report

Chemistry:

Test Data

Client: NAU104
Reference: 14-0395-01

New Solutions

dose %	ctl	19.8	29.6	44.4	66.7	100
Day	**pH (units)**					
0	7.6	7.5	7.3	7.3	7.3	7.4
3	7.9	7.7	7.5	7.5	7.7	7.7
5	7.9	7.6	7.5	7.5	7.7	7.8
7	8.1	7.7	7.6	7.8	7.9	7.8
10	8.3	8.1	7.9	7.8	7.9	7.9
12	7.7	7.6	7.4	7.5	7.7	7.7
14	7.6	7.5	7.4	7.5	7.7	7.8
17	7.8	7.7	7.5	7.5	7.7	7.7
19	7.8	7.5	7.3	7.5	7.7	7.7
21						
	Conductivity (µS/cm)					
0	353	549	850	1218	1739	2640
3	390	610	862	1241	1766	2800
5	390	571	859	1241	1770	2800
7	427	604	854	1231	1766	2770
10	431	603	847	1200	1723	2690
12	361	608	859	1234	1760	2760
14	353	613	854	1227	1739	2750
17	374	597	856	1237	1811	2690
19	366	596	853	1238	1790	2710
21						
	Dissolved Oxygen (mg/L)					
0	8.0	8.0	8.0	8.0	8.0	8.0
3	8.3	8.3	8.3	8.3	8.3	8.4
5	8.1	8.5	8.4	8.6	8.3	8.5
7	8.1	8.1	8.1	8.2	8.1	8.1
10	8.3	8.3	8.3	8.2	8.2	8.1
12	7.7	7.8	7.9	7.9	7.9	8.0
14	7.9	7.8	7.8	7.8	7.7	7.7
17	8.3	8.3	8.1	8.0	8.0	7.9
19	8.3	8.3	8.2	8.1	8.0	8.0
21						
	Temperature (°C)					
0	19	19	19	19	19	19
3	18	18	18	18	18	18
5	20	19	18	18	18	19
7	19	19	19	19	19	19
10	19	19	19	19	19	19
12	19	19	19	19	19	19
14	19	19	19	19	19	19
17	18	18	18	19	19	19
19	19	19	19	19	19	18
21						

Old Solutions

ctl	19.8	29.6	44.4	66.7	100
pH (units)					
8.1	8.0	7.7	7.6	7.7	8.0
8.0	7.4	7.4	7.6	7.9	8.0
8.0	7.7	7.6	7.6	7.9	8.0
8.2	8.2	7.9	7.8	7.9	8.0
8.3	8.2	7.8	7.8	7.8	7.9
8.0	7.9	7.7	7.7	7.8	8.0
7.8	7.6	7.5	7.5	7.6	7.7
7.7	7.1	7.2	7.4	7.6	7.7
7.4	7.3	7.3	7.4	7.7	7.8
Conductivity (µS/cm)					
494	653	872	1232	1826	3200
468	660	888	1280	1867	3110
429	657	894	1259	1862	2990
557	717	1008	1405	2280	4050
580	734	955	1405	1862	3220
458	687	955	1330	1902	3200
408	675	978	1341	1956	2870
435	641	873	1262	1919	3020
503	671	985	1492	2290	3520
Dissolved Oxygen (mg/L)					
8.8	8.5	8.3	8.1	7.9	7.9
8.4	8.3	8.3	8.1	8.2	8.4
8.1	8.1	8.0	7.9	7.7	7.7
8.2	8.2	8.2	8.2	8.1	8.0
8.9	8.4	8.3	8.2	8.1	8.0
7.8	7.7	7.7	7.6	7.6	7.6
7.5	7.7	7.7	7.8	7.8	7.6
8.0	7.8	7.6	7.4	7.4	7.4
7.5	7.6	7.5	7.5	7.4	7.5
Temperature (°C)					
18	18	19	19	19	19
18	18	18	18	18	18
18	19	19	20	19	19
18	18	18	18	18	18
18	18	18	18	18	18
18	18	18	18	18	19
18	18	18	18	18	19
18	19	20	19	19	19
18	19	19	19	19	19

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Comments/Statistics

Client: NAU104
Reference: 14-0395-01

Test Result Comments:
The top concentration tested (100%) is equal to 1500 mg/L TDS

Data Analysis:
Endpoints for mortality could not be calculated. No effect occurred.

Endpoints for reproduction were calculated using a Non-Linear Regression model (2P Linear) with CETIS v. 1.8.7.15

Protocol Deviations:
None

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Quality Assurance Information

Test Method: *Daphnia* Static Acute Test (LC50, 5 treatments plus a control)
HydroQual Test Method: WTR-ME-016
Reference: Biological Test Method: Reference Method for Determining the Acute Lethality of Effluents to *Daphnia magna,* 1990. Environment Canada, EPS 1/RM/14. including May 1996 and December 2000 ammendments.

Test Organism:		**Test Design:**	
test species:	*Daphnia magna*	vol. of test vessel (mL):	500
culture source:	in-house	toxicant:	sodium chloride
original culture source:	Environment Canada	test volume (mL):	150
days to first brood:	11	replicates per treatment:	1
mean brood size:	27	neonates per replicate:	10
ephippia in stock culture:	no	volume per neonate (mL):	15
age of test organisms:	<24 hours old	samples preaerated:	no
culture mortality (%):	7%	hardness adjustment:	no
dissolved oxygen:	40-100% saturation	temperature (°C):	20
light level (water surface):	400-800 lux (cool white)	photoperiod:	16h light:8h dark

control/dilution water: Moderately hard reconstituted water supplemented with vitamin B_{12} (2 µg/L), Na_2SeO_3 (5 µg/L) and 10% (v/v) Perrier water.

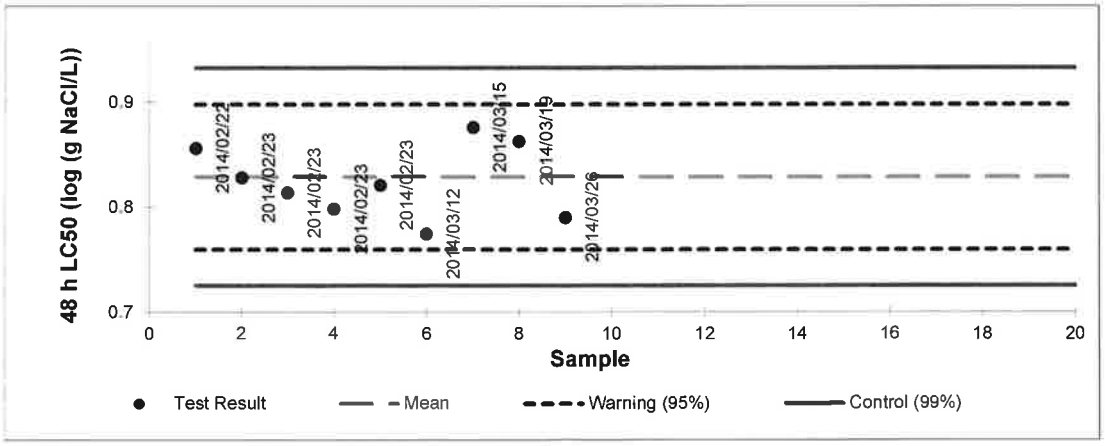
Current Test

toxicant	Sodium chloride (NaCl)				
started on	2014/03/24	ended on	2014/03/26		
Result (LC50 @ 48h)	0.74	log (g NaCl/L); geometric mean			
Confidence Limits (95%)	lower	0.71	upper	0.77	

Historical Values

mean	0.78	sd	0.03	cv(%):	5.2
	lower	upper			
warning limits (±2 sd)	0.71	0.85	(95% confidence limits)		
control limits (±3 sd)	0.68	0.88	(99% confidence limits)		

notes: sd, standard deviation; cv, coefficient of variance
Comments: None



The test data and results are authorized and verified correct.

Technical Lead

CETIS Analytical Report

Daphnia Magna 21-Day Life Cycle Test — **Nautilus Environmental**

Analysis ID:	16-8998-4372	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.8.7
Analyzed:	02 Jun-14 11:07	**Analysis:**	Nonlinear Regression	**Official Results:**	Yes
Batch ID:	15-0506-0997	**Test Type:**	Survival-Reproduction	**Analyst:**	Jeslin Wijaya
Start Date:	28 Mar-14	**Protocol:**	ASTM E1193-97 (1997)	**Diluent:**	
Ending Date:	18 Apr-14	**Species:**	Daphnia magna	**Brine:**	
Duration:	21d 0h	**Source:**		**Age:**	
Sample ID:	00-0015-8774	**Code:**	26C36	**Client:**	Golder
Sample Date:	24 Mar-14	**Material:**	Total Dissolved Solids	**Project:**	
Receive Date:	24 Apr-14	**Source:**	Golder		
Sample Age:	96h	**Station:**	Total Dissolved Solids		

Non-Linear Regression Options

Model Function	X Transform	Y Transform	Weighting Function	PTBS Function
3P Log-Gompertz EV [Y=A*exp(log(0.5)(X/D)^C)]	None	None	Normal [W=1]	Off [Y*=Y]

Regression Summary

Iters	Log LL	AICc	BIC	Adj R2	Optimize	F Stat	Critical	P-Value	Decision(α:5%)
14	-262	530.4	536.3	0.2272	Yes	1.454	2.776	0.2373	Non-Significant Lack of Fit

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	294.7	N/A	618.2
IC10	460.2	104.2	708.2
IC15	601.9	250.1	885.3
IC20	732.5	381.7	1040
IC25	857.3	525.6	1168
IC40	1223	922.2	1541
IC50 JW	~~1478~~	~~1038~~	~~1997~~ > 1460

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
A	172.8	22.8	128.1	217.5	7.576	<0.0001	Significant Parameter
C	1.615	1.117	-0.5749	3.804	1.445	0.1538	Non-Significant Parameter
D	1478	244.7	998.3	1958	6.039	<0.0001	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	46475.28	46475.28	1	19.35	<0.0001	Significant
Lack of Fit	10236.86	3412.285	3	1.454	0.2373	Non-Significant
Pure Error	126694.8	2346.2	54			
Residual	136931.7	2402.31	57			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance	6.22	11.07	0.2854	Equal Variances
	Mod Levene Equality of Variance	1.99	2.386	0.0949	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9797	0.9605	0.4150	Normal Distribution
	Anderson-Darling A2 Normality	0.3837	2.492	0.4001	Normal Distribution

Reproduction Summary

			Calculated Variate						
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
236.9	Negative Control	10	183.2	120	272	15.99	50.57	27.6%	0.0%
309.6		10	146.5	62	183	13.71	43.36	29.6%	20.03%
425.8		10	145.7	69	250	14.5	45.85	31.47%	20.47%
628.8		10	162.3	94	205	10.12	32.02	19.73%	11.41%
954.9		10	117.2	38	155	12.61	39.88	34.03%	36.03%
1460.1		10	87.9	0	187	22.19	70.16	79.82%	52.02%

