
Technical Report Overview

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Report: Final Interpretive Report: Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements

Overview: This report interprets and synthesizes two supplemental studies conducted by Teck in the Elk Valley: Nitrate Chronic Toxicity Study and Sulphate Chronic Toxicity Study. These studies were undertaken to better understand toxicity of nitrate and sulphate to biota that are considered to be representative organisms of the Elk Valley, including invertebrates, fish and amphibians.

This report was prepared for Teck by Golder Associates Ltd.

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31 March 2018

FINAL INTERPRETIVE REPORT

Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements

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REPORT



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List of Abbreviations

Abbreviation	Definition
ANCOVA	Analysis of covariance
ASTM	American Society for Testing and Materials
BC WQG	BC water quality guideline
CaCO ₃	Calcium carbonate equivalent
CETIS	Comprehensive Environmental Toxicity Information System™
CI	Confidence interval around mean value
EC _x	Inhibition concentration causing x percent reduction in frequency of adverse response
EMC	Environmental Monitoring Committee
ENV	BC Ministry of Environment and Climate Change Strategy
EV_ER4	Elk River upstream of Grave Creek
EVWQP	Elk Valley Water Quality Plan
FR-B	Fording River at Fording Bridge
GH_ER2	Elk River upstream reference location
GH_FR1	Upper Fording River upstream of Josephine Falls
GH_FR1-HH	GH_FR1 hardness-supplemented water (to 700 mg/L as CaCO ₃)
HC ₅	Hazardous concentration, fifth percentile, from a species sensitivity distribution
IC _x	Inhibition concentration causing x percent reduction in mean value of sublethal endpoint
LC ₅₀	Lethal concentration (50% mortality)
n/a	Not applicable (confidence interval not calculable)
NO ₃ -N	Nitrate nitrogen
NT	Not tested over range of amended concentrations
RAEMP	Regional Aquatics Effects Monitoring Program
SO ₄	Sulphate ion
SPO	Site Performance Objective
SSD	Species sensitivity distribution
TDS	Total dissolved solids
USEPA	United States Environmental Protection Agency
WCT	Westslope cutthroat trout
YCT	Yeast-Cerophyll®-trout chow food



1.0 INTRODUCTION

This document provides interpretation and synthesis of supplemental studies of nitrate and sulphate toxicity conducted by Teck Coal Ltd. (Teck) in response to environmental permit requirements in the Elk Valley, BC. Two separate programs consisting of a Nitrate Chronic Toxicity Study and a Sulphate Chronic Toxicity Study at high hardness concentrations are described herein. The Nitrate Chronic Toxicity Study was completed by Teck in response to a condition included in a letter approving the Regional Aquatics Effects Monitoring Program (RAEMP) issued by the BC Ministry of Environment (now BC Ministry of Environment and Climate Change Strategy; ENV) on 14 November 2014 (hereafter referred to as the RAEMP Approval Condition). The Sulphate Chronic Toxicity Study was completed in accordance with Section 9.8.1 of *Environmental Management Act* Permit 107517.

Both chronic toxicity studies assessed the sensitivity of invertebrates, fish, and amphibians to nitrate and sulphate in a laboratory setting using site waters from the Elk Valley, and tested at hardness concentrations relevant to conditions in the Elk Valley. Both studies included supplemental testing in Fall 2016; these tests represented a continuation of work to better understand toxicity of nitrate and sulphate to species considered representative of organisms in the Elk Valley. The study design for the most recent supplemental testing program was built from several previous investigations:

- The Phase 1 Mixture Toxicity Study conducted in 2012–2013 (Golder and Nautilus 2013)
- Testing completed in Fall 2013 in support of the Elk Valley Water Quality Plan (EVWQP) (Teck 2014)
- Testing completed in 2015 under Permit 107517, including mixture tests with nitrate and sulphate conducted under Section 9.8.2 (Golder 2016a)
- Pilot testing in 2015 with amphibians for the purposes of method development (Golder and Nautilus 2016)

The details of the study designs for the most recent supplemental tests are provided in Golder (2016b) for fish and invertebrates, and in Golder and Nautilus (2016) for amphibians. The primary goals of the Nitrate Chronic Toxicity Study and the Sulphate Chronic Toxicity Study were to address residual uncertainties from the EVWQP and to help to validate that the Site Performance Objectives (SPOs) remain protective of aquatic life. These studies are but two components of a larger set of chronic toxicity testing requirements being executed by Teck.

1.1 Study Objectives

The Nitrate and Sulphate Chronic Toxicity studies were designed to meet the Permit 107517 and RAEMP Approval Condition requirements. They have generated site-relevant information to achieve the following objectives:

- Evaluate the sensitivity of invertebrates and fish using longer-term tests relative to those conducted prior to Permit 107517—This objective was satisfied by incorporating site-specific embryo-alevin rainbow trout toxicity testing across a wider range of hardness and water quality conditions than was assessed previously for this test type. In addition, incorporation of the 32-day early life-stage test of fathead minnow development test in the sulphate toxicity program strengthened the assessment of chronic toxicity to fish. Both the rainbow trout and fathead minnow test protocols applied test durations equal to or greater than those required for Permit-based testing under Section 9.8 (ii).
- Confirm that the benchmarks established in the EVWQP are applicable to high hardness conditions—Additional longer-term testing was completed with sensitive fish and invertebrate species focussing on the



high hardness concentrations (greater than 250 mg/L as CaCO₃). For nitrate, this objective was satisfied through additional testing of Fording River site waters (high hardness), plus testing of waters amended to higher hardness levels (i.e., approximately 700 mg/L as CaCO₃). The latter treatments were intended to represent conditions in other mine-influenced waters in the Elk Valley, conditions observed in other seasons, and/or conditions representative of long-term estimates of water quality in mine-influenced water bodies. For sulphate, a similar approach was used, but incorporated an even wider range of hardness conditions resulting from the addition of calcium sulphate and magnesium sulphate salts. These results were used to confirm previous test findings, to reduce uncertainty in site-specific effect benchmark derivations, and will support finalization of long term sulphate SPOs per Section 9.8.1 of Permit 107517.

- Evaluate the sensitivity of amphibians to nitrate and sulphate relative to other aquatic species—This objective entailed amphibian toxicity testing of amended (spiked) site waters to assess the sensitivity of a representative species (leopard frog) to nitrate and sulphate using long-term metamorphosis tests¹. These tests, conducted in parallel for nitrate and sulphate, will address the Section 9.8.1 requirement for testing of “other sensitive species” and the specific RAEMP Approval Condition related to amphibian testing of nitrate. The tests were conducted over ranges of nitrate and sulphate exposures that overlapped the effect benchmarks for sensitive species used in the development of SPOs.

This report is limited to discussion of sulphate- and nitrate-amended waters (i.e., “spiking studies”) to support the evaluations of these two specific constituents. Other chronic testing, including semi-annual and quarterly testing of unamended site waters to satisfy Permit 107517, is reported separately in annual interpretative reports.

2.0 SUMMARY OF HISTORICAL TESTING

As documented in Section 1.1, a primary objective of the nitrate and sulphate toxicity study designs was to address uncertainties that have been identified from previous rounds of testing. Prior to the Fall 2016 testing, there were three main rounds of chronic testing that incorporated sulphate and nitrate additions to Elk Valley site waters (i.e., first three boxes of Table 1). The results of tests of nitrate and sulphate conducted prior to 2016 are summarized briefly in the following subsections to provide context for the supplemental testing conducted in 2016. The remainder of the report emphasizes the technical results from the Fall 2016 testing program. Figure 1 illustrates how the Fall 2016 testing program fits into the broader program of chronic testing undertaken by Teck. This report marks the completion of the nitrate and sulphate chronic testing programs for fish and invertebrates, as depicted in the purple-highlighted sections of Figure 1. Additional chronic toxicity tests with amphibians related to nitrate and sulphate toxicity are planned for 2018.

¹ Due to control failures observed in Spring/Summer of 2016 and 2017, the amphibian testing will be repeated in 2018 to complete remaining Permit requirements. Proposed modifications to the testing procedures are discussed in Section 4.1.



NITRATE AND SULPHATE CHRONIC TOXICITY

Table 1: Overview of Site Water Amendment Testing (Spiking Studies) for Nitrate and Sulphate in the Elk Valley

Phase 1 Mixture Toxicity Tests (2012–2013)	<ul style="list-style-type: none">• Included spiking of Fording River site water (FR-B) with nitrate and sulphate• IC_x calculated for multiple species, including <i>C. dubia</i>, rainbow trout embryo-alevin, mayfly
Fall 2013 Chronic Toxicity Tests	<ul style="list-style-type: none">• Included multiple site waters (varying in hardness) amended separately with nitrate and sulphate• Used in conjunction with other information as technical basis for benchmarks for aquatic life, which informed SPO development
Fall 2015 SPO Mixture Study	<ul style="list-style-type: none">• Included multiple site waters amended to site-specific SPO values for nitrate, sulphate, selenium, cadmium• Emphasized the most sensitive long-term chronic endpoints identified in previous testing
Fall 2016 Supplemental Nitrate and Sulphate Tests	<ul style="list-style-type: none">• Improved replication for endpoint precision (<i>C. dubia</i>, rainbow trout)• Additional site waters evaluated (e.g., higher hardness)• Emphasized most sensitive long-term chronic endpoints

FR-B—Fording River Bridge sampling location

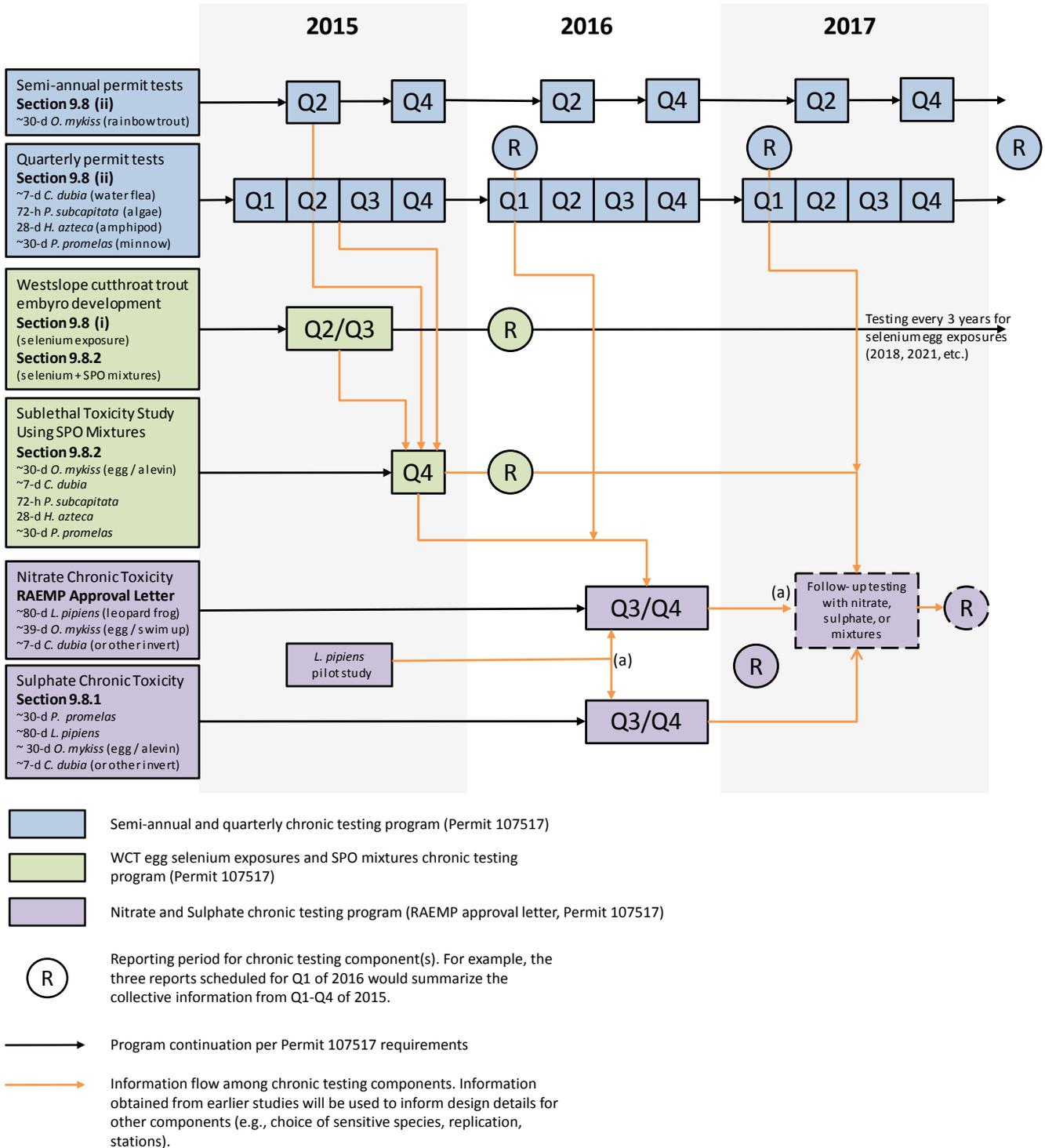
IC_x —Inhibition concentration associated with x% level of adverse response

SPO—Long-term Site Performance Objective from Elk Valley Water Quality Plan



NITRATE AND SULPHATE CHRONIC TOXICITY

Figure 1: Overview of Elk Valley Chronic Toxicity Testing Requirements



(a) The amphibian tests originally planned for Q2–Q3 of 2016 and retested in Q2–Q3 of 2017, were terminated due to a negative control failure. These tests have been reassigned to start in late Q2 (carrying into Q3) of 2018. The initiation date will depend on the developmental status of leopard frog cultures.



2.1 Phase 1 Mixture Toxicity Tests

Preliminary information on the concentration-response of nitrate and sulphate was obtained from mixture testing completed using laboratory water and water from the FR-B location on the Fording River near Line Creek Operations (Golder and Nautilus 2013). Test organisms in the 2012–2013 mixture study included two species of crustaceans (*Hyalella azteca* and *Ceriodaphnia dubia*) and rainbow trout. It also included sulphate toxicity testing with mayflies (*Centroptilum triangulifer*).