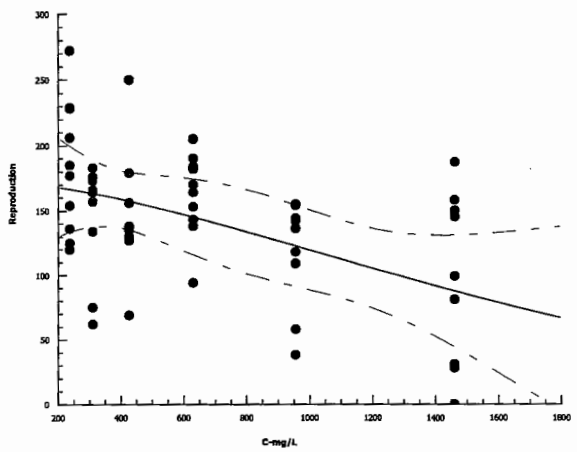
Daphnia Magna 21-Day Life Cycle Test — **Nautilus Environmental**

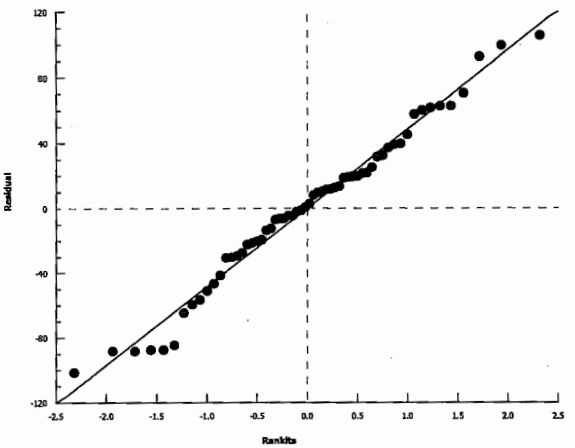
Analysis ID: 16-8998-4372 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 02 Jun-14 11:07 **Analysis:** Nonlinear Regression **Official Results:** Yes

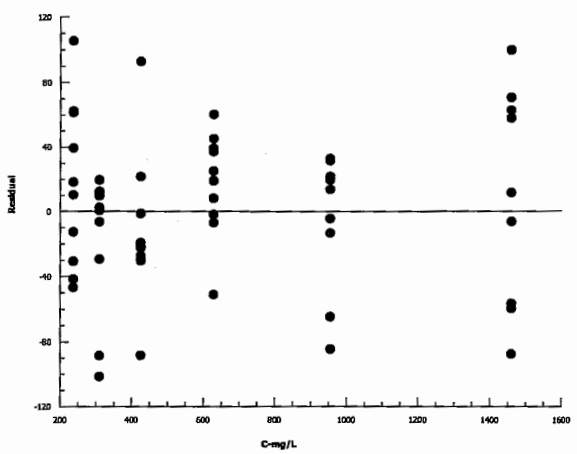
Reproduction Detail

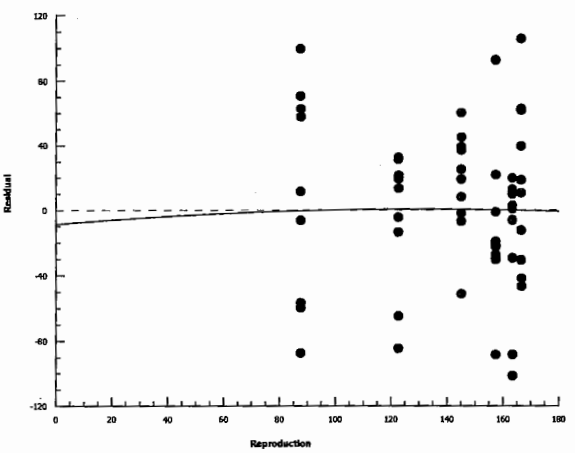
C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
236.9	Negative Control	125	154	272	228	206	185	229	120	136	177
309.6		176	164	62	173	157	183	134	175	166	75
425.8		137	136	69	179	138	250	135	130	156	127
628.8		164	94	182	205	153	190	170	184	138	143
954.9		58	144	118	136	109	38	142	155	118	154
1460.1		150	28	0	31	145	158	99	81	187	0

Graphics 3P Log-Gompertz EV [Y=A*exp(log(0.5)(X/D)^C)]









Maxxam

Your C.O.C. #: A065110

Attention:HOLLY STEWART

HYDROQUAL LABS
#4, 6125 - 12 STREET SE
CALGARY, AB
CANADA T2H 2K1

Report Date: 2014/04/29
Report #: R1559518
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B431882
Received: 2014/04/23, 11:44

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride by Automated Colourimetry	6	N/A	2014/04/29	AB SOP-00020	SM 4500 Cl-G
Elements by ICP - Total	6	2014/04/24	2014/04/24	AB SOP-00042	EPA 200.7
Sulphate by Automated Colourimetry	6	N/A	2014/04/29	AB SOP-00018	SM 4500 SO4-E

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Carmen McKay
29 Apr 2014 15:42:09 -06:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Carmen McKay, Project Manager
Email: CMcKay@maxxam.ca
Phone# (403) 291-3077

==========

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Maxxam

Maxxam Job #: B431882
Report Date: 2014/04/29

HYDROQUAL LABS

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		JL0800	JL0801		JL0802		JL0803		JL0804	JL0805		
Sampling Date												
COC Number		A065110	A065110		A065110		A065110		A065110	A065110		
	Units	CTL	296MG/L	RDL	444MG/L	RDL	667MG/L	RDL	1000MG/L	1500MG/L	RDL	QC Batch
Anions												
Dissolved Sulphate (SO4)	mg/L	93	28	1.0	42 (1)	2.0	59	1.0	89	150	1.0	7467909
Dissolved Chloride (Cl)	mg/L	4.8	160	1.0	210 (1)	2.0	310 (1)	2.0	500 (1)	800 (1)	5.0	7467903

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam

Maxxam Job #: B431882
Report Date: 2014/04/29

HYDROQUAL LABS

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		JL0800	JL0801	JL0802	JL0803	JL0804	JL0805		
Sampling Date									
COC Number		A065110	A065110	A065110	A065110	A065110	A065110		
	Units	CTL	296MG/L	444MG/L	667MG/L	1000MG/L	1500MG/L	RDL	QC Batch
Elements									
Total Calcium (Ca)	mg/L	30	58	84	130	190	290	0.30	7462469
Total Magnesium (Mg)	mg/L	13	7.4	11	16	24	39	0.20	7462469
Total Potassium (K)	mg/L	2.2	2.8	4.1	6.1	9.2	15	0.30	7462469
Total Sodium (Na)	mg/L	28	32	47	71	110	170	0.50	7462469
RDL = Reportable Detection Limit									

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Maxxam

Maxxam Job #: B431882
Report Date: 2014/04/29

HYDROQUAL LABS

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	20.0°C

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam

Maxxam Job #: B431882
Report Date: 2014/04/29

HYDROQUAL LABS

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
7462469	STI	Matrix Spike	Total Calcium (Ca)	2014/04/24		95	%	80 - 120
			Total Magnesium (Mg)	2014/04/24		96	%	80 - 120
			Total Potassium (K)	2014/04/24		96	%	80 - 120
			Total Sodium (Na)	2014/04/24		NC	%	80 - 120
7462469	STI	Spiked Blank	Total Calcium (Ca)	2014/04/24		93	%	80 - 120
			Total Magnesium (Mg)	2014/04/24		97	%	80 - 120
			Total Potassium (K)	2014/04/24		97	%	80 - 120
			Total Sodium (Na)	2014/04/24		94	%	80 - 120
7462469	STI	Method Blank	Total Calcium (Ca)	2014/04/24	<0.30		mg/L	
			Total Magnesium (Mg)	2014/04/24	<0.20		mg/L	
			Total Potassium (K)	2014/04/24	<0.30		mg/L	
			Total Sodium (Na)	2014/04/24	<0.50		mg/L	
7462469	STI	RPD	Total Calcium (Ca)	2014/04/24	0.1		%	20
			Total Magnesium (Mg)	2014/04/24	NC		%	20
			Total Potassium (K)	2014/04/24	NC		%	20
			Total Sodium (Na)	2014/04/24	0.5		%	20
7467903	ZI	Matrix Spike	Dissolved Chloride (Cl)	2014/04/29		106	%	80 - 120
7467903	ZI	Spiked Blank	Dissolved Chloride (Cl)	2014/04/29		102	%	80 - 120
7467903	ZI	Method Blank	Dissolved Chloride (Cl)	2014/04/29	<1.0		mg/L	
7467903	ZI	RPD	Dissolved Chloride (Cl)	2014/04/29	NC		%	20
7467909	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2014/04/29		106	%	80 - 120
7467909	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2014/04/29		106	%	80 - 120
7467909	ZI	Method Blank	Dissolved Sulphate (SO4)	2014/04/29	<1.0		mg/L	
7467909	ZI	RPD	Dissolved Sulphate (SO4)	2014/04/29	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.

NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Maxxam

Maxxam Job #: B431882
Report Date: 2014/04/29

HYDROQUAL LABS

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Peng Liang, Analyst II

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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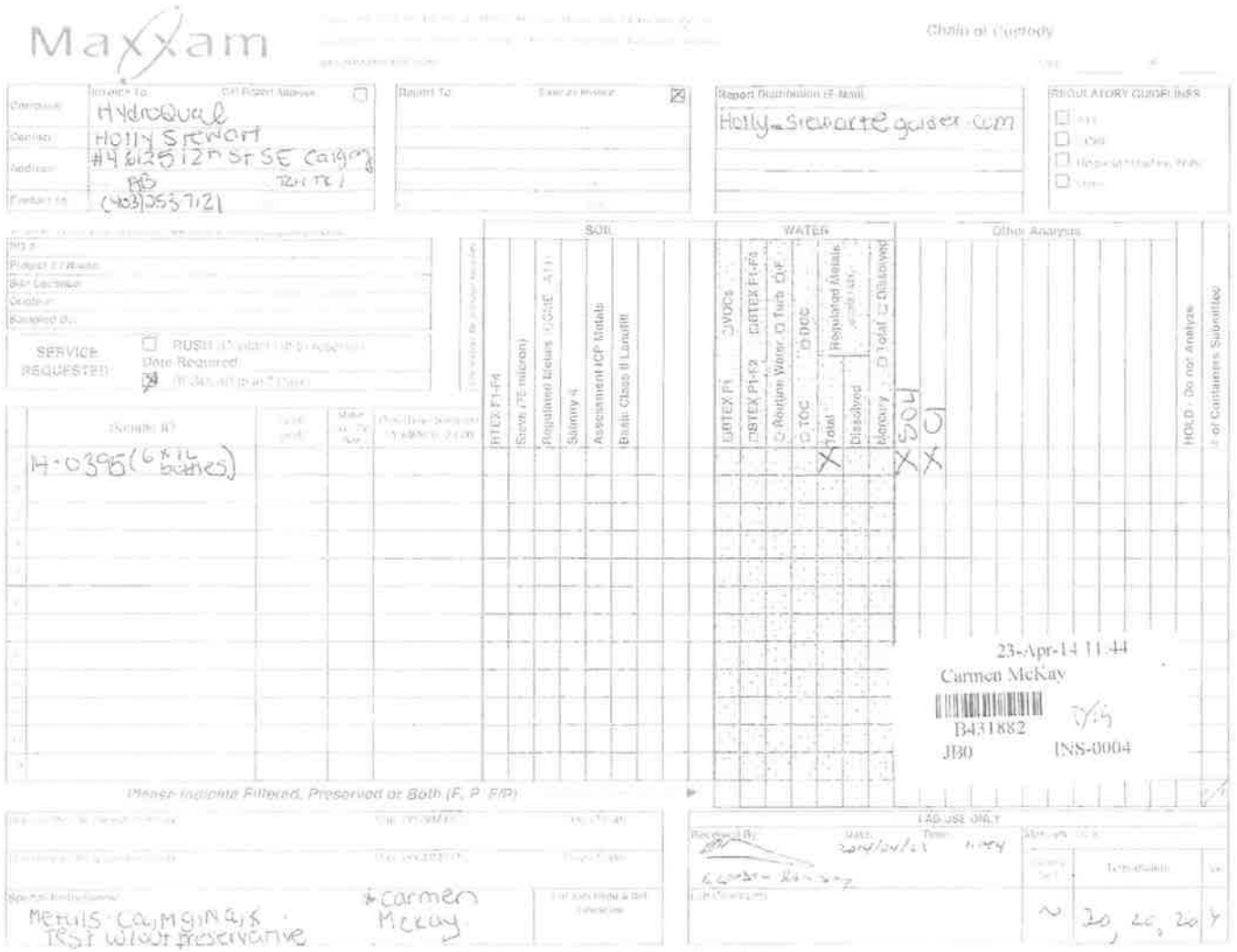
Maxxam