2.1.1 Nitrate

The Phase I Mixture Toxicity Study included several test organisms and endpoints for evaluation of the toxicity of nitrate in Fording River (FR-B) water, including:

- survival and reproduction of *C. dubia* from 7-day tests completed according to Environment Canada (2007)
- survival and growth of amphipods (*H. azteca*) from 14-day tests completed according to Environment Canada (1997, 2013)
- embryo-alevin development of rainbow trout (*O. mykiss*) from 39-day tests completed according to Environment Canada (1998), with exposure extended through full yolk sac absorption
- embryo-alevin development of lake trout (*Salvelinus namaycush*) from 68-day tests completed according to Environment Canada (1998).

Of these tests, the most sensitive endpoints were *C. dubia* reproduction and rainbow trout development (percent swim-up). The reported IC₂₀ for reproductive effects to *C. dubia* in spiked Fording River water was 25 mg/L NO₃-N, and the reported IC₂₀ for percent swim-up of rainbow trout in spiked Fording River water was 26 mg/L NO₃-N. Results of the nitrate toxicity tests are presented in Table 2. Table 2 also summarizes the range of nitrate concentrations tested and associated water hardness.

Table 2: Results of Nitrate Toxicity Tests in Fording River Water, Phase 1 Mixture Toxicity Study

Nitrate Toxicity Test Endpoint	Tested NO ₃ [mg/L NO ₃ -N]	Tested Hardness ^(a) [mg/L as CaCO ₃]	Test Results ^(b)
<i>7-d Ceriodaphnia dubia</i>			
Survival	12.2 to 128	420	LC ₅₀ = 64.9 mg/L NO ₃ -N (54–80)
Reproduction			IC ₂₀ = 25.1 mg/L NO ₃ -N (19–28)
<i>39-d Rainbow trout</i>			
Survival	13.8 to 601	435	LC ₅₀ = 63 mg/L NO ₃ -N (59–68)
Embryo-alevin development (% swim-up)			IC ₂₀ = 25.7 mg/L NO ₃ -N (17–74)
Length			IC ₂₀ > 178.5 mg/L NO ₃ -N (CI not calculable)
Weight			IC ₂₀ = 98 mg/L NO ₃ -N (66–165)
<i>14-d Hyalella azteca</i>			
Survival	12.8 to 128	436	Could not be determined due to poor performance in the control sample
Growth			

(a) Hardness concentrations are approximate.

(b) Effects concentrations are provided as LC₅₀ (lethal concentration) and IC₂₀ (inhibiting concentration) values (95% confidence interval).

mg/L = milligrams per litre; CI = 95% confidence interval.



The lake trout development test was completed in a similar manner to the rainbow trout tests summarized in Table 2; however, only three nitrate concentrations were tested (control, 50, and 150 mg/L NO₃-N). No toxicity of nitrate to lake trout embryo-alevin survival was observed in any treatment. Slightly reduced survival was observed in un-amended control water at 50 mg/L NO₃-N, but this response was not significantly different from survival in control water with no added nitrate.

Golder and Nautilus (2013) also evaluated potential toxicity modifying factors for the nitrate testing, and concluded that some toxicity-modifying effect was observed in the nitrate-only toxicity test that was completed with *C. dubia*. In this test, the IC₂₀ for reproduction in Fording River water was 25.1 mg/L NO₃-N, which is higher than the IC₂₀ for reproduction of <6.3 mg/L NO₃-N observed in the corresponding laboratory control water. However, this toxicity-modifying effect was not consistently observed across all tests, and, for both *C. dubia* and rainbow trout, nitrate toxicity in Fording River water was similar to published toxicity data for tests conducted at lower levels of water hardness.

Overall, the evaluation of toxicity modifying factors indicated the following:

- Although some toxicity-modifying effects were observed with respect to nitrate toxicity in Fording River water, they are not as pronounced as would be expected based on effects of water hardness alone.
- Low chloride concentrations may explain why the toxicity-modifying effect in Fording River water is less than expected, based on the results reported in previous studies.
- Based on the reported IC₂₀ endpoints, and without consideration of the full range of mixture interactions discussed below, effects from nitrate to populations of sensitive representative species would not be expected in the Fording River system until in-stream concentrations approached 25 mg/L, the lowest chronic endpoint reported in the nitrate-only toxicity tests in Fording River water.

2.1.2 Sulphate

The Phase I Mixture Toxicity Study included several test organisms and endpoints for evaluation of the toxicity of sulphate in Fording River (FR-B) water, including:

- Survival and reproduction of *C. dubia* from 7-day tests completed according to Environment Canada (2007).
- Embryo-alevin development of rainbow trout from 28-day tests completed according to Environment Canada (1998).
- Survival and growth of mayflies (*Centroptilum triangulifer*) from 28-day tests completed according to published procedures established by Dr. David Buchwalter (Conley et al. 2009; Xie et al. 2010).

Results of the sulphate toxicity tests are presented in Table 3, which also summarizes the range of sulphate concentrations tested and associated water hardness and total dissolved solids (TDS) concentrations.



NITRATE AND SULPHATE CHRONIC TOXICITY

Table 3: Results of Sulphate Toxicity Tests in Fording River Water and Alkalinity-Supplemented Fording River Water, Phase 1 Mixture Toxicity Study

Sulphate Toxicity Test Endpoint	Tested SO ₄ [mg/L]	Tested TDS ^(a) [mg/L]	Tested Hardness ^(a) [mg/L as CaCO ₃]	Test Results ^(b)
Fording River Water				
<i>7-d Ceriodaphnia dubia</i>				
Survival	165 to 1,610	407 to 2,409	366 to 2,168	LC ₅₀ for sulphate > 1,610 mg/L (CI not calculable); TDS at LC ₅₀ > 2,409 mg/L; hardness at LC ₅₀ > 2,166 mg/L as CaCO ₃
Reproduction				IC ₂₀ for sulphate = 595 mg/L (332–948); TDS at IC ₂₀ = 1,012 mg/L; hardness at IC ₂₀ = 910 mg/L as CaCO ₃
<i>28-d Rainbow trout</i>				
Survival	185 to 1,767	451 to 2,557	406 to 2,301	LC ₅₀ for sulphate = 1,033 mg/L (636–1,414); TDS at LC ₅₀ = 1,599 mg/L; hardness at LC ₅₀ = 1,438 mg/L as CaCO ₃
Embryo-alevin development (%swim-up)				IC ₂₀ for sulphate = 530 mg/L (176–772); TDS at IC ₂₀ = 923 mg/L; hardness at IC ₂₀ = 830 mg/L as CaCO ₃
<i>28-d Mayfly</i>				
Survival	208 to 1,470	476 to 2,158	429 to 1,942	LC ₅₀ for sulphate > 1,470 mg/L (CI not calculable); TDS at LC ₅₀ > 2,158 mg/L; hardness at LC ₅₀ > 1,941 mg/L as CaCO ₃
Growth				IC ₂₀ for sulphate > 1,470 mg/L (CI not calculable); TDS at IC ₂₀ > 2,158 mg/L; hardness at IC ₂₀ > 1,941 mg/L as CaCO ₃
Biomass				IC ₂₀ for sulphate = 885 mg/L (CI not calculable); TDS at IC ₂₀ = 1,398 mg/L; hardness at IC ₂₀ = 1,257 mg/L as CaCO ₃
Alkalinity-supplemented Fording River Water				
<i>7-d Ceriodaphnia dubia</i>				
Survival	170 to 1,630	413 to 2,386	372 to 2,147	LC ₅₀ for sulphate > 1,630 mg/L (CI not calculable); TDS at LC ₅₀ > 2,386 mg/L; hardness at LC ₅₀ > 2,146 mg/L as CaCO ₃
Reproduction				IC ₂₀ for sulphate = 840 mg/L (251–1,227); TDS at IC ₂₀ = 1,322 mg/L; hardness at IC ₂₀ = 1,189 mg/L as CaCO ₃
<i>28-d Rainbow trout</i>				
Survival	186 to 1,775	501 to 2,578	451 to 2,320	LC ₅₀ for sulphate = 988 mg/L (861–1,087); TDS at LC ₅₀ = 1,555 mg/L; hardness at LC ₅₀ = 1,398 mg/L as CaCO ₃
Embryo-alevin development (%swim-up)				IC ₂₀ for sulphate = 622 mg/L (473–738); TDS at IC ₂₀ = 1,052 mg/L; hardness at IC ₂₀ = 946 mg/L as CaCO ₃

^(a) TDS and hardness concentrations varied with the tested sulphate concentration to maintain realistic ratios of major ions (i.e., increasing sulphate concentration is associated with increasing TDS and hardness in mine-influenced waters). Hardness concentrations are approximate. Alkalinity was 140 mg/L (Fording River water) and 180 mg/L (alkalinity-supplemented Fording River water).

^(b) Effects concentrations are provided as IC₂₀ (inhibiting concentration) values with 95% confidence intervals, where calculable.

TDS = total dissolved solids; mg/L = milligrams per litre; CI = 95% confidence interval.



The most sensitive endpoints in the sulphate testing of FR-B water (Table 3) were *C. dubia* reproduction ($IC_{20} = 595 \text{ mg/L SO}_4$) and rainbow trout percent swim-up ($IC_{20} = 530 \text{ mg/L SO}_4$). The addition of alkalinity did not result in statistically significant changes in endpoint values for *C. dubia* reproduction ($IC_{20} = 840 \text{ mg/L SO}_4$) or rainbow trout percent swim-up ($IC_{20} = 622 \text{ mg/L SO}_4$). For both tests, the confidence intervals on the estimated IC_{20} values exhibited broad overlap between the two tested waters, indicating that there was no significant difference in toxicity, and both values were considered to be valid estimates of the true threshold for sulphate toxicity in these water sources.

The sulphate testing yielded the following conclusions:

- Some toxicity-modifying effects were observed with respect to sulphate toxicity in Fording River water, likely attributable to increased water hardness. Specifically, the estimated IC_{20} values for normal surviving rainbow trout embryo-alevins were higher than reported by Elphick et al. (2011) for tests conducted in soft water.
- Based on the reported IC_{20} endpoints, and without consideration of the full range of mixture interactions discussed below, effects from sulphate to populations of sensitive representative species would not be expected in the very hard waters of the Fording River system until in-stream concentrations exceed 530 mg/L , the lowest chronic endpoint reported in the sulphate-only toxicity tests.
- No indication was observed that interactions or additive effects of sulphate and nitrate, or of sulphate and nitrate with other constituents, occur at the estimated IC_{20} concentrations. However, additive effects between nitrate and sulphate could occur at much higher concentrations of both constituents (i.e., nitrate $\geq 41 \text{ mg/L NO}_3\text{-N}$ and sulphate $\geq 931 \text{ mg/L SO}_4$).

2.2 Fall 2013 Nitrate and Sulphate Toxicity Testing

The primary purpose of the Fall 2013 toxicity testing program was to expand upon the Phase 1 Mixture Toxicity Study by testing a wider range of water sources and additional toxicity test endpoints, with the goal of supporting development of benchmarks for the protection of aquatic life. In October 2013, water from five locations in the Elk Valley, including one reference site, was collected and submitted for toxicity testing. Some of the water from each location was tested directly, with the remaining water being spiked with different levels of nitrate or sulphate to create a range of exposure concentrations (Teck 2014). For both sulphate and nitrate, test organisms consisted of two species of fish (rainbow trout and fathead minnows) and two species of invertebrates (*Hyalella azteca* and *Ceriodaphnia dubia*). The selected tests for the Fall 2013 program included the following durations, endpoints, and protocols:

- 7-day survival and growth test using fathead minnows (*Pimephales promelas*; Environment Canada 2011)
- 7-day swim-up fry development test using rainbow trout (*O. mykiss*; Lazorchak and Smith 2007²)
- three-brood (7- to 8-day) survival and reproduction test using water fleas (*C. dubia*; Environment Canada 2007)
- 14-day survival and growth test using a freshwater amphipod (*H. azteca*; Environment Canada 2013).

² This protocol was an adaptation of the Environment Canada (1998) protocol for early life stage testing of salmonids. The test used swim-up fry because site-specific tests of 7-d embryo development in rainbow trout (Golder and Nautilus 2013) did not elicit any toxic responses over a wide range of nitrate exposures.



NITRATE AND SULPHATE CHRONIC TOXICITY

Samples from the Elk and Fording rivers were spiked to evaluate sulphate and nitrate toxicity. Toxicity tests for nitrate were performed using all five site waters as the base water. All five were supplemented with nominal concentrations of 3, 5, 10, 17, 31 and 57 mg/L nitrate (NO₃-N). Each individual test (i.e., each site water and constituent combination) included exposures to a laboratory control water and an unamended sample (i.e., without any added sulphate or nitrate).

Key findings from the Fall 2013 toxicity testing of nitrate included the following:

- Neither fish species (rainbow trout, fathead minnow) was found to be sensitive to nitrate in 7-day exposures, and IC₂₀ values were greater than the highest concentration for all tested waters for both species.
- Nitrate supplementation reduced *C. dubia* reproduction, and this was the most sensitive toxicological endpoint observed.
- The sensitivity of the *C. dubia* reproduction endpoint differed between the Fording and Elk rivers, but was similar between stations on the same river. Toxicity of nitrate to *C. dubia* reproduction was greatest in the spiked Elk River samples, and lowest in the spiked Fording River samples. This relationship was statistically significant, suggesting that another component of water quality modifies the toxicity of nitrate. Statistical analyses yielded *C. dubia* reproduction IC₂₀ estimates for nitrate (stations pooled by reach) of 5.5 mg/L NO₃-N for the Elk River and 17 mg/L NO₃-N for the Fording River.
- The sensitivity of the *H. azteca* survival and biomass endpoints were greater than for either fish species, but not as great as for the *C. dubia* reproduction endpoint.
- The concentration-response analysis for *H. azteca* indicated that the biomass endpoint was more sensitive than the survival or growth (dry weight) endpoints. The biomass endpoint yielded similar IC₂₀ estimates for Elk River water, ranging between 23 and 29 mg/L NO₃-N. The two Fording River waters tested in Fall 2013 yielded somewhat different estimates, with IC₂₀ values ranging from 13–41 mg/L NO₃-N.
- Nitrate toxicity was greatest in the upstream (reference) waters, indicating that mine-influenced waters contain substances or properties that ameliorate nitrate toxicity to some extent.

The four waters used for sulphate testing were supplemented with nominal concentrations of 50, 90, 192, 292, 525 and 945 mg/L sulphate (SO₄) in addition to the concentrations in the unamended samples. Sulphate was added using CaSO₄·2H₂O and MgSO₄·7H₂O at a ratio of calcium and magnesium of 2.6:1 (on a mass basis). The goal was to evaluate organism sensitivity over a reasonably wide range of concentrations, including at hardness levels beyond those considered by the provincial water quality guideline (BC WQG).

Key findings from the Fall 2013 toxicity testing of sulphate included the following:

- For rainbow trout, the most sensitive sublethal IC₂₀ for sulphate was greater than the highest concentration for all tested waters for this species (i.e., >68 mg/L SO₄). This indicated that the fry stage was not as sensitive as embryo-alevin development stages, as documented in Golder and Nautilus (2013) and Meays and Nordin (2013).
- Fathead minnows were not found to be sensitive to sulphate exposure at the fry stage, and IC₂₀ values were greater than the highest concentration for all tested waters for both species.



- Crustaceans were observed to be less sensitive to sulphate in site-specific tests relative to previous testing including other studies of sulphate toxicity in high hardness waters (Elphick et al. 2011). The reproduction of *C. dubia* was not adversely affected up to the maximum concentration tested in Fall 2013 (i.e., total measured concentration of 1200 mg/L SO₄).
- The Fall 2013 testing program concluded that the hardness range of the BC WQG can be extended so that the value of 429 mg/L SO₄ applies to hardness conditions >250 mg/L as CaCO₃, as occurs in the Fording River and in the Elk River just downstream of the Fording River. This BC WQG is lower than the lowest IC₂₀ observed for any species in site-specific testing in 2013, but some uncertainty remained due to high replicate variability observed in the rainbow trout embryo-alevin test.

2.3 EVWQP Benchmarks

In conjunction with the development of the EVWQP, Teck (2014) developed water quality benchmarks for nitrate and sulphate to support the development of long-term targets in the Elk and Fording rivers. Benchmarks were derived for multiple levels of effect, corresponding to approximately 10%, 20% and 50% responses to sensitive aquatic species (Level 1, Level 2 and Level 3 respectively). For sulphate, a specific objective was to determine whether the provincial water quality guideline (WQG) for sulphate, currently specified up to a maximum water hardness of 250 mg/L as CaCO₃, can be extended above 250 mg/L hardness.

Water quality benchmarks for sensitive receptors reflecting 10%, 20% and 50% levels of effect are summarized in Table 4 and Table 5, for nitrate and sulphate respectively. Benchmarks were defined with reference to sensitive species of fish, invertebrates and amphibians. These benchmarks integrated the findings of the site-specific testing of fish and invertebrates described in Sections 2.1 and 2.2, along with consideration of the literature for amphibian toxicity. The nitrate benchmarks derived for the EVWQP (Table 4) also incorporated the observed relationship of toxicity responses to water hardness. The values shown are adjusted to a typical condition representative of the Fording and Elk rivers, but can also be customized to other water hardness conditions using a hardness-dependent equation.



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Table 4: Summary of Effect Benchmarks for Aquatic Receptors Exposed to Nitrate in the Fording and Elk Rivers

Receptor Group	Representative Species and Test Type Used as a Basis for Benchmark	Fording River Benchmarks (mg/L NO ₃ -N)			Elk River Benchmarks (mg/L NO ₃ -N)		
		Level 1 (~10% Effect)	Level 2 (~20% Effect)	Level 3 (~50% Effect)	Level 1 (~10% Effect)	Level 2 (~20% Effect)	Level 3 (~50% Effect)
Fish	Rainbow trout (<i>O. mykiss</i>)—39-day embryo-alevin development completed using augmented site water	16	21	48	9	12	27
Invertebrates	Water flea (<i>C. dubia</i>)—8-day reproduction completed using augmented site water	11	15	31	3	5	21
	Amphipod (<i>H. azteca</i>)—14-day biomass completed using augmented site water	19	23	59	17	26	58
Amphibians	Northern leopard frog (<i>L. pipiens</i>)—52-day growth in length (Level 1) Pacific tree frog (<i>P. regilla</i>)—10-day growth from literature (Levels 2 and 3)	33	405	1,598	19	225	888

Notes:

Values based on a representative hardness of 360 mg/L as CaCO₃ (Fording River) and 200 mg/L as CaCO₃ (Elk River).

Values shown in the table can be adjusted to other hardness values using a slope of 1.0003; however, the analysis does not support extrapolation to values lower than the WQG of 3 mg/L NO₃-N.

Table 5: Summary of Effect Benchmarks for Aquatic Receptors Exposed to Sulphate in Hard to Very Hard Waters, such as those present in the Fording and Elk Rivers

Receptor Group	Representative Species and Test Type Used as a Basis for Benchmark	Derived Benchmarks (mg/L SO ₄)		
		Level 1 (~10% Effect)	Level 2 (~20% Effect)	Level 3 (~50% Effect)
Fish	Rainbow trout (<i>O. mykiss</i>)—21- to 28-day embryo-alevin development; applied geometric mean of SFU/Kennedy study and Phase 1 Mixture Toxicity Study	499	674	1,173
Invertebrates	Water flea (<i>C. dubia</i>)—Three-brood reproduction completed using augmented site water; applied geometric mean of the lowest unbounded concentration from Fall 2013 and the concentration from Phase 1 Mixture Toxicity Study	625	729	1,315
	Mayfly (<i>C. triangulifer</i>)—28-day biomass completed using simulated Fording River water	696	885	1,402
Amphibians	Pacific tree frog (<i>P. regilla</i>)—21-day survival and growth from literature; applied average of two IC estimates derived from same underlying data	481	822	1,545



2.4 Site Performance Objectives Mixture Testing

In conjunction with the approval of the EVWQP, Permit 107517 required additional spiking tests that incorporated sulphate and nitrate amendments, along with other Order constituents, to validate the SPOs when present together in a mixture. Specifically, the SPO mixture study addressed Permit Section 9.8.2 requirements to confirm that when nitrate, selenium, sulphate, and cadmium are present together in surface waters at the long-term SPO concentrations, the waters are not toxic to sensitive aquatic species relevant to the Elk Valley. To address this permit requirement, mixture toxicity tests were undertaken with *C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas*, and *O. mykiss*. A study design for the mixture toxicity tests was submitted to ENV on 30 April 2015 (Golder 2015a,b) and results are summarized in Golder (2016a).

Findings of relevance to the evaluation of nitrate and sulphate toxicity included:

- There was no evidence of adverse effects of SPO mixtures on *C. dubia*, *P. subcapitata*, *P. promelas* or *O. mykiss* at any dilution. These results confirm that Elk and Fording River waters meeting the long-term SPOs specified in Permit 107517 are not toxic to sensitive aquatic receptors.
- Survival and growth in the *H. azteca* test showed no statistically significant differences between laboratory control water and reference waters. However, there were unexplained mortalities in four of ten replicates in the *H. azteca* test in the 100% vol/vol Elk River SPO mixture. These mortalities were not observed in other SPO treatments, and likely reflected a confounding factor that affected some but not all replicates in that test.

The lack of adverse effects associated with sulphate, nitrate, and other mine-related constituents in a mixture provided evidence that the long-term SPOs for sulphate and nitrate are protective of aquatic life. Therefore, to identify the thresholds for toxicity of nitrate and sulphate to aquatic organisms, testing at concentrations above the long-term SPOs was required.

3.0 OVERVIEW OF 2016 STUDY

The final approved study design (Appendix C) provides the details of the study design and methodology for fish and invertebrate testing. Section 3.0 of this document provides a high level summary of the procedures used to collect and analyze toxicity data, with details specific to the nitrate toxicity study and the sulphate toxicity study deferred to Sections 4.0 and 5.0, respectively.

In summary, the program included:

- Collection of site waters from three locations representing a range of hardness conditions:
 - Reference location on the Elk River upstream of Greenhills Operation (GH_ER2)
 - Elk River upstream of Grave Creek, and downstream of the confluence with the Fording River (EV_ER4)
 - Upper Fording River upstream of Josephine Falls, and downstream of Greenhills Creek (GH_FR1)



- Amendment (spiking) of the water collected at GH_FR1 to create modified base water³ (GH_FR1-HH) with higher hardness (700 mg/L as CaCO₃). The amendment introduced magnesium sulphate and calcium sulphate, using a ratio of calcium:magnesium that was representative of mine-influenced conditions (i.e., 2.6:1).
- For base waters (GH_ER2, EV_ER4, GH_FR1, GH_FR1-HH [nitrate only]), amendment of samples with nitrate additions or sulphate additions (separately) to create a series of amended concentrations per sample site, similar to the approach used in the 2013 work completed in support of the EVWQP (Teck 2014).
- Completion of the following chronic toxicity tests for nitrate: 39-d embryo-alevin rainbow trout development test (extended to yolk sac absorption); three-brood *C. dubia* reproduction.
- Completion of the following chronic toxicity tests for sulphate: 30-d embryo-alevin rainbow trout development test; three-brood *C. dubia* reproduction, 32-d fathead minnow larval development test.
- Concentration-response assessment for each test endpoint to quantify the influence of each primary constituent (sulphate, nitrate) and the potential influence of secondary constituents (e.g., hardness, other water quality factors) on the nature of concentration-response.
- Development of point estimates (i.e., IC_x estimates) to depict the sensitivity of each test species to nitrate or sulphate exposure.
- Comparison of IC_x estimates to previous testing to confirm that benchmarks for the protection of aquatic life developed for the EVWQP remain protective.

3.1 Base Water Characteristics

3.1.1 Primary Constituents

The final approved study design (Appendix C) provided estimated concentrations of nitrate, sulphate, and water hardness for the purpose of determining approximate treatment dilution series concentrations. These estimated (predicted) concentrations were made well in advance of the Fall 2016 sampling program based on seasonal patterns observed in recent years of water quality monitoring. Predicted concentrations of nitrate, sulphate and hardness from the approved study design were compared to measured concentration ranges as summarized below. Due to a high level of agreement between predicted and measured concentrations, no modifications to the study design were required:

- Station GH_ER2
 - Predicted nitrate 0.05 mg/L NO₃-N; measured nitrate range 0.07–0.09 mg/L NO₃-N
 - Predicted sulphate 20 mg/L SO₄; measured sulphate range 22–23 mg/L SO₄
 - Predicted hardness 165 mg/L CaCO₃; measured hardness range 163–182 mg/L CaCO₃
- Station EV_ER4

³ Base water is defined as site water (with or without hardness adjustment) prior to the introduction of the supplemental nitrate or sulphate.



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- Predicted nitrate 3.0 mg/L NO₃-N; measured nitrate range 2.9–3.0 mg/L NO₃-N
- Predicted sulphate 70 mg/L SO₄; measured sulphate range 76–77 mg/L SO₄
- Predicted hardness 245 mg/L CaCO₃; measured hardness range 249–265 mg/L CaCO₃
- Station GH_FR1
 - Predicted nitrate 10 mg/L NO₃-N; measured nitrate range 9.8–10.9 mg/L NO₃-N
 - Predicted sulphate 185 mg/L SO₄; measured sulphate range 212–226 mg/L SO₄
 - Predicted hardness 430 mg/L CaCO₃; measured hardness range 437–482 mg/L CaCO₃
- Station GH_FR1-HH
 - Predicted hardness 700 mg/L CaCO₃; measured hardness range 672–719 mg/L CaCO₃
 - Nitrate and sulphate identical to GH_FR1 without hardness adjustment

Sulphate concentrations in unamended waters were below the provincial guidelines in all samples. The only unamended water that exceeded the provincial guideline for nitrate was GH_FR1.

3.1.2 Secondary Constituents

In addition to nitrate, sulphate, and hardness, concentrations of other water quality parameters are of interest to determine whether there is potential for contribution of these constituents to the patterns of responses in toxicity tests. For each of the four base waters, these constituents were present in consistent concentrations across all nitrate and sulphate treatments, with the exception of sodium, calcium, and magnesium, which were used as counter-ions to deliver the supplemental nitrate and sulphate into solution.

Results of analytical chemistry on each site water (for all site weekly samples) are presented in Tables 6–10. These measurements were taken one day following the collection of the samples in the field, and prior to the introduction of supplemental nitrate or sulphate. For sample GH_FR1-HH, only hardness data are presented (Table 10) because the sample was an aliquot of GH_FR1 (Table 9), with the only change to water chemistry being the addition of salts to increase hardness to approximately 700 mg/L CaCO₃.

Comparison of water quality data to provincial and federal water quality guidelines indicated that water quality parameters were below levels of potential concern, with the following exceptions:

- Alkalinity—The “working” provincial guideline for alkalinity (total as CaCO₃) for protection of aquatic life is >20 mg/L, and this unbounded guideline applies to any freshwater body with low sensitivity to acid inputs (>8 mg/L dissolved calcium) (BC MOE 2017). This guideline was exceeded in all site waters, including reference water. The mean concentration in upstream reference water was 147 mg/L as CaCO₃, reflecting the elevated background concentrations of carbonates and bicarbonates in Elk Valley surface waters. Mine-influenced samples contained higher alkalinity (mean of 164 mg/L as CaCO₃ at Station EV_ER4 and 197 mg/L as CaCO₃ at Station GH_FR1). These modest elevations in alkalinity above reference levels are unlikely to elicit significant responses to aquatic toxicity endpoints.