Chain of Custody

Company: Hydroquel
Contact: Holly Stewart
Address: #4 6125 12th St SE Calgary AB T2H 2E1
Telephone: (403) 255 7121

Report To:

Report Distribution (E-Mail): Holly_stewart@golder.com

REGULATORY GUIDELINES

Invoice To: Same as Report Address

PO #:
Project / Reason:
Sub-Facility:
Quote #:
Sampled By:

SERVICE REQUESTED: RUSH
Date Required:

SOIL: PHC F1-F4; Sieve (75 micron); Regulated Metals (CCME ...); Salinity %; Assessment ICP Metals; Basic Class II Landfill

WATER: BTEX F1; BTEX F1-F2; DVOCs; DBTEX F1-F2; Acetone Water; Turb; O/F; TOC; DOC; Regulated Metals (CCME ...); Total; Dissolved; Mercury; Total; Dissolved

Other Analysis: X SO4, X Cl

Sample ID	Date Sampled	Time Sampled	Matrix	# of Containers Submitted	HOLD - Do not Analyze
M-0395 (6 x 1L bottles)					

Please Indicate Filtered, Preserved or Both (F, P, F/P)

Special Instructions: METALS: Ca, Mg, Na, K TEST W/OUT PRESERVATIVE

Sampled By: Carmen Mckay

LAB USE ONLY

Received By: Carmen
Date: 2014/04/23
Time: 1144

Temperature: 20, 20, 20

23-Apr-14 11:44
Carmen McKay
B431882
JB0
INS-0004

Maxxam

Your Project #: 14-0395
Your C.O.C. #: A019281

Attention:HOLLY STEWART

HYDROQUAL LABS
#4, 6125 - 12 STREET SE
CALGARY, AB
CANADA T2H2K1

Report Date: 2014/04/04
Report #: R1546686
Version: 1

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B425216
Received: 2014/03/31, 15:10

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Chloride by Automated Colourimetry	6	N/A	2014/04/04	AB SOP-00020	SM 4500 Cl-G
Elements by ICP - Total	6	2014/04/03	2014/04/03	AB SOP-00042	EPA 200.7
Sulphate by Automated Colourimetry	6	N/A	2014/04/04	AB SOP-00018	SM 4500 SO4-E

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key A.Gordon Anna Gordon
04 Apr 2014 14:40:26 -06:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Anna Gordon, Project Manager
Email: AGordon@maxxam.ca
Phone# (403) 291-3077

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Maxxam

Maxxam Job #: B425216
Report Date:

HYDROQUAL LABS
Client Project #: 14-0395

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		JE9961	JE9962		JE9963		JE9964		JE9965	JE9966		
Sampling Date												
COC Number		A019281	A019281		A019281		A019281		A019281	A019281		
	Units	CTL	296 MG/L	RDL	444 MG/L	RDL	667 MG/L	RDL	1000 MG/L	1500 MG/L	RDL	QC Batch
Anions												
Dissolved Sulphate (SO4)	mg/L	87	29	1.0	41 (1)	2.0	58	1.0	90	140	1.0	7440973
Dissolved Chloride (Cl)	mg/L	3.8	160	1.0	210 (1)	2.0	320 (1)	2.0	490 (1)	740 (1)	5.0	7440967

RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

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Maxxam

Maxxam Job #: B425216
Report Date:

HYDROQUAL LABS
Client Project #: 14-0395

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		JE9961	JE9962	JE9963	JE9964	JE9965	JE9966		
Sampling Date									
COC Number		A019281	A019281	A019281	A019281	A019281	A019281		
	Units	CTL	296 MG/L	444 MG/L	667 MG/L	1000 MG/L	1500 MG/L	RDL	QC Batch
Elements									
Total Calcium (Ca)	mg/L	28	57	85	130	190	280	0.30	7439641
Total Magnesium (Mg)	mg/L	12	7.1	11	16	24	35	0.20	7439641
Total Potassium (K)	mg/L	2.0	2.6	4.0	6.0	9.0	14	0.30	7439641
Total Sodium (Na)	mg/L	26	32	46	69	100	150	0.50	7439641
RDL = Reportable Detection Limit									

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam

Maxxam Job #: B425216
Report Date:

HYDROQUAL LABS
Client Project #: 14-0395

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	13.3°C

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam

Maxxam Job #: B425216
Report Date:

HYDROQUAL LABS
Client Project #: 14-0395

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
7439641	SRT	Matrix Spike	Total Calcium (Ca)	2014/04/03		NC	%	80 - 120
			Total Magnesium (Mg)	2014/04/03		95	%	80 - 120
			Total Potassium (K)	2014/04/03		95	%	80 - 120
			Total Sodium (Na)	2014/04/03		NC	%	80 - 120
7439641	SRT	Spiked Blank	Total Calcium (Ca)	2014/04/03		93	%	80 - 120
			Total Magnesium (Mg)	2014/04/03		93	%	80 - 120
			Total Potassium (K)	2014/04/03		94	%	80 - 120
			Total Sodium (Na)	2014/04/03		90	%	80 - 120
7439641	SRT	Method Blank	Total Calcium (Ca)	2014/04/03	<0.30		mg/L	
			Total Magnesium (Mg)	2014/04/03	<0.20		mg/L	
			Total Potassium (K)	2014/04/03	<0.30		mg/L	
			Total Sodium (Na)	2014/04/03	<0.50		mg/L	
7439641	SRT	RPD	Total Calcium (Ca)	2014/04/03	1.2		%	20
			Total Magnesium (Mg)	2014/04/03	0.2		%	20
			Total Potassium (K)	2014/04/03	0.3		%	20
			Total Sodium (Na)	2014/04/03	0.2		%	20
7440967	ZI	Matrix Spike	Dissolved Chloride (Cl)	2014/04/04		103	%	80 - 120
7440967	ZI	Spiked Blank	Dissolved Chloride (Cl)	2014/04/04		99	%	80 - 120
7440967	ZI	Method Blank	Dissolved Chloride (Cl)	2014/04/04	<1.0		mg/L	
7440967	ZI	RPD	Dissolved Chloride (Cl)	2014/04/04	NC		%	20
7440973	ZI	Matrix Spike	Dissolved Sulphate (SO4)	2014/04/04		107	%	80 - 120
7440973	ZI	Spiked Blank	Dissolved Sulphate (SO4)	2014/04/04		102	%	80 - 120
7440973	ZI	Method Blank	Dissolved Sulphate (SO4)	2014/04/04	<1.0		mg/L	
7440973	ZI	RPD	Dissolved Sulphate (SO4)	2014/04/04	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

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NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Maxxam

Maxxam Job #: B425216
Report Date:

HYDROQUAL LABS
Client Project #: 14-0395

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Peng Liang, Analyst II

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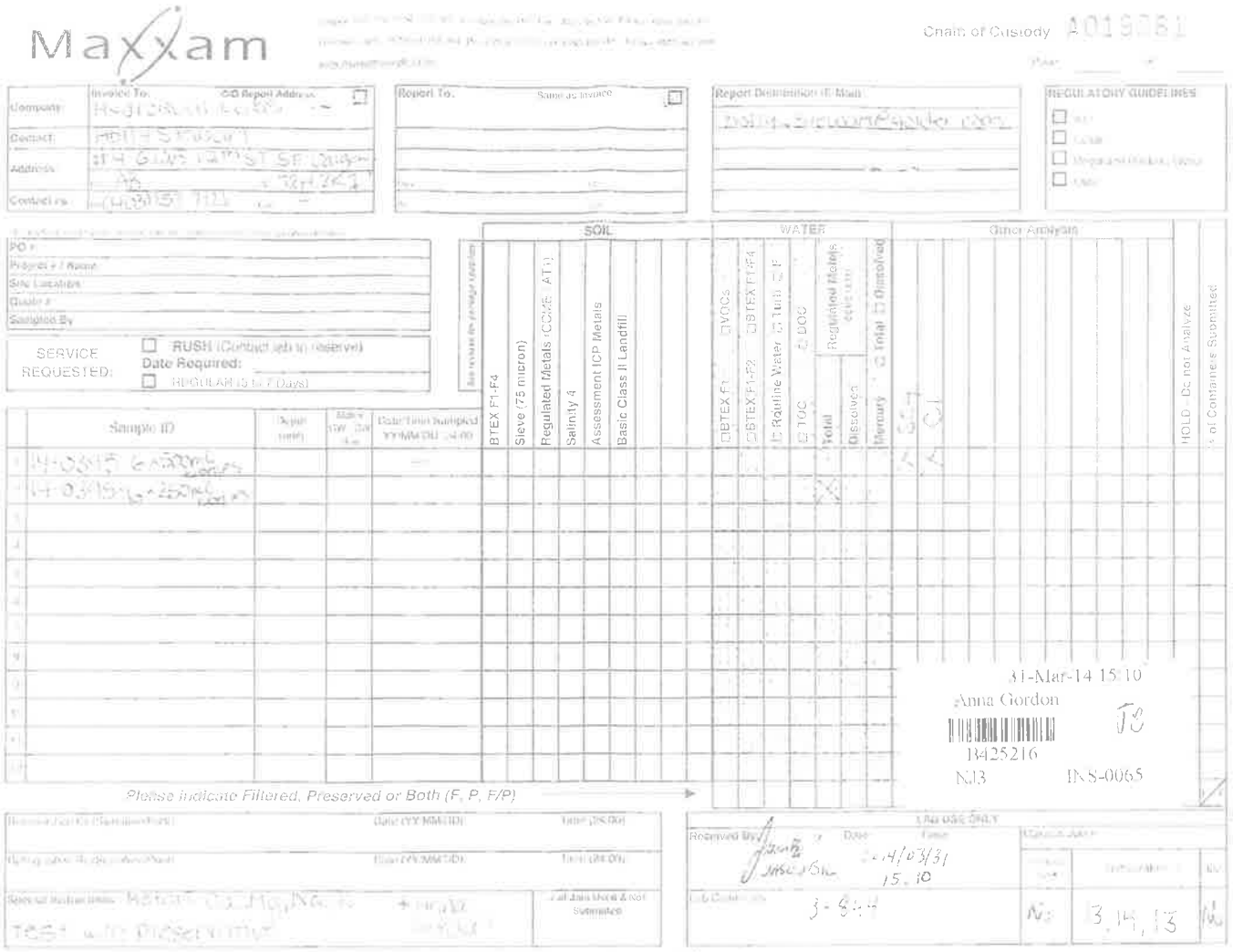
Maxxam
Chain of Custody
Company:
Contact:
Address:
Report To.
Same as Invoice
Report Distribution (E-Mail)
REGULATORY GUIDELINES
PO #
Project # / Name
Site Location
Quote #
Sampled By
SERVICE REQUESTED:
RUSH (Contact lab to reserve)
Date Required:
REGULAR (5 to 7 Days)
SOIL
WATER
Other Analysis
BTEX F1-F4
Sieve (75 micron)
Regulated Metals (CCME ATL)
Salinity 4
Assessment ICP Metals
Basic Class II Landfill
BTEX F1
VOCs
BTEX F1-F2
BTEX F1-F4
Routine Water
TOC
DOC
Regulated Metals
Total
Dissolved
Mercury
Dissolved
Total
HOLD - Do not Analyze
# of Containers Submitted
Sample ID
Date/Time Sampled
31-Mar-14 15:10
Anna Gordon
B425216
NJ3
INS-0065
Please Indicate Filtered, Preserved or Both (F, P, F/P)
LAB USE ONLY
Received By:
Date
Time
15:10
3.14.13