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Table 7: Water Quality for Site Water EV_ER4 Prior to Supplemental Nitrate or Sulphate Amendment

Sample Characteristics				EV_ER4										
				Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 1-4 (Mean)	Week 1-4 (CV%)	Week 1-6 (Mean)	Week 1-6 (CV%)	
Field Date Sampled				25-Oct-2016	1-Nov-2016	8-Nov-2016	15-Nov-2016	22-Nov-2016	29-Nov-2016					
Client Sample ID				EV_ER4	EV_ER4-RD2	EV_ER4_RD3	EV_ER4_RD4	EV_ER4_RD5	EV_ER4_RD6					
Lab Date Sampled				26-Oct-2016	2-Nov-2016	9-Nov-2016	16-Nov-2016	23-Nov-2016	30-Nov-2016					
Time Sampled				10:00	11:30	10:30	14:11	0:00	12:00					
ALS Sample ID				L1848912-3	L1852463-3	L1855744-3	L1858716-3	L1861625-3	L1864606-3					
Parameter	Unit	BC MOE Aquatic Life Guideline	CCME Aquatic Life Guideline											
Physical Tests (Water)														
Total Dissolved Solids	mg/L	—	—	305	293	298	289	289	299	296	2%	296	2%	
Hardness, Total (as CaCO3)	mg/L	—	—	249	257	253	253	265	248	253	1%	254	2%	
Anions and Nutrients (Water)														
Alkalinity, Total (as CaCO3)	mg/L	20	W	163	162	167	162	162	164	164	1%	163	1%	
Ammonia, Total (as N)	mg/L	1.2	pH	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	—	—	—	—	
Chloride (Cl)	mg/L	150	A	120	2.02	1.92	1.97	1.96	2.00	2.00	2%	2.0	2%	
Nitrate (as N)	mg/L	3	A	2.9	2.91	2.89	3.00	2.93	2.88	2.88	2%	2.9	2%	
Nitrite (as N)	mg/L	0.02	A	0.06	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	—	—	—	
Phosphorus (P)-Total	mg/L	0.005-0.015	A	0.004-0.100	0.0038	0.0053	0.0036	0.0023	<0.0020	0.0044	33%	0.0039	28%	
Sulphate (SO4)	mg/L	309-429	H	—	77.3	75.5	76.4	75.9	76.6	76.4	1%	76	1%	
Total Metals (Water)														
Aluminum (Al)-Total	mg/L	—	—	0.1	0.0099	0.0106	0.0071	0.0109	0.0065	0.0110	18%	0.0093	22%	
Antimony (Sb)-Total	mg/L	0.009	W	—	<0.00010	0.00012	<0.00010	0.00027	<0.00010	<0.00010	—	—	—	
Arsenic (As)-Total	mg/L	0.005	A	0.005	0.00025	0.00017	0.00020	0.00016	0.00021	0.00018	21%	0.0002	17%	
Barium (Ba)-Total	mg/L	1	W	—	0.0689	0.0696	0.0662	0.0660	0.0697	0.0684	0.068	3%	0.068	2%
Beryllium (Be)-Total	mg/L	0.00013	W	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Boron (B)-Total	mg/L	1.2	A	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	—	—	—	
Cadmium (Cd)-Total	mg/L	0.00029	H	0.00022	0.0000103	0.0000171	0.0000159	0.0000159	0.0000175	0.0000147	0.000015	21%	0.000015	17%
Calcium (Ca)-Total	mg/L	—	—	—	65.2	68.9	65.4	64.6	69.3	64.9	66	3%	66	3%
Cesium (Cs)-Total	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Chromium (Cr)-Total	mg/L	0.0010-0.0089	W	0.0010-0.0089	0.00029	0.00025	0.00024	0.00033	0.00034	0.00025	0.00028	15%	0.00028	15%
Cobalt (Co)-Total	mg/L	0.004	A	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Copper (Cu)-Total	mg/L	0.006	H	0.0033	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	—	—	—	
Iron (Fe)-Total	mg/L	1	A	0.3	0.013	0.010	<0.010	0.014	0.010	<0.010	0.012	17%	0.012	18%
Lead (Pb)-Total	mg/L	0.0086	H	0.0053	0.000087	<0.000050	<0.000050	0.000052	<0.000050	<0.000050	—	—	—	
Lithium (Li)-Total	mg/L	—	—	—	0.0089	0.0085	0.0098	0.0098	0.0098	0.0098	0.0093	7%	0.0094	6%
Magnesium (Mg)-Total	mg/L	—	—	—	21.6	20.5	21.3	22.0	22.2	20.8	21	3%	21	3%
Manganese (Mn)-Total	mg/L	1.265	H	—	0.00103	0.00108	0.00087	0.00102	0.00090	0.00088	0.001	9%	0.00096	9%
Molybdenum (Mo)-Total	mg/L	1	A	0.073	0.00113	0.00119	0.00117	0.00123	0.00124	0.00118	0.0012	4%	0.0012	3%
Nickel (Ni)-Total	mg/L	0.11-0.15	W	0.13	0.00053	0.00072	0.00084	0.00061	0.00071	0.00058	0.00068	20%	0.00067	17%
Phosphorus (P)-Total	mg/L	0.005-0.015	A	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	—	—	—	
Potassium (K)-Total	mg/L	—	—	—	0.650	0.635	0.652	0.690	0.663	0.699	0.66	4%	0.66	4%
Selenium (Se)-Total	mg/L	0.002	A	0.001	0.010	0.011	0.011	0.011	0.011	0.011	4%	0.011	4%	
Silicon (Si)-Total	mg/L	—	—	—	1.99	2.04	2.02	1.97	2.10	2.11	2.0	2%	2.0	3%
Silver (Ag)-Total	mg/L	0.0015	H	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Sodium (Na)-Total	mg/L	—	—	—	2.20	2.26	2.19	2.45	2.35	2.64	2.3	5%	2.3	7%
Strontium (Sr)-Total	mg/L	—	—	—	0.243	0.242	0.245	0.247	0.249	0.24	0.24	1%	0.24	1%
Sulfur (S)-Total	mg/L	—	—	—	27.0	27.7	27.9	26.4	29.7	27.4	27	3%	28	4%
Thallium (Tl)-Total	mg/L	0.0008	W	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Tin (Sn)-Total	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Titanium (Ti)-Total	mg/L	—	—	—	<0.00030	<0.00030	<0.00030	0.00040	<0.00030	<0.00030	—	—	—	
Uranium (U)-Total	mg/L	0.0085	W	0.015	0.00124	0.00124	0.00135	0.00137	0.00125	0.00129	0.0013	5%	0.0013	4%
Vanadium (V)-Total	mg/L	—	—	—	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	—	—	—	
Zinc (Zn)-Total	mg/L	0.0525	H	0.03	0.0186	<0.0030	<0.0030	0.0364	0.0046	<0.0030	0.0275	46%	0.0199	80%
Dissolved Metals (Water)														
Aluminum (Al)-Dissolved	mg/L	0.05	A	—	0.0013	0.0017	0.0014	0.0017	0.0011	0.0022	0.0015	14%	0.0016	25%
Antimony (Sb)-Dissolved	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Arsenic (As)-Dissolved	mg/L	—	—	—	0.00014	0.00016	0.00014	0.00016	0.00015	0.00016	0.00015	8%	0.00015	6%
Barium (Ba)-Dissolved	mg/L	—	—	—	0.0674	0.0685	0.0632	0.0648	0.0678	0.0670	0.066	4%	0.066	3%
Beryllium (Be)-Dissolved	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Boron (B)-Dissolved	mg/L	—	—	—	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	—	—	—	
Cadmium (Cd)-Dissolved	mg/L	—	—	—	0.0000112	0.0000116	0.0000117	0.0000104	0.0000129	0.0000102	0.000011	5%	0.000011	9%
Calcium (Ca)-Dissolved	mg/L	—	—	—	63.7	68.4	65.4	62.7	66.5	63.9	65	4%	65	3%
Cesium (Cs)-Dissolved	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Chromium (Cr)-Dissolved	mg/L	—	—	—	0.00021	0.00017	0.00019	0.00023	0.00027	0.00020	0.0002	13%	0.00021	16%
Cobalt (Co)-Dissolved	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Copper (Cu)-Dissolved	mg/L	—	—	—	<0.00020	<0.00036	<0.00020	<0.00020	<0.00020	<0.00020	—	—	—	
Iron (Fe)-Dissolved	mg/L	—	—	—	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	—	—	—	
Lead (Pb)-Dissolved	mg/L	—	—	—	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	—	—	—	
Lithium (Li)-Dissolved	mg/L	—	—	—	0.0085	0.0082	0.0096	0.0095	0.0092	0.0097	0.009	8%	0.0091	7%
Magnesium (Mg)-Dissolved	mg/L	—	—	—	20.9	19.8	21.8	21.8	21.5	19.7	21	5%	21	5%
Manganese (Mn)-Dissolved	mg/L	—	—	—	0.00066	0.00066	0.00065	0.00061	0.00054	0.00058	0.00065	4%	0.00062	8%
Molybdenum (Mo)-Dissolved	mg/L	—	—	—	0.00109	0.00111	0.00113	0.00113	0.00114	0.00114	0.0011	2%	0.0011	2%
Nickel (Ni)-Dissolved	mg/L	—	—	—	<0.00050	0.00060	0.00068	0.00055	0.00057	<0.00050	0.00061	11%	0.0006	10%
Phosphorus (P)-Dissolved	mg/L	—	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	—	—	—	
Potassium (K)-Dissolved	mg/L	—	—	—	0.624	0.639	0.700	0.704	0.644	0.670	0.67	6%	0.66	5%
Selenium (Se)-Dissolved	mg/L	—	—	—	0.0106	0.0105	0.0110	0.0105	0.0108	0.0101	0.011	2%	0.011	3%
Silicon (Si)-Dissolved	mg/L	—	—	—	1.88	1.93	2.00	1.89	1.88	1.95	1.9	3%	1.9	2%
Silver (Ag)-Dissolved	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Sodium (Na)-Dissolved	mg/L	—	—	—	2.12	2.23	2.22	2.41	2.30	2.38	2.2	5%	2.3	5%
Strontium (Sr)-Dissolved	mg/L	—	—	—	0.237	0.234	0.245	0.236	0.238	0.237	0.24	2%	0.24	2%
Sulfur (S)-Dissolved	mg/L	—	—	—	25.8	25.0	26.3	25.5	26.3	24.8	26	2%	26	2%
Thallium (Tl)-Dissolved	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Tin (Sn)-Dissolved	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.00014	—	—	—	
Titanium (Ti)-Dissolved	mg/L	—</												



NITRATE AND SULPHATE CHRONIC TOXICITY

Table 8: Water Quality for Site Water GH_FR1 Prior to Supplemental Nitrate or Sulphate Amendment