Day 0 - March 28, 2014 HYDROQUAL

Target TDS	**mg/L**	**Control**	**296**	**444**	**667**	**1000**	**1500**
Alkalinity	mg/L	111	44	55	63	78	89
Cl	mg/L	3.8	160	210	320	490	740
SO4	mg/L	87	29	41	58	90	140
Ca	mg/L	28	57	85	130	190	280
Mg	mg/L	12	7.1	11	16	24	35
K	mg/L	2	2.6	4	6	9	14
Na	mg/L	26	32	46	69	100	150
TDS (calculated)	mg/L	225.4	314.1	430	636.8	949.8	1412.4

Day 21 - April 18, 2014 HYDROQUAL

Target TDS	**mg/L**	Control	296	444	667	1000	1500
Alkalinity	mg/L	129	28	39	48	63	73
Cl	mg/L	4.8	160	210	310	500	800
SO4	mg/L	93	28	42	59	89	150
Ca	mg/L	30	58	84	130	190	290
Mg	mg/L	13	7.4	11	16	24	39
K	mg/L	2.2	2.8	4.1	6.1	9.2	15
Na	mg/L	28	32	47	71	110	170
TDS (calculated)	mg/L	248.4	305	421.5	620.9	960	1507.8
Average TDS	mg/L	236.9	309.55	425.75	628.85	954.9	1460.1

TECHNICAL MEMORANDUM

DATE June 10, 2014 **PROJECT No.** 14-1349-0003/1500/1503

TO Erica Bonhomme, Snap Lake Environmental Manager
De Beers Canada Inc.(DBCI)

CC Tasha Hall and Alison Snow (Golder); Alexandra Hood (DBCI)

FROM Peter M. Chapman **EMAIL** pmchapman@golder.com

COPEPOD TDS TOXICITY TEST RESULTS

Please find attached the Nautilus Environmental report on toxicity testing conducted with the copepod species, *Cyclops vernalis*, exposed to synthetic lake water intended to simulate Snap Lake TDS conditions. Note that, although this specific species of copepod is not found in Snap Lake, the genus *Cyclops* is present in Snap Lake.

The copepod test was conducted as a 20-day (d) test, with survival and growth (length) the endpoints measured. The IC20 (i.e., 20% inhibitory effect concentration) for growth effects derived from testing with this copepod species was > 1,508 mg/L. These findings of no effects at the highest tested TDS concentrations mirror those determined previously for algae, diatoms, rotifers, insect larvae, Lake Trout, and Artic Grayling (Golder 2013). As reported separately (Golder 2014), *Daphnia magna* (waterfleas) also showed no effects at the highest tested TDS concentrations in three of five 21-d tests performed to assess effects on survival and reproduction.

The combined findings from all site-specific toxicity testing conducted to date indicate that the fish and the food chain upon which they depend in Snap Lake will not likely be adversely affected by TDS concentrations of up to 1,000 mg/L and possibly higher.

We trust that this technical memorandum and attachment provide you with the information you require at this time. Should you have any questions, or require further information, please contact the undersigned.

GOLDER ASSOCIATES LTD.

Prepared by:

Peter M. Chapman

Peter M Chapman, PhD
Principal, Senior Environmental Scientist

Reviewed by:

Cathy A. McPherson

Cathy A McPherson, BSc
Senior Environmental Scientist

PMC/CAM/me

Att.

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Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

REFERENCES CITED

Golder (Golder Associates Ltd). 2013. Development of Total Dissolved Solids (TDS) Benchmark for Aquatic Life for Snap Lake. Prepared for De Beers Canada Inc, Yellowknife, NWT, Canada.

Golder. 2014. Additional *Daphnia magna* 21-day TDS Toxicity Test Results. Prepared for De Beers Canada Inc, Yellowknife, NWT, Canada. June 10, 2014.

ATTACHMENT 1

NAUTILUS ENVIRONMENTAL DATA REPORT: COPEPOD *Cyclops vernalis*

Nautilus Environmental

Evaluation of the sensitivity of a copepod, *Cyclops vernalis*, to total dissolved solids

Final Report

Report date:
June 9, 2014

Submitted to:

Golder Associates
Burnaby, BC

8664 Commerce Court
Burnaby, BC
V5A 4N7

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1.0 INTRODUCTION

Nautilus Environmental conducted a toxicity test for Golder Associates Ltd. (Golder) to evaluate the effects of a site-specific mixture of Total Dissolved Solids (TDS) on a freshwater copepod, *Cyclops vernalis*. This species has not been widely used in toxicity testing before and standard methods for evaluating sensitivity of freshwater copepods have not been established. Consequently, test method development was necessary to establish appropriate endpoints for this test species. The test method evaluated survival and growth over a 20-day exposure period as primary endpoints from the test. A low rate of reproduction was also observed in the test; however, this endpoint exhibited a relatively high degree of variability unrelated to TDS exposure and was therefore not used for establishing effect levels in the test.

This report describes the results of these toxicity tests. Copies of laboratory data sheets are provided in Appendix A. Results of analytical chemistry are provided in Appendix B.

2.0 METHODS

2.1 Synthetic lake water and test solution preparation

The composition of the synthetic lake water used for the study was based on concentrations of major ions present in Snap Lake. The synthetic lake water was prepared by dissolving reagent-grade sodium, potassium, calcium, and magnesium salts (i.e., NaCl, KCl, $MgCl_2.6H_2O$, $MgSO_4$, $CaCl_2.2H_2O$, and $NaHCO_3$) in reverse osmosis-treated (RO) water. The nominal TDS concentration of the synthetic lake water was 1,500 mg/L, with individual ions present in ratios representative of the current site-specific receiving environment conditions.

Dilutions of the synthetic lake water were then prepared using deionized water and with a 0.67 times dilution factor to achieve a nominal concentration series of 1,500, 1,000, 667, 444, and 296 mg TDS/L. The test solutions were analyzed for ionic composition by ALS Laboratory Group (Burnaby, BC) to verify the concentrations of the major ions, which were then used to calculate TDS concentrations. One batch of the highest concentration of the TDS solutions (i.e., 1,500 mg/L) was prepared prior to the test and was used for preparing dilutions throughout the test.

Actual measured TDS concentrations presented in this report were calculated from measured concentrations of ionic constituents (a spreadsheet showing these TDS calculations and the ALS analytical reports are provided in Appendix B).

2.2 Toxicity tests

Copepods were initially obtained from Boreal Science, St Catharines, ON, on January 28, 2014, and were identified as *Cyclops* sp. The species was subsequently identified as *Cyclops vernalis* by a taxonomist (Fraser Environmental, North Vancouver, BC) from a subsample of organisms collected from the culture and preserved in ethanol.

The culture was maintained at 22±1°C under a 16:8 h light-dark photoperiod. Culture water was prepared by reconstituting deionized water with reagent grade salts to achieve moderately hard water (80 to 100 mg/L as $CaCO_3$); this is the same water type that is used in the laboratory for culturing *Daphnia magna*. The culture was held in 1-L beakers and fed three times per week with a mixture of cells of a green alga, *Pseudokirchneriella subcapitata,* and digested yeast, cerophyll, and trout chow (dYCT). The cuture water was provided with gentle aeration and the water was replaced weekly.

Once the culture was stable and reproduction appeared to be consistently occurring, nauplii of <0.2 mm size were obtained by gently filtering through a Nitex screen.

Survival and growth tests were conducted using *C. vernalis* according to test conditions summarized in Table 1. The test was conducted using four replicates for each test concentration and ten <0.2 mm nauplii in each test container. The test containers were 375 mL glass jars containing approximately 300 mL of test solution. A screen-tube was placed in each jar; screen tubes were comprised of 1.5 inch inside diameter Plexiglass cylinders with a piece of 25 µm Nitex screen sandwiched between pieces of the Plexiglass cylinder (Figure 1). The test organisms were placed in the screen tube, above the Nitex screen. This apparatus was designed to enable water changes to occur without disturbing or losing the test organisms since the test solution could be drawn down by syphoning the water from the glass jar, outside of the screen tube.

The test organisms were observed daily, at which time mortalities were recorded and removed. In cases where an egg sac was observed on a female copepod, the female was removed from the test container using a glass pipette and isolated in test solution in a 20 mL glass test tube so that number of nauplii produced could be assessed; the adults were monitored daily, and nauplii were typically released from the egg sac within two to three days.

The test was terminated after twenty days, at which time the final survival rate was recorded and the adult copepods were preserved in ethanol. Length, from the tip of the rostrum to the end of the pleopods was measured the following day using a dissecting microscope with a calibrated ocular micrometer. Since male copepods of this species are smaller than females, the gender of the individuals was recorded so that growth of male and female copepods could be evaluated separately.

Figure 1. Test apparatus.