Sample Characteristics				GH_FR1										
				Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 1-4 (Mean)	Week 1-4 (CV%)	Week 1-6 (Mean)	Week 1-6 (CV%)	
Field Date Sampled				25-Oct-2016	1-Nov-2016	8-Nov-2016	15-Nov-2016	22-Nov-2016	29-Nov-2016	—	—	—	—	
Client Sample ID				GH_FR1	GH_FR1-RD2	GH_FR1_RD3	GH_FR1_RD4	GH_FR1_RD5	GH_FR1_RD6	—	—	—	—	
Lab Date Sampled				26-Oct-2016	2-Nov-2016	9-Nov-2016	16-Nov-2016	23-Nov-2016	30-Nov-2016	—	—	—	—	
Time Sampled				10:00	11:30	10:30	14:11	0:00	12:00	—	—	—	—	
ALS Sample ID				L1848912-1	L1852463-1	L1855744-1	L1858716-1	L1861625-1	L1864606-2	—	—	—	—	
Parameter	Unit	BC MOE Aquatic Life Guideline	CCME Aquatic Life Guideline											
Physical Tests (Water)														
Total Dissolved Solids	mg/L	—	—	577	552	575	563	580	583	567	2%	572	2%	
Hardness, Total (as CaCO3)	mg/L	—	—	448	465	460	459	482	437	458	2%	459	3%	
Anions and Nutrients (Water)														
Alkalinity, Total (as CaCO3)	mg/L	20	W	193	192	204	197	195	199	197	3%	197	2%	
Ammonia, Total (as N)	mg/L	1.2	pH	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	—	—	—	—	
Chloride (Cl)	mg/L	150	A	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	—	—	—	—	
Nitrate (as N)	mg/L	3	A	10	10	10	10	10	11	10	1%	10	4%	
Nitrite (as N)	mg/L	0.02	A	0.06	0.06	0.06	0.06	0.06	0.06	0.06	—	—	—	
Phosphorus (P)-Total	mg/L	0.005-0.015	A	0.004-0.100	0.0069	0.0028	<0.0020	0.0036	0.0041	0.004	49%	0.004	35%	
Sulphate (SO4)	mg/L	309-429	H	—	226	225	218	221	223	212	2%	221	2%	
Total Metals (Water)														
Aluminum (Al)-Total	mg/L	—	—	0.1	0.0106	0.0210	0.0170	0.0090	0.0114	0.0093	0.014	39%	0.013	37%
Antimony (Sb)-Total	mg/L	0.009	W	—	0.00017	0.00029	0.00017	0.00055	0.00021	0.00014	0.0003	61%	0.00026	60%
Arsenic (As)-Total	mg/L	0.005	A	0.005	0.00018	0.00013	0.00013	0.00012	0.00018	0.00011	0.00014	19%	0.00014	22%
Barium (Ba)-Total	mg/L	1	W	—	0.103	0.104	0.0995	0.0959	0.109	0.107	0.1	4%	0.1	5%
Beryllium (Be)-Total	mg/L	0.00013	W	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Boron (B)-Total	mg/L	1.2	A	1.5	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	—	—	—	
Cadmium (Cd)-Total	mg/L	0.00029	H	0.00022	0.0000149	0.0000192	0.0000190	0.0000161	0.0000219	0.0000171	0.000017	12%	0.000018	14%
Calcium (Ca)-Total	mg/L	—	—	—	102	104	104	103	109	101	103	1%	104	3%
Cesium (Cs)-Total	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Chromium (Cr)-Total	mg/L	0.0010-0.0089	W	0.0010-0.0089	0.00013	0.00018	0.00017	0.00021	0.00021	0.00015	0.00017	19%	0.00018	18%
Cobalt (Co)-Total	mg/L	0.004	A	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Copper (Cu)-Total	mg/L	0.006	H	0.0033	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	—	—	—	
Iron (Fe)-Total	mg/L	1	A	0.3	0.014	0.025	0.029	0.018	0.021	0.019	0.022	31%	0.021	25%
Lead (Pb)-Total	mg/L	0.0086	H	0.0053	0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	—	—	—	
Lithium (Li)-Total	mg/L	—	—	—	0.0175	0.0166	0.0195	0.0188	0.0191	0.0196	0.018	7%	0.019	6%
Magnesium (Mg)-Total	mg/L	—	—	—	49.5	47.3	47.6	50.8	51.0	44.9	49	3%	49	5%
Manganese (Mn)-Total	mg/L	1.265	H	—	0.00134	0.00181	0.00192	0.00140	0.00199	0.00179	0.0016	18%	0.0017	16%
Molybdenum (Mo)-Total	mg/L	1	A	0.073	0.00106	0.00112	0.00111	0.00116	0.00106	0.000986	0.0011	4%	0.0011	6%
Nickel (Ni)-Total	mg/L	0.11-0.15	W	0.13	0.00268	0.00289	0.00300	0.00289	0.00307	0.00191	0.0029	5%	0.0027	16%
Phosphorus (P)-Total	mg/L	0.005-0.015	A	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	—	—	—	
Potassium (K)-Total	mg/L	—	—	—	1.29	1.29	1.27	1.40	1.32	1.31	1.3	5%	1.3	3%
Selenium (Se)-Total	mg/L	0.002	A	0.001	0.045	0.047	0.047	0.046	0.049	0.053	0.046	2%	0.048	6%
Silicon (Si)-Total	mg/L	—	—	—	2.19	2.30	2.33	2.31	2.29	2.33	2.3	3%	2.3	2%
Silver (Ag)-Total	mg/L	0.0015	H	0.00025	<0.000010	<0.000010	<0.000010	<0.000010	0.000033	<0.000010	—	—	—	
Sodium (Na)-Total	mg/L	—	—	—	1.98	2.11	1.93	2.26	2.07	2.12	2.1	7%	2.1	6%
Strontium (Sr)-Total	mg/L	—	—	—	0.150	0.148	0.154	0.157	0.154	0.148	0.15	3%	0.15	2%
Sulfur (S)-Total	mg/L	—	—	—	77.6	80.8	80.4	78.4	83.4	71.4	79	2%	79	5%
Thallium (Tl)-Total	mg/L	0.0008	W	0.0008	<0.000010	0.000016	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Tin (Sn)-Total	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Titanium (Ti)-Total	mg/L	—	—	—	<0.00030	0.00063	<0.00030	<0.00030	<0.00030	<0.00030	—	—	—	
Uranium (U)-Total	mg/L	0.0085	W	0.015	0.00244	0.00246	0.00264	0.00265	0.00243	0.00242	0.0025	4%	0.0025	4%
Vanadium (V)-Total	mg/L	—	—	—	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	—	—	—	
Zinc (Zn)-Total	mg/L	0.0525	H	0.03	0.0032	<0.0030	<0.0030	0.0231	0.0558	0.0072	0.013	107%	0.022	107%
Dissolved Metals (Water)														
Aluminum (Al)-Dissolved	mg/L	0.05	A	—	0.0012	0.0014	0.0013	<0.0010	0.0011	<0.0010	0.0013	8%	0.0013	10%
Antimony (Sb)-Dissolved	mg/L	—	—	—	0.00016	0.00019	0.00016	0.00019	0.00016	0.00013	0.00018	10%	0.00017	14%
Arsenic (As)-Dissolved	mg/L	—	—	—	<0.00010	0.00011	<0.00010	0.00010	<0.00010	<0.00010	—	—	—	
Barium (Ba)-Dissolved	mg/L	—	—	—	0.101	0.103	0.0968	0.0967	0.103	0.104	0.099	3%	0.1	3%
Beryllium (Be)-Dissolved	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Boron (B)-Dissolved	mg/L	—	—	—	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	—	—	—	
Cadmium (Cd)-Dissolved	mg/L	—	—	—	0.0000140	0.0000090	0.0000147	0.0000159	0.0000164	0.0000155	0.000013	23%	0.000014	19%
Calcium (Ca)-Dissolved	mg/L	—	—	—	99.9	102	99.7	101	104	99.9	101	1%	101	2%
Cesium (Cs)-Dissolved	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Chromium (Cr)-Dissolved	mg/L	—	—	—	0.00011	0.00011	<0.00010	0.00013	<0.00010	<0.00010	—	—	—	
Cobalt (Co)-Dissolved	mg/L	—	—	—	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	—	—	—	
Copper (Cu)-Dissolved	mg/L	—	—	—	<0.00020	0.00022	0.00022	<0.00020	<0.00020	<0.00020	—	—	—	
Iron (Fe)-Dissolved	mg/L	—	—	—	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	—	—	—	
Lead (Pb)-Dissolved	mg/L	—	—	—	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	—	—	—	
Lithium (Li)-Dissolved	mg/L	—	—	—	0.0166	0.0156	0.0182	0.0181	0.0178	0.0195	0.017	7%	0.018	8%
Magnesium (Mg)-Dissolved	mg/L	—	—	—	48.5	44.3	46.0	48.9	48.1	43.1	47	5%	46	5%
Manganese (Mn)-Dissolved	mg/L	—	—	—	0.00104	0.00122	0.00120	0.00111	0.00119	0.00155	0.0011	7%	0.0012	14%
Molybdenum (Mo)-Dissolved	mg/L	—	—	—	0.00104	0.00105	0.00108	0.00112	0.00103	0.000944	0.0011	3%	0.001	6%
Nickel (Ni)-Dissolved	mg/L	—	—	—	0.00253	0.00275	0.00282	0.00273	0.00278	0.00186	0.0027	5%	0.0026	14%
Phosphorus (P)-Dissolved	mg/L	—	—	—	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	—	—	—	
Potassium (K)-Dissolved	mg/L	—	—	—	1.28	1.21	1.24	1.37	1.26	1.32	1.3	5%	1.3	5%
Selenium (Se)-Dissolved	mg/L	—	—	—	0.0460	0.0466	0.0468	0.0476	0.0500	0.0454	0.047	1%	0.047	3%
Silicon (Si)-Dissolved	mg/L	—	—	—	2.06	2.08	2.09	2.08	2.09	2.19	2.1	1%	2.1	2%
Silver (Ag)-Dissolved	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Sodium (Na)-Dissolved	mg/L	—	—	—	1.97	2.01	1.87	2.12	1.93	2.05	2.0	5%	2.0	4%
Strontium (Sr)-Dissolved	mg/L	—	—	—	0.146	0.143	0.148	0.151	0.147	0.146	0.15	2%	0.15	2%
Sulfur (S)-Dissolved	mg/L	—	—	—	72.4	74.5	72.9	72.7	75.0	69.2	73	1%	73	3%
Thallium (Tl)-Dissolved	mg/L	—	—	—	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	—	—	—	
Tin (Sn)-Dissolved	mg/L	—</												



NITRATE AND SULPHATE CHRONIC TOXICITY

Table 9: Hardness for Site Water GH_FR1-HH Prior to Supplemental Nitrate Amendment

Sample Characteristics				GH_FR1-HH									
				Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 1-4 (Mean)	Week 1-4 (CV%)	Week 1-6 (Mean)	Week 1-6 (CV%)
Field Date Sampled				25-Oct-2016	1-Nov-2016	8-Nov-2016	15-Nov-2016	22-Nov-2016	29-Nov-2016				
Client Sample ID				GH_FR1-HH	GH_FR1-RD2-HH	GH_FR1_RD3-HH	GH_FR1_RD4-HH	GH_FR1_RD5-HH	GH-FR1_RD6-HH				
Lab Date Sampled				26-Oct-2016	2-Nov-2016	9-Nov-2016	16-Nov-2016	23-Nov-2016	30-Nov-2016				
Time Sampled				10:00	11:30	10:30	14:11	0:00	12:00				
ALS Sample ID				—	—	—	—	—	—				
Parameter	Unit	BC MOE Aquatic Life Guideline	CCME Aquatic Life Guideline										
Physical Tests (Water)													
Hardness, Total (as CaCO3)	mg/L	—	—	709	717	684	706	719	672	704	2%	701	3%

Notes: W = Working Guideline; A = Approved Guideline; I = Interim guideline; pH = pH dependent guideline; H = hardness-dependent guideline (value shown is adjusted to 150 mg/L hardness); — = no guideline available, or value not calculable; CV = coefficient of variance. Shaded cells indicate exceedance of BC Approved or Working Water Quality Guidelines.



- Selenium— The long-term average selenium guideline is 2 µg/L total selenium. This guideline was exceeded in all mine-influenced site waters, but none of the reference water samples. Although selenium may cause acute toxicity at high concentrations, the observed concentration ranges in mine-influenced water (10–11 µg/L in EV_ER4; 45–49 µg/L in GH_FR1) fall below the concentration ranges for acute toxicity and for chronic toxicity elicited through water exposures only (BC MOE 2012, USEPA 2016). The most deleterious effect on aquatic organisms is due to its chronic bioaccumulative properties; these chronic effects are manifested primarily through selenium accumulation primarily through the dietary pathway, and not directly through water (Chapman et al. 2010).
- Zinc—The maximum concentration of total zinc in any individual water sample was 55.8 µg/L in Week 5 at GH_FR1. This concentration marginally exceeded the provincial water quality guideline adjusted to hardness of 150 mg/L as CaCO₃ (lower bound used for screening) but this elevated zinc concentration was transitory, such that the 30-d average zinc concentration was below the screening guideline. Furthermore, the zinc concentration was well below the guideline using sample-specific hardness (302 µg/L) and the dissolved concentration zinc concentration in this sample was only 2.0 µg/L.

In summary, the water quality in all unamended samples was appropriate for use in the study, with few if any parameters present that could influence the toxicological endpoints in the study. Moreover, even if responses occurred due to conditions of unamended water quality, these would be observed in all treatments for each water source (and hence controlled for). The amended water samples therefore served as suitable reference waters against which the corresponding exposure series of nitrate, sulphate, and hardness amendments could be compared.

3.1.3 Variations in Water Quality

An additional consideration for study interpretation was the variance in water quality characteristics among weekly sampling events at the same location. The correspondence of weekly samples to toxicity tests was:

- Week 1 (25 October 2018)—water supply for 7-d *C. dubia* tests, and the first week of all *P. promelas* and *O. mykiss* tests
- Weeks 2–4 (1 November, 8 November, and 15 November 2018)—water supply for all *P. promelas* and *O. mykiss* tests
- Week 5 (22 November 2018)—water supply for final week of *P. promelas* tests, and penultimate week of *O. mykiss* tests with nitrate
- Week 6 (29 November 2018)— water supply for final week of *O. mykiss* tests with nitrate only

Because the fish toxicity tests used between 4 and 6 separate samples of site water, it was important to confirm that variations in water quality did not confound the study design. This was evaluated through calculation of coefficients of variance (CVs) for each analyte and water source (Tables 6–10) and through graphical analysis of key constituents (Figure 2). The CV is a measure of relative variability, calculated as the ratio of the standard deviation to the arithmetic mean. CVs were not calculated for substances with a majority of values below detection limits. For most analytes, the CVs were less than 0.1. When results were evaluated over the full six weeks, only a few analytes yielded CVs of greater than 0.5:

- EV_ER4—total zinc (CV=0.80), dissolved zinc (CV=0.79)



- GH_FR1—total zinc (CV=1.07), dissolved zinc (CV=0.69), and total antimony (CV=0.60)

Figure 2 portrays the week-to-week variance in water chemistry for each sampling location. The substances that are of greatest importance to the study design (nitrate, sulphate, hardness, and other indicators of ionic strength) exhibited very low variance among sampling events, with concentration differences generally within the range of analytical precision, and no indications of systematic trends over the six week period. The constituent with the highest degree of variation (zinc) is depicted in Figure 2(h). The degree of variation was greatest in sample GH_FR1 and elevated CVs were driven by two anomalous total zinc concentrations of over 30 µg/L. The reason for the elevated variance for zinc is unknown, but as all of the concentrations are below water quality guidelines once adjusted to sample-specific hardness, such variations are expected to have negligible consequences for the toxicological outcomes of the study.

3.2 Statistical Methods

3.2.1 General Procedures

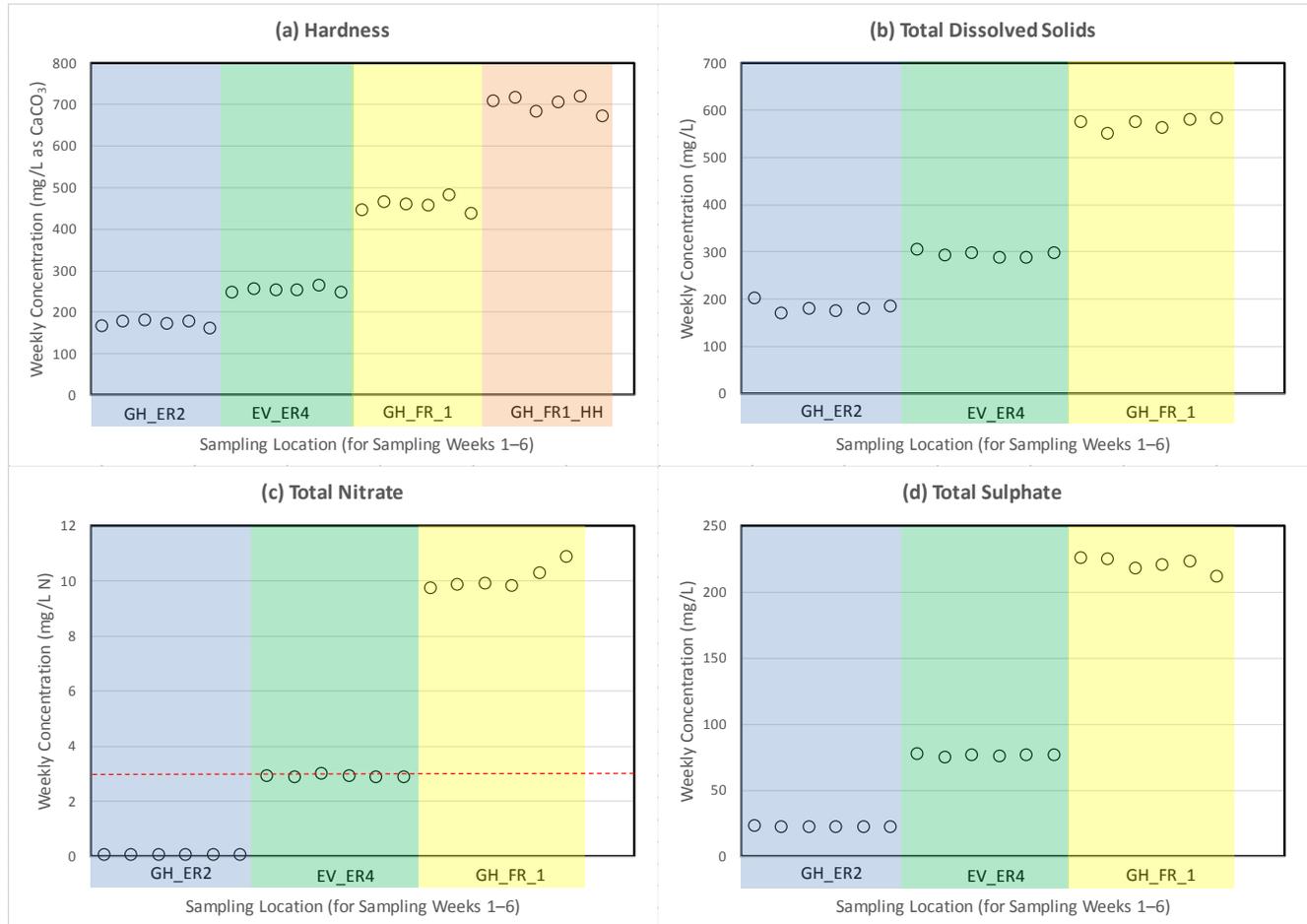
The data analysis followed the procedures identified in the final approved study design (Appendix C) and included the following data processing procedures:

- The responses were calculated as the mean response in the amended waters divided by the treatment mean in the unamended waters, then multiplied by 100 to provide a response on a percentage basis. All inhibition concentration estimates (IC/EC_x) in this report are based on scaling to the matched unamended site water for each water source.
- Responses were calculated as both treatment mean responses (for presentation of general trends, such as those depicted on Figure 3) and as replicate-specific responses (for use in formal statistical analysis).
- Statistical endpoints were calculated using replicate-specific results to avoid loss of information through aggregation. This applied to the statistics presented in the laboratory report (i.e., CETIS calculations) and to analysis of covariance (ANCOVA) used to identify groups of related stations.
- The “unamended waters” mentioned above refer to the site waters prior to the introduction of supplemental nitrate or sulphate additions, but after hardness adjustment (if applicable).
- For each toxicity test and substance (nitrate or sulphate), a single negative laboratory control was run concurrently with the treatments from all base waters and amendments. This was possible because the tests (both control and exposed treatments) were initiated on the same day for each test protocol.
- Laboratory control performance was not used to standardize test water responses; rather it was used for quality assurance performances (i.e., test validity and as an indication of organism health).



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Figure 2: Water Quality Characteristics of Base Waters Prior to Amendment with Nitrate or Sulphate, Collected from Six Consecutive Weeks in Fall 2016



Notes:

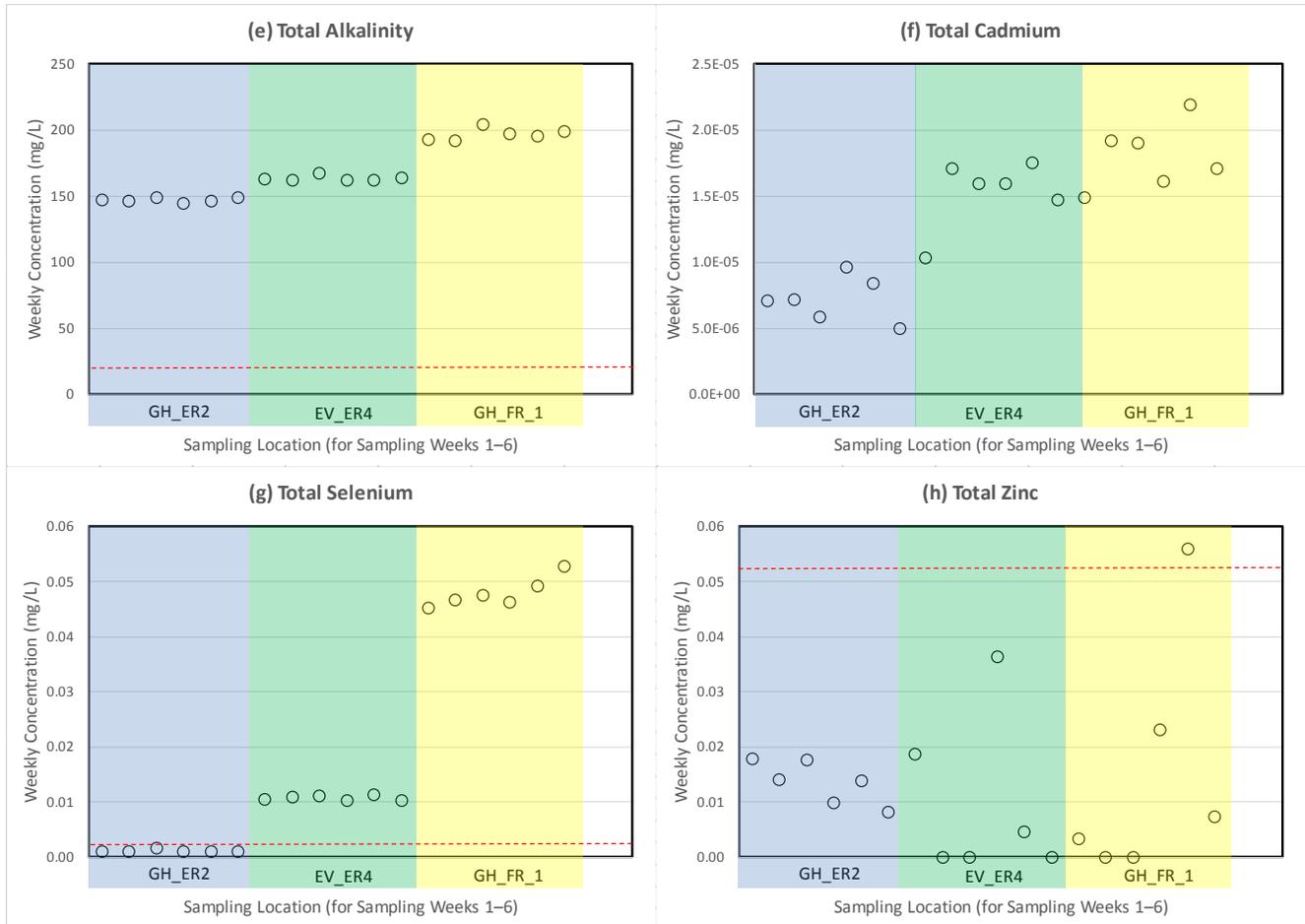
From left to right, water samples correspond to 25 October 2016, 1 November 2016, 8 November 2016, 15 November 2016, 22 November 2016, and 29 November 2016.

Red dashed line depicts BC provincial water quality guideline (if available).

- 7-d (three brood) *C. dubia* tests used samples from Week 1 only
- 32-d *P. promelas* tests used samples collected in Weeks 1–5
- 30-d *O. mykiss* tests used samples collected in Weeks 1–4 (test terminated prior to need for Week 5 refresh)
- 39-d *O. mykiss* tests used samples from Weeks 1–6



NITRATE AND SULPHATE CHRONIC TOXICITY



Notes:

From left to right, water samples correspond to 25 October 2016, 1 November 2016, 8 November 2016, 15 November 2016, 22 November 2016, and 29 November 2016.

Red dashed line depicts BC provincial water quality guideline (standardized to 150 mg/L hardness for zinc).

- 7-d (three brood) *C. dubia* tests used samples from Week 1 only
- 32-d *P. promelas* tests used samples collected in Weeks 1–5
- 30-d *O. mykiss* tests used samples collected in Weeks 1–4 (test terminated prior to need for Week 5 refresh)
- 39-d *O. mykiss* tests used samples from Weeks 1–6

3.2.2 Endpoint Estimates

The evaluation of toxicity test endpoint data from the Fall 2016 study was conducted in two ways:

- default endpoint estimates from the laboratory report (provided for each water source)
- analysis of covariance (ANCOVA) of individual replicate data



The laboratory report (Appendix A) provided calculations of LC_{50} and EC_{25}/IC_{25} values from concentration-response calculations conducted for each water source (i.e., waters from different sampling locations, reflecting different base chemistry prior to amendment with nitrate or sulphate). These estimates were calculated using Tidepool (2013) software and were calculated based on comparison of the results in nitrate or sulphate-amended waters to the corresponding unamended site waters. The use of EC_{25}/IC_{25} for sublethal endpoints is consistent with the standard reporting of the analytical laboratory for chronic toxicity test results; however, the EC_{10}/IC_{10} values and EC_{20}/IC_{20} values were also obtained from the Tidepool (2013) data sheets for comparison to previous testing results. The EC_{20}/IC_{20} values are considered more reliable for making comparisons among studies because an EC_{20}/IC_{20} value has narrower confidence bands relative to smaller effect sizes (i.e., improved reliability for making comparisons among studies), and because use of a 20% response to a sensitive species has precedent for use in aquatic ecological risk assessments (Mebane 2010, Suter et al. 1995). Lower effect sizes (e.g., EC_{10}/IC_{10}) have typically been used to represent a conservative threshold for absence of effects, rather than a threshold level for negative effects (CCME 2007). An effect level of 10% or less is generally considered to be indistinguishable from normal variability in control or reference organisms (Environment Canada 2005). Alternative point estimates to the EC_{20}/IC_{20} values such as the 10% and 50% effect estimates are provided in the detailed statistical analyses for each test species presented in the attachments to Appendix A. Section 6.0 compares results of previous testing using both EC_{10}/IC_{10} values and EC_{20}/IC_{20} values.

The ANCOVA approach was a refinement of the statistical analysis intended to identify water sources that exhibited similar concentration-response profiles. Where concentration-response profiles were statistically different among water sources, it was preferable to derive separate endpoint estimates; however, aggregation of water sources yielding similar concentration-response was preferred, to improve precision of the endpoint estimates and improved statistical power. Initially, to explore the data and evaluate best curve fitting models, various model fits such as Gompertz, log-linear, sigmoidal, and cubic models were analyzed. However, because the range of concentrations tested did not encompass very high magnitude responses (such as adverse effects of 70 to 100%), the S-shaped (sigmoidal) model types commonly applied for curve fitting to aquatic toxicity data did not result in the best model fit. Most Gompertz models and other sigmoidal models did not converge on solution and/or lack of model fit was evident. Therefore, the model fitting evaluated linear and quadratic models; these model types provided satisfactory representation of the observed concentration-response profiles. The spacing of the treatments across the exposure axis was often suited to an analysis with untransformed data (i.e., transformations were not needed to avoid violating underlying statistical model assumptions). If assumptions such as normality were not met, we used ANCOVA on log-transformed data or rank-ANCOVA (non-parametric tests).

In order to determine whether to pool data from multiple water sources, we used ANCOVA to test the equality of slopes between locations. If slopes were significantly different between locations, this was an indication of difference in concentration-response, and we then conducted pairwise comparisons (Tukey test) to determine which groups differed from each other.

Sections 4 and 5 provide summary tables for the selected statistical models used to fit the data. Additional details for the ANCOVA model fits, including parameter estimates, are provided in Appendix D.



4.0 NITRATE CHRONIC TOXICITY STUDY

The Nitrate Chronic Toxicity Study consisted of the following three components, reflective of the test species being considered: an amphibian testing component, an invertebrate test component, and a fish test component. Each of these components is discussed in more detail below. The health histories of the test organisms used in the exposures were acceptable and met the requirements of the test protocols. With the exception of amphibian tests, the tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests (Appendix A). There were no deviations from the test methodologies, other than planned modifications described in the study design (Golder 2016b).

4.1 Amphibian Testing

Amphibian testing was required as part of the RAEMP approval letter, which required additional nitrate toxicity testing, including "amphibian toxicity testing to assess the sensitivity of representative species to nitrate using long-term metamorphosis tests." The first stage of amphibian testing entailed completion of a chronic survival, growth and development pilot study with *L. pipiens* exposed to nitrate and sulphate. The purpose of this study was to ensure that this species could be cultured and tested successfully in the laboratory, and to provide preliminary indications of effects ranges for testing in subsequent experiments.

Pilot study findings of relevance to the design of the nitrate study included:

- The results of the pilot study indicated that the testing conditions used in this study were suitable for testing with *L. pipiens*.
- The test was able to detect effects of nitrate to larval survival and provided preliminary estimates of LC₂₀ and LC₅₀ values (19.2 mg/L NO₃-N and 28.8 mg/L NO₃-N, respectively); testing above and below these concentrations was recommended for definitive testing. No effects were observed for any growth endpoint at any exposure concentration.
- There was a statistically significant difference in survival and days to metamorphosis between a soft laboratory water control and reconstituted hard water. This effect was identified as an important consideration for the 2016 amphibian testing of the hard waters of the Elk Valley.

The detailed study design for additional amphibian testing was prepared by Golder and Nautilus (2016) and submitted by Teck on 15 April 2016, and subsequently reviewed by EMC. Following review of the amphibian study design by EMC, the *L. pipiens* tests were initiated as planned by Nautilus in their Burnaby BC laboratory, with testing commencing in June 2016. However, a high rate of mortality was observed early in the exposure period, including the negative controls, ultimately causing a control failure and termination of the test. As described in Teck (2016), a second round of testing in July 2016, including copper amendment to control for potential microbial effects, also failed to meet laboratory control performance criteria. Consequently, the 2016 amphibian testing program was terminated. The laboratory theorized that poor test performance may be related to specimen batch health, possibly related to a viral or bacterial infection within the supplied egg masses. The program was repeated in 2017, and tadpoles hatched successfully prior to the initiation of the test; however, a high rate of mortality was again observed early in the exposure period, including the negative controls. A second attempt in 2017 using the same egg supply using laboratory synthetic water was attempted but ultimately yielded another control failure.

The consequence of the control failures described above is that all amphibian tests must be reinitiated in 2018 using new organism cultures. Leopard frogs have a single annual development testing window, requiring that



testing will be postponed until late Spring of 2018. Given the two consecutive years of control failures, some revisions to the test have been discussed with EMC to reduce potential for additional test failures:

- Use of synthetic (laboratory-prepared) water, prepared to match the composition of Elk Valley conditions prior to amendment with nitrate salts, would reduce the potential for microbial effects in the exposure water.
- Use of a second supplier of leopard frog egg masses will be investigated as a contingency for potentially compromised egg quality. The leopard frog egg masses used in 2016 and 2017 were obtained from Dr. Vance Trudeau at the University of Ottawa. These eggs were sourced from a local experimental pond, then transported to the laboratory where gravid females were induced to spawn. Although egg quality may not be responsible for the test failures in 2016 or 2017, addition of a second egg supplier would reduce potential for problems in 2018, and allow for switching of egg supply if one source produces superior quality specimens.
- Division of the testing program into two discrete batches of treatments will be undertaken, either in separate parts of a single laboratory, or divided between two laboratories. In the event that one batch of tests exhibits indication of compromised conditions (e.g., early mortality in controls), the egg/larvae from the other batch of tests will be used to set up a new set of treatments so that testing can still be completed within the seasonal testing window.

4.2 Invertebrate Testing

4.2.1 Methods

The test species used to represent the invertebrate community was *C. dubia*, using the Environment Canada three-brood survival and reproduction protocol. The summary of test conditions for this protocol is provided in Appendix B (Table B-2).