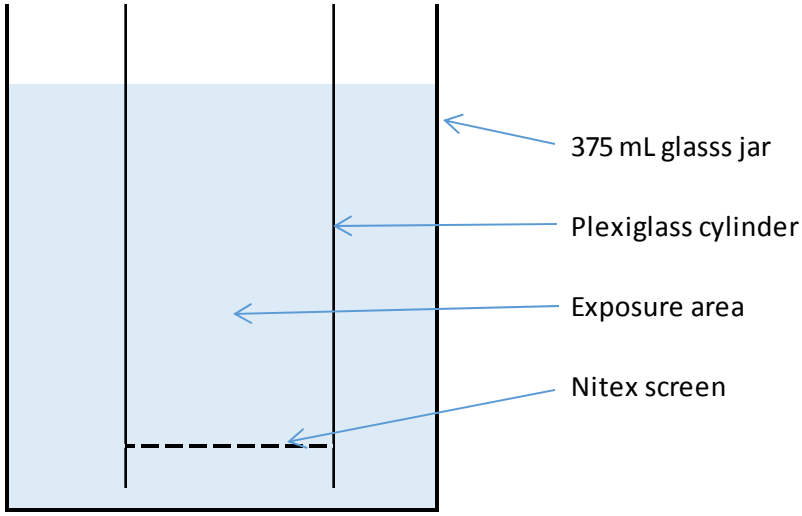


Table 1. Summary of test conditions: *Cyclops vernalis* survival and growth test.

Test type	Static renewal (weekly for the first week and twice weekly thereafter)
Endpoints	Survival and growth
Organism source	In-house culture, originally obtained from Boreal Science, St. Catharines, ON
Organism age	<24 hr old nauplii
Feeding	*Pseudokirchneriella subcapitata* and digested yeast, cerophyll, and trout chow (dYCT)
Test chamber	375 mL glass jar
Test volume	250 mL
Test temperature	22 ± 1°C
Control/Dilution water	Moderately hard reconstituted water
Number of organisms/replicate	10
Number of replicates	4
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test protocol	Developed in house

2.3 QA/QC

Nautilus follows a comprehensive QA/QC program to ensure that all data generated are of high quality and are scientifically defensible. To meet these objectives, Nautilus has implemented quality control procedures:

- Negative controls to ensure that appropriate testing performance criteria are met;
- Use of appropriate species, life stage, and test methods to meet the study objectives;
- Appropriate number of replicates to allow the proper statistical analyses;
- Calibration and proper maintenance of instruments to ensure accurate measurements;
- Proper documentation and recordkeeping to allow traceability of performance;
- Adequate supervision and training of staff to ensure that methods are followed;
- Proper handling and storage of samples to ensure sample integrity;
- Procedures in place to address issues that may arise during testing and ensure the implementation of appropriate corrective actions; and,
- Rigorous review of data by a Registered Professional Biologist to ensure that the data are of good quality and are scientifically defensible prior to release to the client.

3.0 RESULTS AND DISCUSSION

Results of the toxicity test are shown in Table 2 and are discussed below on the basis of measured TDS concentrations. Survival in the test solutions ranged from 60 to 78% in the various concentrations. No mortalities were observed until day 13 of the exposure, with occasional mortalities being observed in all replicates and test concentrations over the following seven days. Cannibalism may have contributed to mortalities that were observed during the last week of the test, since *C. vernalis* adults are increasingly carnivorous. Consequently, the growth endpoint from the test provides the most robust measure of the potential effects on the test organisms.

For both male and female copepods, growth of copepods was generally similar to the control in the lowest (295 mg/L) and highest (1,508 mg/L) test concentrations, with higher growth rates being observed in the 441, 666, and 1,008 mg/L concentrations. Thus, there was no adverse effects relative to the control in any of the test concentrations, with optimal growth rates being achieved between 441 and 1,008 mg/L TDS (Figure 2). The data reported here for length exhibited a high degree of consistency between replicates, with coefficients of variation of approximately 6% for females and 10% for males.

A low rate of reproduction was observed in the test, indicating that the copepods had reached maturity. However, only six female copepods produced nauplii during the test: three in control replicates; and, one in each of the 293, 441, and 1,008 mg/L TDS solutions; brood sizes for these six females ranged from 8 to 16 nauplii. In addition, three females in a control replicate, and one in the each of the 441, 666, and 1,508 mg/L TDS concentrations were holding eggs at the end of the test. The rate of reproduction was too low to evaluate any differences between concentrations.

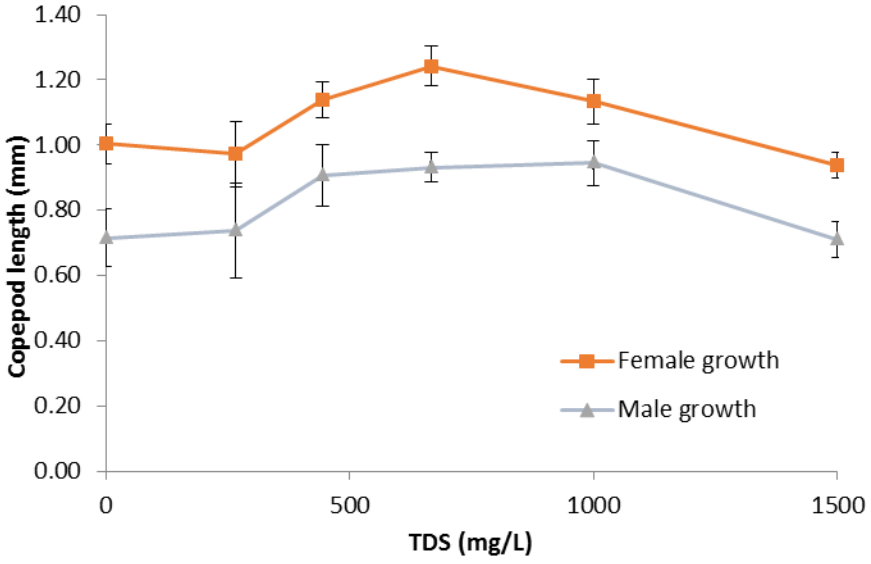
Collectively, the data from this test indicate no evidence of adverse effects on *C. vernalis* growth relative to the control in concentrations of up to 1,508 mg/L TDS (the IC20). Optimal growth rates occurred at concentrations between 441 and 1,008 mg/L TDS.

Table 2. Test results for the *Cyclops vernalis* test with TDS.

Concentration (mg/L TDS)		Survival (%)	Female length (mm)	Male length (mm)
Nominal	**Measured**	**(mean ± SD)**	**(mean ± SD)**	**(mean ± SD)**
Control		78 ± 5	1.00 ± 0.06	0.72 ± 0.09
296	295	63 ± 17	0.97 ± 0.10	0.74 ± 0.15
444	441	73 ± 10	1.14 ± 0.06	0.91 ± 0.09
667	666	70 ± 10	1.24 ± 0.06	0.93 ± 0.05
1000	1008	60 ± 8	1.13 ± 0.07	0.94 ± 0.07
1500	1508	60 ± 8	0.94 ± 0.04	0.71 ± 0.06
Test endpoint				
LC50		>1508	--	--
IC20		--	>1508	>1508
IC50		--	>1508	>1508

IC = Inhibition Concentration.
LC = Lethal Concentration.
SD = Standard Deviation.

Figure 2. Length (mean ± SD) of male and female *Cyclops vernalis* after 20 day exposure to TDS.



3.1 QA/QC

This test organism has not been widely used in toxicity testing programs and, consequently, a standard test methodology and database of reference toxicant test results was not available for use in this test. Regardless, the data presented here produced a high degree of consistency between replicates for growth. Survival in the test concentrations ranged from 60 to 78% even though they may have been adversely affected by cannibalism towards the end of the test. Regardless, the test produced data that can be used to assess the potential for effects associated with Snap Lake TDS.

APPENDIX A – *Cyclops vernalis* Toxicity Test Data

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Calder
Sample ID: TDS
Work Order #: /

Start Date & Time: march 21/14 @ 1630h
Stop Date & Time: April 4/14 @ 1400h
Test Species: ~~Ceriodaphnia dubia~~ Cyclops vernalis
~~Emm~~

Concentration: control	Days 0	1 old	new	2 old	new	3 old	new	4 old	new	5 old	new	6 old	new	7 final
Temperature (°C)	20.5		22.0		22.0		22.0	22.0		22.0		22.0		
DO (mg/L)	8.6													
pH	7.5													
Cond. (µS/cm)	361													
Initials	Emm					Emm		Emm		Emm		Emm		

Concentration: 296mg/L TDS	Days 0	1 old	new	2 old	new	3 old	new	4 old	new	5 old	new	6 old	new	7 final
Temperature (°C)	20.5		22.0		22.0		22.0	22.0		22.0		22.0		
DO (mg/L)	8.7													
pH	7.3													
Cond. (µS/cm)	601													
Initials	Emm					Emm		Emm		Emm		Emm		

Concentration: 444mg/L TDS	Days 0	1 old	new	2 old	new	3 old	new	4 old	new	5 old	new	6 old	new	7 final
Temperature (°C)	20.5		22.0		22.0		22.0	22.0		22.0		22.0		
DO (mg/L)	8.7													
pH	7.3													
Cond. (µS/cm)	873													
Initials	Emm					Emm		Emm		Emm		Emm		

Concentration: 667mg/L TDS	Days 0	1 old	new	2 old	new	3 old	new	4 old	new	5 old	new	6 old	new	7 final
Temperature (°C)	20.5		22.0		22.0		22.0	22.0		22.0		22.0		
DO (mg/L)	8.6													
pH	7.3													
Cond. (µS/cm)	1289													
Initials	Emm					Emm		Emm		Emm		Emm		

	MHW Control			
Hardness*	100			
Alkalinity*	70			

* mg/L as CaCO3

Analysts: AWb, Emm
Reviewed by: JRE
Date reviewed:

WQ Ranges: T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 (mg/L) ; pH = 6 to 8.5

Sample Description: 1500mg/L TDS made in-house March 12/14

Comments: **Broodboard Used:**

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: /

Start Date & Time: March 21/14 @ 1630h
Stop Date & Time: April 1/14 @ 1400h
Test Species: ~~*Ceriodaphnia dubia*~~ Cyclops vernalis
emm

Concentration	Days 0	1		2		3		4		5		6		7
10000mg/L TDS	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.5	22.0	~~22.7~~	22.0		22.0		22.0		22.0		22.0		
DO (mg/L)	8.6													
pH	7.3													
Cond. (µS/cm)	1882													
Initials	Emm	"		"		Emm		Emm		Emm		Emm		

emm

Concentration	Days 0	1		2		3		4		5		6		7
1500mg/L TDS	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)	20.5	22.0		22.0		22.0		22.0		22.0		22.0		
DO (mg/L)	8.6													
pH	7.3													
Cond. (µS/cm)	2740													
Initials	Emm	"		"		Emm		Emm		Emm		Emm		

emm

Concentration	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

	Control			
Hardness*	160			
Alkalinity*	70			

* mg/L as CaCO3

Analysts: AW, Emm
Reviewed by: JRE
Date reviewed:

WQ Ranges: T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 (mg/L) ; pH = 6 to 8.5
Sample Description:

Comments: **Broodboard Used:**

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: /

Start Date & Time: March 21/14 @ 1630h
Stop Date & Time: April 6/14 @ 1400h
Test Species: ~~*Ceriodaphnia dubia*~~ cyclops vernalis (Emm)