The 2016 nitrate testing program for *C. dubia* included:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location on the Elk River upstream of Greenhills Operation (GH_ER2)
 - Elk River upstream of Grave Creek, and downstream of the confluence with the Fording River (EV_ER4)
 - Upper Fording River upstream of Josephine Falls and downstream of Greenhills Creek (GH_FR1)
- Amendment (spiking) of the water collected at GH_FR1 to create modified base water⁴ with higher hardness (700 mg/L as CaCO₃). The amendment introduced magnesium sulphate and calcium sulphate, using a ratio of calcium:magnesium that is representative of mine-influenced conditions (i.e., 2.6:1). The purpose of this amendment was to represent higher hardness conditions that are observed in some portions of the Fording River watershed upstream of GH_FR1, and that are observed during periods of elevated hardness during winter base flow. The name convention assigned to this high-hardness modified base water was GH_FR1-HH.
- For all base waters (GH_ER2, EV_ER4, GH_FR1, GH_FR1-HH), amendment of samples with nitrate additions (using sodium nitrate salts) was conducted to create a series of six additional nitrate concentrations

⁴ Base water is defined as site water (with or without hardness adjustment) prior to the introduction of the supplemental nitrate.



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per sample site, similar to the approach used in the 2013 work completed in support of the EVWQP (Teck 2014).

- For each base water, the nitrate concentrations were developed to span from expected no-effect concentrations to concentrations expected to yield significant toxicity (i.e., approximately 50% inhibition of reproduction). Given the hardness-dependence previously observed for nitrate, the concentration series was different for each water source (i.e., higher hardness waters evaluated higher nitrate concentrations).
- A modification to the Environment Canada three-brood survival and reproduction protocol was incorporated to provide additional replication for the survival endpoint. This modification has been incorporated in response to a recommendation from the EMC based on review of the final draft study design. For each standard test replicate (i.e., each of the 10 test replicates per treatment required by the Environment Canada protocol), two additional replicates were prepared, such that each treatment contained an A, B, and C replicate. The A replicate was evaluated following the standard test protocol, with quantification of both the survival of the first-generation females and three broods of reproduction (neonates). The B and C replicates were evaluated for mortalities at end of test only. Accordingly, the reproduction endpoint included data from up to 30 neonate broods (from 10 first-generation females, each contributing up to three broods), whereas the survival endpoint included data from a total of 30 first-generation females.

The total measured concentrations of nitrate in the nitrate treatments are summarized below. These concentrations reflect the sum of both the nitrate in the base waters plus nitrate added through the addition of sodium nitrate.

- Station GH_ER2—0.14 (unamended), 3.4, 5.2, 9.1, 15.1, 24.0, and 43.9 mg/L NO₃-N
- Order Station EV_ER4—2.9 (unamended), 5.2, 8.1, 12.1, 19.6, 30.9, and 49.5 mg/L NO₃-N
- Order Station GH_FR1—9.8 (unamended), 14.3, 20.6, 25.4, 38.1, 53.8, and 73.4 mg/L NO₃-N
- Treatment GH_FR1-HH (Station GH_FR1 water with supplemented hardness)—10.5 (no nitrate amendment), 14.4, 20.4, 27.2, 38.2, 52.4, and 73.9 mg/L NO₃-N.

These measured concentrations closely matched the target concentrations specified in the study design.

4.2.2 Results

Detailed tabulated results of the nitrate toxicity tests using *C. dubia* are provided in Tables 8 to 11 of Appendix A. The site waters showed no adverse effects relative to the negative laboratory controls for this species.

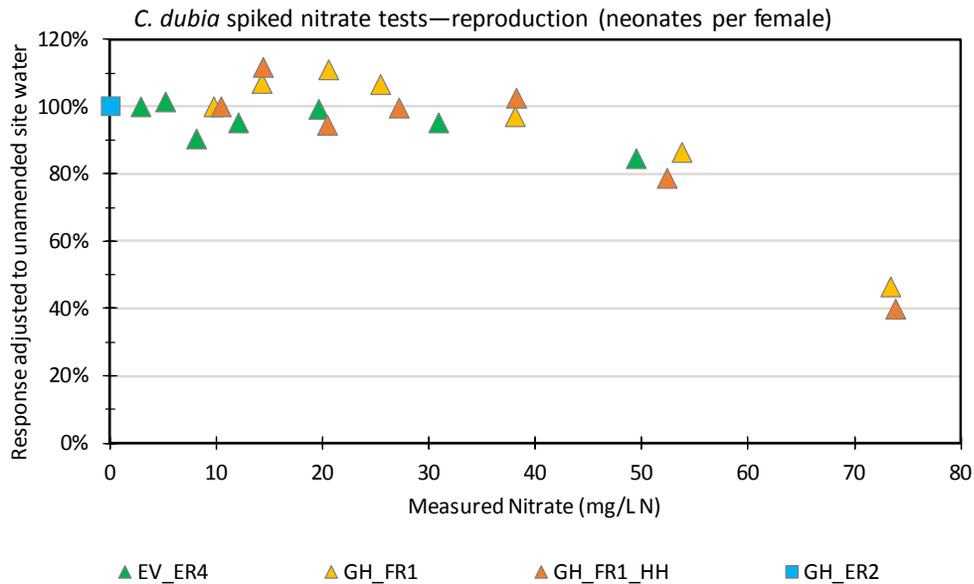
For tests with nitrate, there were no adverse effects relative to the unamended samples observed on survival of *C. dubia* with any of the four site waters that were tested. Survival ranged from 90–100% in all treatments, and was 100% in most treatments. The incorporation of additional replication for the survival endpoint provided additional confidence that there was no significant mortality across the study. With the exception of the 8.1 mg/L treatment for EV_ER4, there was either zero mortalities or only a single mortality in each treatment. Reproduction was inhibited in site waters GH_ER2, GH_FR1, and hardness-adjusted site water GH_FR1 (Figure 3); the IC₂₅ values were 37.3, 56.7 and 51.9 mg/L NO₃-N, respectively (Table 10). There were no adverse effects observed in the test with site water EV_ER4, resulting in an IC₂₅ of >49.5 mg/L NO₃-N.



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The ANCOVA analysis (Figure 4; Table 11) indicated that the reference water GH_ER2 was different from the three other locations (mine-influenced waters) so we grouped water sources accordingly and calculated endpoints separately for these groups.

Figure 3: Mean Reproduction of *C. dubia* by Treatment for Tests conducted in Nitrate Supplemented Water in 2016.



Fording River GH_FR1-HH consists of GH_FR1 water hardness-supplemented to 700 mg/L as CaCO₃ prior to addition of nitrate.

Table 10: CETIS Statistical Endpoints from Individual Water Sources from *C. dubia* Nitrate Tests

Watercourse	Teck WQ Station ID	Survival LC ₂₀ (mg/L SO ₄)	Reproduction IC ₂₀ (mg/L NO ₃ -N)	Reproduction IC ₂₅ (mg/L NO ₃ -N)	Reproduction IC ₅₀ (mg/L NO ₃ -N)
Fording River	GH_FR1	>73.4	54.5 (43.3–57.8)	56.7 (48.5–59.8)	69.7 (65.8–n/a)
	GH_FR1-HH	>73.9	47.7 (42.9–56.3)	51.9 (44.8–58.1)	65.9 (58.2–72.3)
Elk River	GH_ER2	>43.8	29.6 (18.5–42.5)	37.3 (22.6–n/a)	>43.8
	EV_ER4	>49.5	>49.5	>49.5	>49.5

Point estimates shown with 95% confidence limits, where applicable (n/a—confidence limits not applicable).

CETIS—Comprehensive Environmental Toxicity Information System (Tidepool 2013).



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Figure 4: Reproduction of *C. dubia* (Individual Replicate Data) for Tests conducted in Nitrate Supplemented Water in 2016, with Best Fit Model for Each Station (left pane) and Grouped Water Sources (right pane).

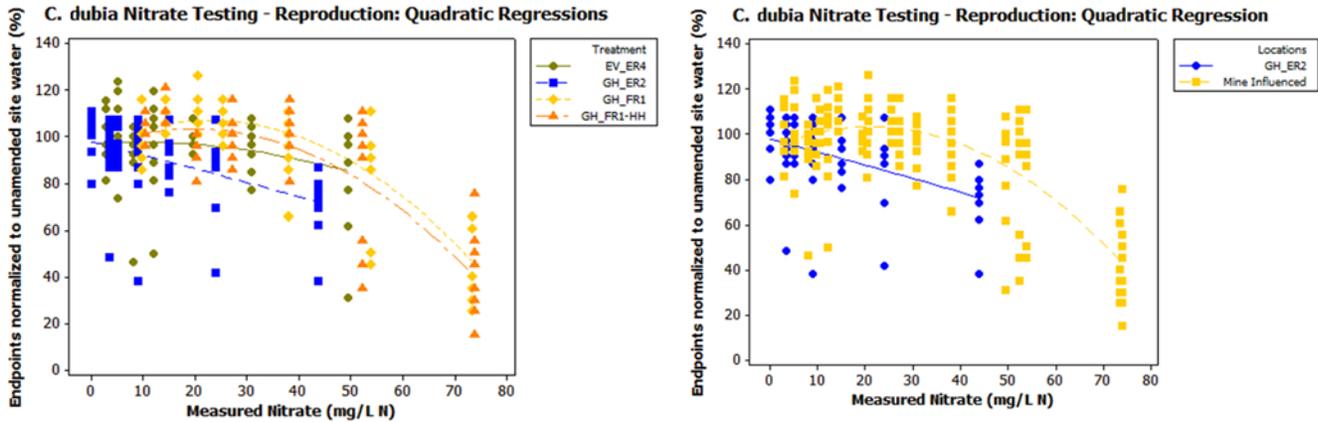


Table 11: ANCOVA Results for *C. dubia* Reproduction in Nitrate Tests in 2016

Water Source	Compared to Water Source	Statistical Difference ⁽¹⁾	P-Value ⁽²⁾	Conclusion
EV_ER4	GH_ER2	10.37	0.004*	Reference water different from mine-influenced
EV_ER4	GH_FR1	-7.44	0.044*	Marginal result, considered not different once effect of simultaneous multiple comparisons considered
EV_ER4	GH_FR1-HH	-4.34	0.42	Not different
GH_ER2	GH_FR1	-17.81	<0.001*	Reference water different from mine-influenced
GH_ER2	GH_FR1-HH	-14.72	<0.001*	Reference water different from mine-influenced
GH_FR1	GH_FR1-HH	3.09	0.70	Not different
Water Source	Calculated IC ₁₀ (mg/L NO ₃ -N)	Calculated IC ₂₀ (mg/L NO ₃ -N)	Calculated IC ₅₀ (mg/L NO ₃ -N)	
GH_ER2	15.1	29.5	69.9	Reference water
Pooled (EV_ER4, GH_FR1, GH_FR1-HH)	50.7	57.3	72.3	Mine-influenced waters

Pairwise comparison statistically significant at $\alpha=0.05$.

- (1) Statistical difference = Difference between treatment means, evaluated for statistical significance using Tukey's Honestly Significant Difference test.
- (2) P-Values are the results of pairwise comparisons between the treatments listed in the first two columns of the table. Tukey's Honestly Significant Difference test was used to generate pairwise results where the overall treatment effect was statistically significant.



The concentration-response for *C. dubia* reproduction, including the IC_x estimates in Table 11 and the graphical depictions in Figure 3 and Figure 4, indicate several findings of importance:

- The sensitivity of *C. dubia* to nitrate was greatest in the reference site waters (GH_ER2), confirming the findings from previous testing that water composition (particularly hardness) is a modifier for nitrate toxicity to *C. dubia*.
- The overall sensitivity of *C. dubia* to nitrate was lower than observed in previous testing of Elk Valley waters, with IC₂₀ values for reproduction greater than observed in the Phase 1 Mixture Study or the Fall 2013 Study.
- The observed IC₂₀ values for reproduction in 2016 were consistent with literature-based values gleaned from other testing of this species for similar hardness conditions (Baker et al. 2017).
- The nature of hardness-dependence observed in Fall 2016 was slightly different than observed in previous site-specific testing. Specifically, the three mine influenced waters tested in 2016 exhibited similar sensitivity, indicating that the ameliorative effect of hardness may reach a maximum in the Fording River, and remain stable at even higher hardness conditions such as those represented by GH_FR1-HH.

4.3 Fish Testing

4.3.1 Methods

The test species used to represent fish was the rainbow trout *Oncorhynchus mykiss*. Emphasis on rainbow trout embryo-alevin tests in the 2016 testing program was based on the demonstrated sensitivity of early life stage trout to nitrate, as reported in literature studies (McGurk et al. 2006) and in previously completed site-specific tests (Golder and Nautilus 2013). Rainbow trout were also specifically referenced for consideration in the RAEMP Approval Condition. Although the semi-annual Permit-based testing for rainbow trout under Section 9.8(ii) entails use of the Environment Canada (1998) ~30-day embryo-alevin test protocol, a modification to a slightly longer duration was applied for evaluation of nitrate. The 39-day early life stage rainbow trout test (with full adsorption of the yolk sac) targeted the most sensitive species and life stage identified in previous site-specific testing. The summary of test conditions for this protocol is provided in Appendix B (Table B-3).

The 2016 nitrate testing program for rainbow trout included:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location on the Elk River upstream of Greenhills Operation (GH_ER2)
 - Elk River upstream of Grave Creek, and downstream of the confluence with the Fording River (EV_ER4)
 - Upper Fording River upstream of Josephine Falls, and downstream of Greenhills Creek (GH_FR1)
- Amendment (spiking) of the water collected at GH_FR1 to create an additional base water with higher hardness (700 mg/L as CaCO₃), exactly as described in Section 4.2.1 for invertebrate testing.
- For all base waters (GH_ER2, EV_ER4, GH_FR1, GH_FR1-HH), amendment of samples with nitrate additions (using sodium nitrate salts) to create a series of six additional nitrate concentrations per sample site.
- The range of the concentration series was slightly different than for *C. dubia*, reflecting the differences in the effect concentrations from past site-specific testing. The concentration ranges have been specified separately



for each water source due to the anticipated hardness-dependence of nitrate toxicity, as documented in the literature for several freshwater aquatic species.