Concentration: control

	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)		22.0	20.5	22.5		22.5		22.0		22.5	22.0	22.5		22.0
DO (mg/L)		6.9	8.6							6.1	8.5			
pH		7.2	7.4							7.4	7.9			
Cond. (µS/cm)		353								355				
Initials		Emm						Emm		Emm		Emm		Emm

old d em

Concentration: 296

	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)		22.0	21.0	22.5		22.5		22.0		22.5	22.0	22.5		22.0
DO (mg/L)		7.0	8.0							6.4	8.4			
pH		6.8	7.2							7.2	7.4			
Cond. (µS/cm)		610								604				
Initials		Emm						Emm		Emm		Emm		Emm

old d em

Concentration: 444

	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)		21.5	21.0	22.5		22.5		22.0		22.5	22.0	22.5		22.0
DO (mg/L)		6.8	8.4							6.4	8.6			
pH		6.8	6.8							7.2	7.4			
Cond. (µS/cm)		886								889				
Initials		Emm						Emm		Emm		Emm		Emm

old em

Concentration: 667

	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)		21.5	21.5	22.5		22.5		22.0		22.5	22.0	22.5		22.0
DO (mg/L)		6.7	8.6							6.2	8.5			
pH		6.9	6.8							7.3	7.4			
Cond. (µS/cm)		1297								1280				
Initials		Emm						Emm		Emm		Emm		Emm

old em

	Control			
Hardness*	100			
Alkalinity*	70			

* mg/L as CaCO3

Analysts: ~~AWD~~/Emm
Reviewed by: JRE
Date reviewed:

WQ Ranges: T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 (mg/L) ; pH = 6 to 8.5
Sample Description:

Comments: **Broodboard Used:**

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Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: /

Start Date & Time: March 21/14 @ 1630h
Stop Date & Time: April 10/14 @ 1400h
Test Species: ~~*Ceriodaphnia dubia*~~ Cyclops vernalis
emm

Concentration 1000	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)		21.5	21.0	22.5		22.5		22.0		22.5	22.0	22.5		22.0
DO (mg/L)		6.7	8.6							6.1	8.5			
pH		6.9	7.3							7.3	7.4			
Cond. (µS/cm)		1890								1879				
Initials		Emm						Emm		Emm		Emm		Emm

6 ov 7 ov 8 ov 9 10 11 12 Days

old
em

Concentration 1500	0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)		21.5	21.0	22.5		22.5		22.0		22.5	22.0	22.5		22.0
DO (mg/L)		7.0	8.5							6.0	8.5			
pH		6.9	7.2							7.4	7.3			
Cond. (µS/cm)		2760								2770				
Initials		Emm						Emm		Emm		Emm		Emm

6 ov 7 ov 8 ov 9 10 11 12 Days

old
em

Concentration	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days 0	1		2		3		4		5		6		7
	init.	old	new	old	new	old	new	old	new	old	new	old	new	final
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

	Control			
Hardness*	100			
Alkalinity*	70			

* mg/L as CaCO3

Analysts: AWD, Emm
Reviewed by: JRE
Date reviewed:

WQ Ranges: T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 (mg/L) ; pH = 6 to 8.5
Sample Description:

Comments: **Broodboard Used:**

page 3a

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #:

Start Date & Time: March 21/14 @ 1630
Stop Date & Time: April 10/14 @ 1400
Test Species: ~~Ceriodaphnia dubia~~ Cyclops vernalis

Concentration: control	Days	13	14	14/15	15/16	17	18	19	20
		0 old	1	2	3	4	5	6	7
		init.	old / new	old / new	old / new	old / new	old / new	old / new	final
Temperature (°C)		22.5	22.0 / 21.0	22.5 /	22.5 /	22.5 /	22.5 / 20.5	22.0 /	22.5
DO (mg/L)		/	6.6 / 7.8	/	/	/	6.2 / 8.5	/	6.1
pH		/	7.7 / 7.8	/	/	/	7.2 / 7.8	/	7.5
Cond. (µS/cm)		/	355 /	/	/	/	356 /	/	368
Initials		Emm	Emm	A	A	Emm	Emm	Emm	Emm

Concentration: 296 mg/L TDS	Days	13	14	15	16	17	18	19	20
		0 old	1	2	3	4	5	6	7
		init.	old / new	old / new	old / new	old / new	old / new	old / new	final
Temperature (°C)		22.5	22.0 / 22.0	22.5 /	22.5 /	22.5 /	22.5 / 21.0	22.0 /	22.5
DO (mg/L)		/	6.5 / 7.8	/	/	/	6.4 / 8.4	/	6.2
pH		/	7.1 / 7.2	/	/	/	7.2 / 7.6	/	7.4
Cond. (µS/cm)		/	620 /	/	/	/	614 /	/	629
Initials		Emm	Emm	A	A	Emm	Emm	Emm	Emm

Concentration: 444 mg/L TDS	Days	13	14	15	16	17	18	19	20
		0 old	1	2	3	4	5	6	7
		init.	old / new	old / new	old / new	old / new	old / new	old / new	final
Temperature (°C)		22.0	22.5 / 22.0	22.5 /	22.5 /	22.5 /	22.5 / 21.0	22.0 /	22.5
DO (mg/L)		/	6.4 / 7.7	/	/	/	6.2 / 8.4	/	6.3
pH		/	7.3 / 7.2	/	/	/	7.3 / 7.5	/	7.3
Cond. (µS/cm)		/	890 /	/	/	/	889 /	/	905
Initials		Emm	Emm	A	A	Emm	Emm	Emm	Emm

Concentration: 667 mg/L TDS	Days	13	14	15	16	17	18	19	20
		0 old	1	2	3	4	5	6	7
		init.	old / new	old / new	old / new	old / new	old / new	old / new	final
Temperature (°C)		22.5	22.5 / 22.0	22.5 /	22.5 /	22.5 /	22.5 / 21.0	22.0 /	22.5
DO (mg/L)		/	6.5 / 7.8	/	/	/	6.3 / 8.4	/	6.2
pH		/	7.2 / 7.3	/	/	/	7.3 / 7.6	/	7.4
Cond. (µS/cm)		/	1324 /	/	/	/	1309 /	/	1341
Initials		Emm	Emm	A	A	Emm	Emm	Emm	Emm

	Control			
Hardness*	100			
Alkalinity*	70			

Analysts: AWD, Emm
Reviewed by: JRE
Date reviewed:

* mg/L as CaCO3

WQ Ranges: T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 (mg/L) ; pH = 6 to 8.5

Sample Description:

Comments: **Broodboard Used:**

Chronic Freshwater Toxicity Test
Initial and Final Water Quality Measurements

Client: Golder
Sample ID: TDS
Work Order #: /

Start Date & Time: March 21/14 @ 1630h
Stop Date & Time: April 10/14 @ 1400h
Test Species: ~~Ceriodaphnia dubia~~ Cyclops vernalis

mg/L TDS Concentration: 1000

	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	22.5	22.5	22.0	22.5		22.5		22.5		22.5	21.0	22.0		22.5
DO (mg/L)		6.7	7.9							6.1	8.4			6.1
pH		7.0	7.3							7.2	7.8			7.3
Cond. (µS/cm)		1953								1915				1915
Initials	EMM	EMM		AD		AD		EMM		EMM		EMM		EMM

mg/L TDS Concentration: 1500

	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	22.5	22.5	22.0	22.5		22.5		22.5		22.5	21.0	22.0		22.5
DO (mg/L)		6.4	7.9							6.1	8.3			6.0
pH		7.2	7.4							7.2	7.7			7.7
Cond. (µS/cm)		2850								2790				2890
Initials	EMM	EMM		AD		AD		EMM		EMM		EMM		EMM

Concentration: 0

	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	22.5													
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials	EMM													

Concentration: 0

	Day 0 init.	Day 1 old	Day 1 new	Day 2 old	Day 2 new	Day 3 old	Day 3 new	Day 4 old	Day 4 new	Day 5 old	Day 5 new	Day 6 old	Day 6 new	Day 7 final
Temperature (°C)	22.5													
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

	Control			
Hardness*	100			
Alkalinity*	70			

Analysts: AWb, EMM
Reviewed by: JRE
Date reviewed:

* mg/L as CaCO3

WQ Ranges: T (°C) = 25 ± 1; DO (mg/L) = 3.3 to 8.4 (mg/L) ; pH = 6 to 8.5

Sample Description:

Comments: **Broodboard Used:**

emm Cyclops vernalis

~~Embryo-Alevin-Fry~~ Toxicity Test
Daily Mortality

Client: Calder
Sample ID: TDS
Work Order #: n/a

Start Date & Time: March 21/14 @ 16300
Stop Date: April 10/14 @ 1400
Test Species: Cyclops vernalis

No alive emm

(mg/L TDS) concentration	Rep	Day of Test - ~~No. of Mortalities~~ 1	2	3	4	5	6	7	Total Dead Fish	Total Undeveloped	Total No. Fry	Total Exposed
control	A	10	10	10	10	10	10	10				
	B											
	C											
	D											
296	A											
	B											
	C											
	D											
444	A											
	B											
	C											
	D											
667	A											
	B	9										
	C											
	D											
1000	A											
	B											
	C											
	D											
1500	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
Tech Initials		A	A	EMM	EMM	EMM	EMM	EMM				

Comments: (1) 50% of soln lost thru side hole

Reviewed by: JRE **Date reviewed:** 8 June 2014

Cyclops vernalis

~~Embryo-Alevin-Fry~~ Toxicity Test
emm
Daily Mortality

Client: Golder
Sample ID: TDS
Work Order #: n/a

Start Date & Time: March 21/14 @ 1630
Stop Date: April 10/14 @ 1406
Test Species: Cyclops vernalis

(mg/L) TDS	Rep	Day of Test - No. of Mortalities 8	9	10	11	12	13	14	Total Dead Fish	Total Undeveloped	Total No. Fry	Total Exposed ③ A B C D
control	A	0	0	0	0	0	0	0				Day 13 rep B 15 / Day 13 rep D 11
	B					②	0 ③	0				
	C						0	0				
	D					②	1 ③	0				
296	A						0	1				Day 14 rep B 8
	B						0	② ②				
	C						0	1				
	D					emm	0	0				Day 13 rep A 10
444	A				②	②	0 ③	0				
	B						0	1				
	C						0	1				
	D						0	2				
667	A	0	0	0	0	0	0	0				
	B											
	C	0	0	0	0	emm 02	0	0				
	D						0	1				
1000	A	①	①				0	0				
	B						0	2				
	C	①	①				1	0				Day 13 rep D
	D				②		③ 0	03 emm				1 11
1500	A						1	0				
	B						2	2				
	C						0	1				
	D						0	3				
	A											
	B											
	C											
	D											
	A											
	B											
	C											
	D											
Tech Initials		A	~	EMM	EMM	EMM	EMM	EMM				

Comments: ① rep loss 50% of water. ② 1 female w/ eggs.
③ young released & counted

Reviewed by: JRE **Date reviewed:** 8 June 2014

Cyclops vernalis

~~Embryo-Alevin-Fry~~ Toxicity Test
Daily Mortality

Client: Golder
Sample ID: TDS
Work Order #: N/a
Start Date & Time: March 21/14 @ 1630
Stop Date: April 10/14 @ 1400
Test Species: Cyclops vernalis

(mg/L) TDS	Rep	Day of Test - No. of Mortalities 15	16	17	18	19	20	Total Dead Fish	Total Undeveloped	Total No. ~~Fry~~ live adults	Total Exposed
Control	A	0	0	0 2 emm	0	0 emm	0			8	
	B			0	2	1	0			7	
	C			1 emm	0	1 emm	0			8	day 19 rep D
	D			0	0	0	1			8	16
296	A			0	2	0	0			7	
	B			1	1	0	0			8	
	C			0	5 emm	0	0			4	
	D			0 3 emm	0	0	0			7	
444	A			0	0	2	0			8	
	B			0	2	0	0			7	
	C			0	1	0	0			8	
	D			0	1	0	1			6	
667	A			0	0	2	0			8	
	B									0 6 emm	
	C	0	0	2	0	0	0			6	
	D			0	0	1	1			7	
1000	A			1	0	0	2			7	
	B			2	0	0	0			6	
	C			0	3	0	1			5	
	D			0	0	0	1			6	
1500	A			1	0	1	1			6	
	B			0	1	0	0			5	
	C			1	1	0	0			9 7	
	D			0	1	0	0			7 6	
	A										
	B										
	C										
	D										
	A										
	B										
	C										
	D										
Tech Initials		AWD	AWD	FMM	FMM	FMM	FMM				

Comments:
(1) female w/ eggs
(2) female released young, counted
(3) No young observed on 7

Reviewed by: JRE
Date reviewed: 8 June 2014

Concentration (mg/L TDS)	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
Control - 0	A1	1.02	f		B1	1.03	f	15 yng
	A2	1.06	f	39 eggs	B2	0.98	f	
	A4	0.84	f		B3	0.74	f	
	A6	1	f		B5	1	f	
	A8	0.92	f		B6	1.15	f	4 eggs
	A3	0.8	m		B4	0.58	m	
	A5	0.62	m		B7	0.83	m	
	A7	0.63	m		B8	dead		
	A9	dead			B9	dead		
	A10	dead			B10	dead		
	AVG	0.86125				0.901428571		
	Fem	0.968			Fem	0.98		
	Mal	0.683333333			Mal	0.705		
	Ratio	63%			Ratio	71%		
	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	C1	1.01	f		D1	1.25	f	16 yng
	C2	1.02	f		D2	1.31	f	11 yng
	C3	0.82	f		D3	0.8	f	
	C4	1	f	19 eggs	D7	1.12	f	
	C6	0.95	f		D8	1	f	
	C7	1.05	f		D4	0.9	m	
	C5	0.74	m		D5	0.72	m	
	C8	0.53	m		D6	0.9	m	
	C9	dead			D9	dead		
	C10	dead			D10	dead		
	AVG	0.89				1.00		
	Fem	0.975			Fem	1.096		
	Mal	0.635			Mal	0.84		
	Ratio	75%			Ratio	63%		
296	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	A1	1.02	f		B1	0.8	f	
	A3	1.05	f		B2	1	f	
	A4	1.1	f		B3	1.05	f	
	A5	1.05	f		B4	1.02	f	
	A7	1.02	f		B5	1.2	f	
	A2	0.82	m		B6	1.05	f	8 young
	A6	0.82	m		B7	0.78	m	
	A8	dead			B8	0.85	m	
	A9	dead			B9	dead		
	A10	dead			B10	dead		
	AVG	0.982857143				0.96875		
	Fem	1.048			Fem	1.02		
	Mal	0.82			Mal	0.815		
	Ratio	71%			Ratio	75%		
	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	C1	0.7	f		D1	1	f	
	C3	0.8	f		D3	1.05	f	
	C4	0.98	f		D4	0.92	f	
	C2	0.52	m		D5	1.05	f	
	C5	dead			D6	1.08	f	
	C6	dead			D7	0.88	f	
	C7	dead			D2	0.8	m	
	C8	dead			D8	dead		
	C9	dead			D9	dead		
	C10	dead			D10	dead		
	AVG	0.75				0.968571429		
	Fem	0.826666667			Fem	0.996666667		
	Mal	0.52			Mal	0.8		
	Ratio	75%			Ratio	86%		

Control	Mean	SD
Survival	77.5%	5.0%
Growth	0.913	0.060
Female growth	1.005	0.061
Male growth	0.716	0.088
Ratio	67.9%	6.4%

296 mg/L TDS		
Survival	62.5%	17.1%
Growth	0.918	0.112
Female growth	0.973	0.100
Male growth	0.739	0.146
Ratio	76.8%	6.2%

444	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	A1	1.1	f	10 young	B2	1.12	f	
	A2	1.08	f	~20 eggs	B4	1.25	f	
	A3	1.02	f		B5	1.12	f	
	A6	1.25	f		B7	1.1	f	
	A7	0.8	f		B1	0.88	m	
	A8	1.12	f		B3	0.9	m	
	A4	0.8	m		B6	0.98	m	
	A5	0.75	m		B8			
	A9	dead			B9	dead		
	A10	dead			B10	dead		
	AVG	0.99				1.05		
	Fem	1.061666667			Fem	1.1475		
	Mal	0.775			Mal	0.92		
	Ratio	75%			Ratio	57%		
	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	C1	0.95	f		D2	1.2	f	
	C2	1.2	f		D4	1.23	f	
	C5	1.15	f		D5	1.3	f	
	C6	1.18	f		D6	1.05	f	
	C7	1.25	f		D1	0.89	m	
	C3	0.98	m		D3	1	m	
	C4	1	m		D7	dead		
	C8	1	m		D8	dead		
	C9	dead			D9	dead		
	C10	dead			D10	dead		
	AVG	1.08875				1.111666667		
	Fem	1.146			Fem	1.195		
	Mal	0.993333333			Mal	0.945		
	Ratio	63%			Ratio	67%		

444 mg/L TDS	Mean	SD
Survival	72.5%	9.6%
Growth	1.060	0.053
Female growth	1.138	0.055
Male growth	0.908	0.094
Ratio	65.3%	7.5%

667	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	A2	1.22	f		B1	n/a		*jar broken
	A3	1.28	f		B2	n/a		
	A4	1.35	f		B3	n/a		
	A5	1.12	f		B4	n/a		
	A6	1.4	f		B5	n/a		
	A8	1.25	f		B6	n/a		
	A1	0.98	m		B7	n/a		
	A7	0.8	m		B8	n/a		
	A9	dead			B9	n/a		
	A10	dead			B10	n/a		
		1.175				n/a		
	Fem	1.27						
	Mal	0.89						
	Ratio	0.75			Ratio			
	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	C1	1.2	f		D4	1.22	f	~ 18 eggs
	C2	1.12	f		D5	1.22	f	
	C3	1.05	f		D6	1.3	f	
	C4	1.3	f		D7	1.4	f	
	C5	1.2	f		D1	0.88	m	
	C6	0.98	m		D2	0.9	m	
	C7	dead			D3	1	m	
	C8	dead			D8	dead		
	C9	dead			D9	dead		
	C10	dead			D10	dead		
	AVG	1.141666667				1.131428571		
	Fem	1.174			Fem	1.285		
	Mal	0.98			Mal	0.926666667		
	Ratio	83%			Ratio	57%		

667 mg/L TDS		
Survival	70.0%	10.0%
Growth	1.149	0.023
Female growth	1.243	0.060
Male growth	0.932	0.045
Ratio	71.8%	13.4%

1000	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	A1	1.15	f		B2	1.02	f	
	A2	1.12	f		B3	1.3	f	
	A4	1.32	f		B4	1.25	f	
	A6	1.02	f		B6	1.32	f	
	A3	0.95	m		B1	0.97	m	
	A5	1.05	m		B5	0.9	m	
	A7	0.98	m		B7	dead		
	A8	dead			B8	dead		
	A9	dead			B9	dead		
	A10	dead			B10	dead		
	AVG	1.084285714				1.126666667		
	Fem	1.1525			Fem	1.2225		
	Mal	0.993333333			Mal	0.935		
	Ratio	57%			Ratio	67%		
	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	C1	1.38	f		D2	1.04	f	
	C2	1	f		D3	1.12	f	
	C3	0.97	f		D4	0.95	f	
	C4	0.91	f		D5	1.25	f	11 yng
	C5	0.85	m		D6	1.11	f	
	C6	dead			D1	1	m	
	C7	dead			D7	dead		
	C8	dead			D8	dead		
	C9	dead			D9	dead		
	C10	dead			D10	dead		
	AVG	1.022				1.078333333		
	Fem	1.065			Fem	1.094		
	Mal	0.85			Mal	1		
	Ratio	80%			Ratio	83%		

1000 mg/L TDS	Mean	SD
Survival	60.0%	8.2%
Growth	1.078	0.043
Female growth	1.134	0.070
Male growth	0.945	0.069
Ratio	71.8%	12.1%

1500	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	A1	1.05	f	~ 13 eggs	B1	0.8	f	
	A2	0.95	f		B2	0.78	f	
	A5	0.95	f		B3	1	f	
	A6	1	f		B4	0.95	f	
	A3	0.75	m		B5	0.95	f	
	A4	0.8	m		B6	dead		* all females
	A7	dead			B7	dead		
	A8	dead			B8	dead		
	A9	dead			B9	dead		
	A10	dead			B10	dead		
	AVG	0.916666667				0.896		
	Fem	0.9875			Fem	0.896		
	Mal	0.775			Mal			
	Ratio	67%			Ratio	100%		
	Rep	Length (mm)	f/m	comments:	Rep	Length (mm)	f/m	comments:
	C1	0.98	f		D1	1.05	f	
	C4	0.75	f		D2	0.95	f	
	C5	0.9	f		D3	0.8	f	
	C6	1.02	f		D5	0.97	f	
	C7	0.97	f		D4	0.62	m	
	C2	0.72	m		D6	0.72	m	
	C3	0.65	m		D7	dead		
	C8	dead			D8	dead		
	C9	dead			D9	dead		
	C10	dead			D10	dead		
	AVG	0.855714286				0.851666667		
	Fem	0.924			Fem	0.9425		
	Mal	0.685			Mal	0.67		
	Ratio	71%			Ratio	67%		

1500 mg/L TDS	Mean	SD
Survival	60.0%	8.2%
Growth	0.880	0.032
Female growth	0.938	0.038
Male growth	0.710	0.057
ratio	76.2%	16.0%

Notes		
	F	Female
	M	Male
	Eggs	Unhatched eggs observed at test termination
	Young	Neonates that hatched during exposure
	Ratio	Ratio of females:males in the test cotainer

APPENDIX B – Analytical Chemistry

NAUTILUS ENVIRONMENTAL
ATTN: Jeslin Wijaya
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 14-MAR-14
Report Date: 21-MAR-14 17:26 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1432679

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers: 1
Legal Site Desc:

ALS ENVIRONMENTAL ANALYTICAL REPORT

Grouping	Analyte	L1432679-1 Water 14-MAR-14 CONTROL	L1432679-2 Water 14-MAR-14 296 MG/L TDS	L1432679-3 Water 14-MAR-14 444 MG/L TDS	L1432679-4 Water 14-MAR-14 667 MG/L TDS	L1432679-5 Water 14-MAR-14 1000 MG/L TDS
Sample ID / Description / Sampled Date / Sampled Time / Client ID						
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	209	361	529	783	1140
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	76.9	21.7	32.1	45.6	73.7
	Chloride (Cl) (mg/L)	2.25	147	218	339	515
	Sulfate (SO4) (mg/L)	97.6	26.3	38.2	58.8	84
Total Metals	Calcium (Ca)-Total (mg/L)	16.6	61.6	91.8	138	204
	Magnesium (Mg)-Total (mg/L)	13.7	7.08	10.7	15.8	23.6
	Potassium (K)-Total (mg/L)	2.8	3.0	4.5	6.5	9.8
	Sodium (Na)-Total (mg/L)	38.4	34.3	52.5	80.9	122

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1432679-6				
	Description	Water				
	Sampled Date	14-MAR-14				
	Sampled Time					
	Client ID	1500 MG/L TDS				
Grouping	**Analyte**					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1790				
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	111				
	Chloride (Cl) (mg/L)	772				
	Sulfate (SO4) (mg/L)	135				
Total Metals	Calcium (Ca)-Total (mg/L)	304				
	Magnesium (Mg)-Total (mg/L)	37.4				
	Potassium (K)-Total (mg/L)	15.0				
	Sodium (Na)-Total (mg/L)	186				

* Please refer to the Reference Information section for an explanation of any qualifiers detected.

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Calcium (Ca)-Total	MS-B	L1432679-1, -2, -3, -4, -5, -6

Qualifiers for Individual Parameters Listed:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2

This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.

ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.

This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".

MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B

This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).

TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

This analysis is carried out using procedures adapted from APHA Method 2540 "Solids". Solids are determined gravimetrically. Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, TDS is determined by evaporating the filtrate to dryness at 180 degrees celsius.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

1

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

TESTING LOCATION (Please Circle)

Nautilus Environmental

L1432679-COFC

Chain of Custody

British Columbia
8664 Commerce Court
Burnaby, British Columbia, Canada V5A 4N3
Phone 604.420.8773

Date_____Page___of___

Sample Collection

Report to:

Company	Nautilus Environmental
Address	8664 Commerce Court
City/State/Zip	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya
Phone	604-420-8773
Email	jeslin@nautilusenvironmental.com

Invoice To:

Company	Nautilus Environmental
Address	8664 Commerce Court
City/State/Zip	Burnaby, BC V5A 4N7
Contact	Jeslin Wijaya
Phone	604-420-8773
Email	jeslin@nautilusenvironmental.com

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	ANALYSES REQUIRED: Total Calcium	Total Magnesium	Total Sodium	Total Potassium	Total Chloride	Total Sulphate	Alkalinity	TDS			Receipt Temperature (°C)
1	Control	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
2	296 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
3	444 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
4	667 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
5	1000 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
6	1500 mg/L TDS	14-Mar-14		Water	125mL & 1L	2		x	x	x	x	x	x	x	x			
7																		
8																		
9																		
10																		

PROJECT INFORMATION		SAMPLE RECEIPT	
Client:		**Total No. of Containers**	
PO No.:		**Received Good Condition?**	
Shipped Via:		**Matches Test Schedule?**	

SPECIAL COMMENTS/INSTRUCTIONS : 21-d *D. magna* chronic test. Day 0. All samples are not preserved.

RELINQUISHED BY (CLIENT)

(Signature) (Time): 1600h
(Printed Name) (Date): Jeslin Wijaya March 14/14
(Company): Nautilus Environmental Company Inc.

RELINQUISHED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (COURIER)

(Signature) (Time)
(Printed Name) (Date)
(Company)

RECEIVED BY (LABORATORY)

(Signature) (Time): 18:40
(Printed Name) (Date): Mar14
(Company): 21.3°C

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

NAUTILUS ENVIRONMENTAL
ATTN: Emma Marcus
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 16-APR-14
Report Date: 23-APR-14 15:10 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1443825

Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1443825-1	L1443825-2	L1443825-3	L1443825-4	L1443825-5
	Description	Water	Water	Water	Water	Water
	Sampled Date	11-APR-14	11-APR-14	11-APR-14	11-APR-14	11-APR-14
	Sampled Time					
	Client ID	CTRL-0MG/L TDS	276 MG/L TDS	444 MG/L TDS	667 MG/L TDS	1000 MG/L TDS
Grouping	**Analyte**					
WATER						
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	73.3	23.6	34.5	48.6	79.8
	Chloride (Cl) (mg/L)	2.35	150	228	337	517
	Sulfate (SO4) (mg/L)	94.5	26.7	39.2	58.8	89
Total Metals	Calcium (Ca)-Total (mg/L)	16.5	61.3	91.2	138	205
	Magnesium (Mg)-Total (mg/L)	13.8	7.55	11.2	17.1	25.5
	Potassium (K)-Total (mg/L)	2.5	2.9	4.3	6.6	9.9
	Sodium (Na)-Total (mg/L)	33.5	35.6	52.5	79.5	119

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1443825-6				
	Description	Water				
	Sampled Date	11-APR-14				
	Sampled Time					
	Client ID	1500 MG/L TDS				
Grouping	**Analyte**					
WATER						
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	95.6				
	Chloride (Cl) (mg/L)	780				
	Sulfate (SO4) (mg/L)	136				
Total Metals	Calcium (Ca)-Total (mg/L)	295				
	Magnesium (Mg)-Total (mg/L)	38.0				
	Potassium (K)-Total (mg/L)	14.7				
	Sodium (Na)-Total (mg/L)	178				

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-COL-VA	Water	Alkalinity by Colourimetric (Automated)	EPA 310.2
This analysis is carried out using procedures adapted from EPA Method 310.2 "Alkalinity". Total Alkalinity is determined using the methyl orange colourimetric method.			
ANIONS-CL-IC-VA	Water	Chloride by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
ANIONS-SO4-IC-VA	Water	Sulfate by Ion Chromatography	APHA 4110 B.
This analysis is carried out using procedures adapted from APHA Method 4110 B. "Ion Chromatography with Chemical Suppression of Eluent Conductivity" and EPA Method 300.0 "Determination of Inorganic Anions by Ion Chromatography".			
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
This analysis is carried out using procedures adapted from "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, and with procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846 published by the United States Environmental Protection Agency (EPA). The procedures may involve preliminary sample treatment by acid digestion, using either hotblock or microwave oven (EPA Method 3005A). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
VA	ALS ENVIRONMENTAL - VANCOUVER, BRITISH COLUMBIA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogate - A compound that is similar in behaviour to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.
mg/kg - milligrams per kilogram based on dry weight of sample.
mg/kg wwt - milligrams per kilogram based on wet weight of sample.
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight of sample.
mg/L - milligrams per litre.
< - Less than.
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Nautilus Environmental

TESTING LOCATION (Please Circle)

L1443825-COFC

British Columbia
8664 Commerce Court
Burnaby, British Columbia, Canada V5A 4N3
Phone 604.420.8773

Chain of Custody

April 15/14 Date _____ Page 1 of 1

Sample Collection By:

Report to:		**Invoice To:**	
Company	Nautilus Environmental	**Company**	Nautilus Environmental
Address	8664 Commerce Court	**Address**	8664 Commerce Court
City/State/Zip	Burnaby, BC, V5A 4N3	**City/State/Zip**	Burnaby, BC, V5A 4N3
Contact	~~Emma Marus~~ Emma Marus	**Contact**	~~Emma Marus~~ Emma Marus
Phone	604-420-8773	**Phone**	604-420-8773
Email	emma@nautilusenvironmental.com	**Email**	emma@nautilusenvironmental.com

	SAMPLE ID	DATE	TIME	MATRIX	CONTAINER TYPE	NO. OF CONTAINERS	COMMENTS	ANALYSES REQUIRED: Ca, Mg, Na, K, SO4, Cl (filtered)	alkalinity	Ca	Mg	Na	K	SO4	Cl			Receipt Temperature (°C)
1	Ctrl - 0mg/L TDS	April 11/14	n/a	water	125ml plastic	1 x 125ml	Day 20	X	X	X	X	X	X	X	X			
2	276 mg/L TDS	April 11/14	↓	↓	↓	↓	↓	X	X	X	X	X	X	X	X			
3	444 mg/L TDS	April 11/14						X	X	X	X	X	X	X	X			
4	667 mg/L TDS	April 11/14						X	X	X	X	X	X	X	X			
5	1000 mg/L TDS	April 11/14						X	X	X	X	X	X	X	X			
6	1500 mg/L TDS	April 11/14						X	X	X	X	X	X	X	X			
7																		
8																		
9																		
10																		

PROJECT INFORMATION

Client:	
PO No.:	
Shipped Via:	

SAMPLE RECEIPT

Total No. of Containers	
Received Good Condition?	
Matches Test Schedule?	

RELINQUISHED BY (CLIENT)

(Signature) (Time) April 15/14

(Printed Name) Emma Marus (Date) @ 1730

(Company) Nautilus Environmental

RELINQUISHED BY (COURIER)

(Signature) (Time)

(Printed Name) (Date)

(Company)

SPECIAL INSTRUCTIONS/COMMENTS:

RECEIVED BY (COURIER)

(Signature) (Time)

(Printed Name) (Date)

(Company)

RECEIVED BY (LABORATORY)

(Signature) Elise (Time) 19:30

(Printed Name) (Date) Apr 15

(Company) temp 19.2

Additional costs may be required for sample disposal or storage. Payment net 30 unless otherwise contracted.

Day 0 - March 21, 2014						
mg/L TDS	*Control*	*296*	*444*	*667*	*1000*	*1500*
mg/L						
Alkalinity	76.9	21.7	32.1	45.6	73.7	111
Cl	2.25	147	218	339	515	772
SO4	97.6	26.3	38.2	58.8	84	135
Ca	16.6	61.6	91.8	138	204	304
Mg	13.7	7.08	10.7	15.8	23.6	37.4
K	2.8	3	4.5	6.5	9.8	15
Na	38.4	34.3	52.5	80.9	122	186
Day 0 TDS	**217.5**	**292.3**	**435.0**	**666.4**	**1002.6**	**1516.0**

Day 20 - April 10, 2014						
mg/L TDS	*Control*	*296*	*444*	*667*	*1000*	*1500*
mg/L						
Alkalinity	73.3	23.6	34.5	48.6	79.8	95.6
Cl	2.35	150	228	337	517	780
SO4	94.5	26.7	39.2	58.8	89	136
Ca	16.5	61.3	91.2	138	205	295
Mg	13.8	7.55	11.2	17.1	25.5	38
K	2.5	2.9	4.3	6.6	9.9	14.7
Na	33.5	35.6	52.5	79.5	119	178
Day 20 TDS	**207.1**	**298.2**	**447.1**	**666.2**	**1013.3**	**1499.1**
Average TDS	**212.3**	**295.3**	**441.0**	**666.3**	**1008.0**	**1507.5**