The measured concentrations in the treatments were:

- Station GH_ER2—0.1 (unamended), 3.1, 5.1, 8.9, 14.4, 25.8, and 45 mg/L NO₃-N
- Order Station EV_ER4—2.9 (unamended), 5.1, 9.0, 14.7, 25.4, 42.7, and 69.3 mg/L NO₃-N
- Order Station GH_FR1—10.2 (unamended), 14.1, 20.2, 27.5, 38.4, 53.6, and 74.5 mg/L NO₃-N
- Treatment GH_FR1-HH (GH_FR1 with supplemented hardness)—10.2 (no nitrate amendment), 14.9, 22.3, 34.7, 49.3, 72.9, and 110.6 mg/L NO₃-N

These concentrations reflect the sum of both the nitrate in the collected waters plus nitrate added through the addition of sodium nitrate. These concentrations closely matched the target concentrations specified in the study design.

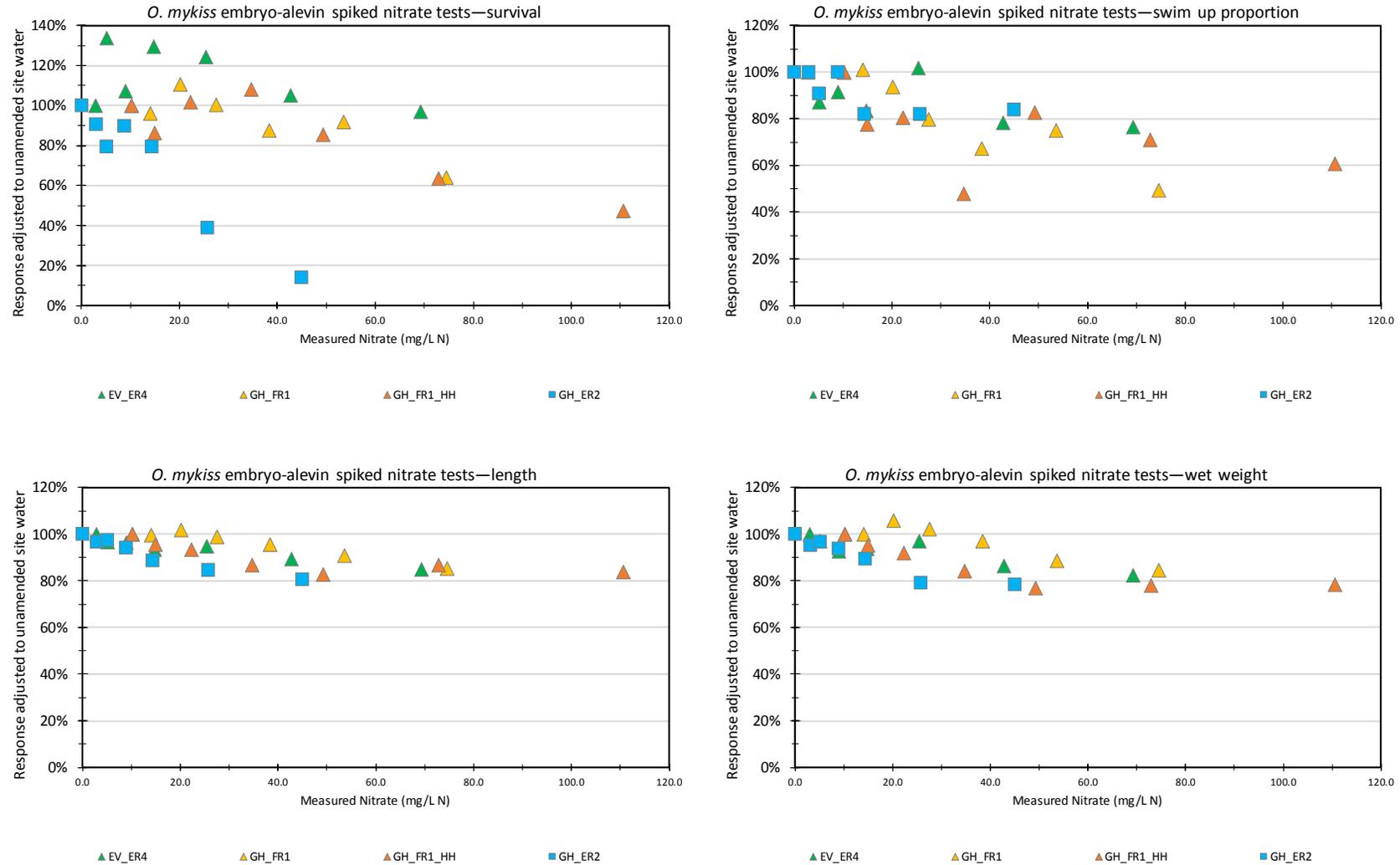
4.3.2 Results

For tests with nitrate, there were no adverse effects on rainbow trout relative to the negative laboratory control in the unamended site waters GH_ER2, EV_ER4, or GH_FR1; however, the hardness adjusted GH_FR1-HH sample exhibited significantly lower survival and proportion reaching swim-up relative to the negative control (Table 21 of Appendix A). All treatments of GH_FR1-HH appear to be similarly affected by the hardness adjustment; survival rates were approximately half or less of the negative control performance in all GH_FR1-HH treatments. This effect is attributable to the hardness adjustment rather than to the water composition of the original sample, because the GH_FR1 sample without hardness adjustment did not exhibit these differences relative to the negative control. Furthermore, there were no properties of the unamended GH_FR1 sample that would have influenced the sensitivity of fish during the hardness adjustment (Section 3.1.2). The results for GH_FR1-HH have higher uncertainty than the other tested waters, but a nitrate concentration-response was still evident in spite of this additional source of variance (Figure 5).



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Figure 5: Mean Responses for Rainbow Trout Endpoints by Treatment for Tests conducted in Nitrate Supplemented Water in 2016.



Fording River GH_FR1-HH consists of GH_FR1 water hardness-supplemented to 700 mg/L as CaCO₃ prior to addition of nitrate.



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Adverse effects were observed on survival of *O. mykiss* with site waters GH_ER2, GH_FR1, and hardness adjusted GH_FR1 (Figure 5); the resulting LC₂₀ values were 15.8, 59.9 and 60.4 mg/L NO₃-N, respectively. The LC₂₀ for survival in EV_ER4 was greater than the highest concentration tested (>69.3 mg/L NO₃-N). For the proportion of surviving fish that reached swim-up by the end of the exposure, effects were observed in the GH_FR1 and hardness-adjusted GH_FR1 samples, with EC₂₀ values of 33.4 and 14.5 mg/L NO₃-N, respectively. Conversely, there were no large magnitude adverse effects on proportion of fish reaching swim-up in samples GH_ER2 or EV_ER4 (Figure 5). No mean responses greater than 20% were observed on the length and wet weight endpoints in any of the samples, although a slight reduction in growth with increasing nitrate concentration was observed (Figure 5; Table 12).

Table 12: CETIS Statistical Endpoints for Individual Water Sources from *O. mykiss* Tests

Watercourse	Teck WQ Station ID	Survival			Swim-Up Proportion		
		LC ₂₀ (mg/L NO ₃ -N)	LC ₂₅ (mg/L NO ₃ -N)	LC ₅₀ (mg/L NO ₃ -N)	EC ₂₀ (mg/L NO ₃ -N)	EC ₂₅ (mg/L NO ₃ -N)	EC ₅₀ (mg/L NO ₃ -N)
Fording River	GH_FR1	59.9 (n/a–n/a)	64.0 (1.9–n/a)	>74.5	33.4 (2.3–54.4)	39.1 (6.1–67.6)	>74.5
	GH_FR1-HH	60.4 (n/a–n/a)	67.2 (n/a–n/a)	103.4 (n/a–n/a)	14.5 (10.4–145.3)	23.6 (5.7–n/a)	>110.6
Elk River	GH_ER2	15.8 (6.7–21.5)	17.2 (8.0–23.0)	25.2 (16.7–31.7)	>45	>45	>45
	EV_ER4	>69.3	>69.3	>69.3	39.9 (20.5–n/a)	>69.3	>69.3

Watercourse	Teck WQ Station ID	Length			Weight		
		IC ₂₀ (mg/L NO ₃ -N)	IC ₂₅ (mg/L NO ₃ -N)	IC ₅₀ (mg/L NO ₃ -N)	IC ₂₀ (mg/L NO ₃ -N)	IC ₂₅ (mg/L NO ₃ -N)	IC ₅₀ (mg/L NO ₃ -N)
Fording River	GH_FR1	>74.5	>74.5	>74.5	>74.5	>74.5	>74.5
	GH_FR1-HH	>110.6	>110.6	>110.6	>110.6	>110.6	>110.6
Elk River	GH_ER2	>45	>45	>45	24.5 (11.5–n/a)	>45	>45
	EV_ER4	>69.3	>69.3	>69.3	>69.3	>69.3	>69.3

Point estimates shown with 95% confidence limits, where applicable (n/a—confidence limits not applicable).
 CETIS—Comprehensive Environmental Toxicity Information System (Tidepool 2013).

The analysis of covariance for the survival endpoint is presented in Table 13 and Figure 6. The pairwise comparisons of site waters indicated that the reference water GH_ER2 exhibited a distinct concentration-response from the remaining site waters, which were found to be similar and therefore pooled. For sublethal endpoints, a significant relationship was observed between nitrate exposure concentration and response; however, the sensitivity to nitrate was lower than for the survival endpoint, and the groupings of water sources were different (Table 14).



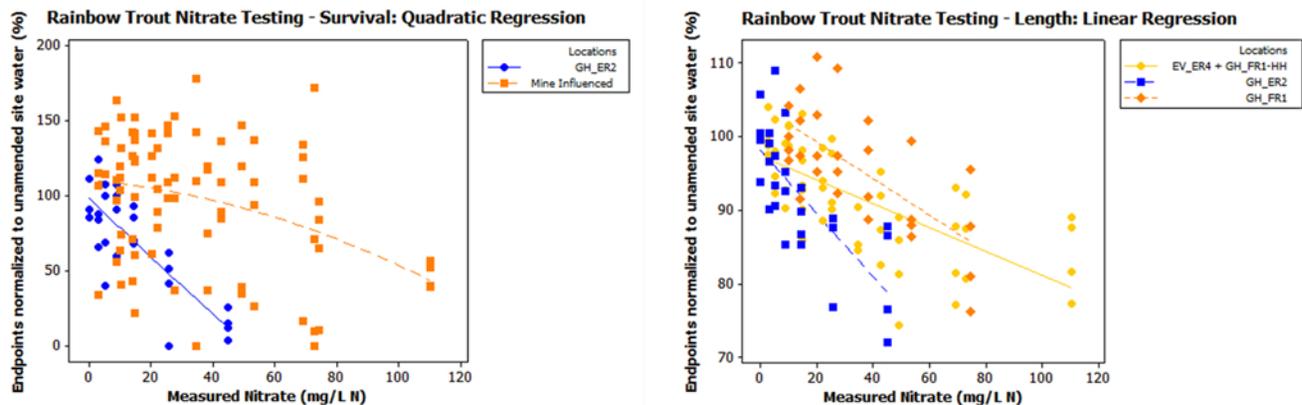
NITRATE AND SULPHATE CHRONIC TOXICITY

Table 13: ANCOVA Results for *O. mykiss* Survival Endpoint—Nitrate Tests in 2016

Water Source	Compared to Water Source	Statistical Difference	P-Value	Conclusion
EV_ER4	GH_ER2	50.74	<0.001*	Reference water different from mine-influenced
EV_ER4	GH_FR1	12.62	0.37	Not different
EV_ER4	GH_FR1-HH	14.40	0.28	Not different
GH_ER2	GH_FR1	-38.13	<0.001*	Reference water different from mine-influenced
GH_ER2	GH_FR1-HH	-36.35	0.001*	Reference water different from mine-influenced
GH_FR1	GH_FR1-HH	1.78	0.996	Not different
Water Source	Calculated LC ₁₀ (mg/L NO ₃ -N)	Calculated LC ₂₀ (mg/L NO ₃ -N)	Calculated LC ₅₀ (mg/L NO ₃ -N)	
GH_ER2	4.9	9.9	25.1	Reference water
Pooled (EV_ER4, GH_FR1, GH_FR1-HH)	34.4	55.3	98.4	Mine-influenced waters

*Pairwise comparison statistically significant at $\alpha=0.05$.

Figure 6: Concentration-Response for Survival and Growth of Rainbow Trout Exposed to Nitrate Supplemented Water in 2016, with Best Fit Model for Grouped Water Sources.





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Table 14: ANCOVA Results for *O. mykiss* Sublethal Endpoints—Nitrate Tests in 2016

Water Source	Calculated EC ₁₀ /IC ₁₀ (mg/L NO ₃ -N)	Calculated EC ₂₀ /IC ₂₀ (mg/L NO ₃ -N)	Calculated EC ₅₀ /IC ₅₀ (mg/L NO ₃ -N)	Comments
Swim-up Proportion				
All water sources pooled	11.7	25.1	>111	Quadratic model provided best fit
Length				
GH_ER2	22.8	45.7	>111	Linear model provided best fit
GH_FR1	42.1	84.2	>111	Linear model provided best fit
Pooled (EV_ER4 + GH_FR1-HH)	60.1	>111	>111	Linear model provided best fit
Weight				
All water sources pooled	32.6	83.7	>111	Quadratic model provided best fit

In summary, the ANCOVA-based evaluations for rainbow trout identified the following:

- Survival—The comparison of slopes identified that reference water was significantly different from all mine-influenced waters, and that the mine-influenced waters should be pooled (Table 13). Survival was the most sensitive test endpoint to nitrate in both reference water and mine-influenced site water.
- Swim-up Proportion—Slopes were not significantly different among locations (ANCOVA: $p=0.33$), indicating that all water sources should be pooled (Table 14).
- Length—Slopes were significantly different among locations (ANCOVA: $p=0.005$). Post-hoc pairwise comparisons for length identified that EV_ER4 and GH_FR1-HH should be pooled, with the remaining water sources modelled separately (Table 14; Figure 6).
- Weight—Slopes were not significantly different among locations (ANCOVA: $p=0.33$), indicating that all water sources could be pooled together (Table 14).

The concentration-response analysis for rainbow trout toxicity endpoint data indicates several findings of importance:

- The survival and proportion swim-up endpoints were the most sensitive indicators of nitrate toxicity to rainbow trout. Although a weak significant trend was identified for growth (both as weight and length), the IC_x values for growth were higher than for the other endpoints.
- The sensitivity of *O. mykiss* to nitrate was greatest in the reference site waters (GH_ER2), similar to the findings for the water flea *C. dubia*. Water composition (particularly hardness) therefore appears to be a modifier for nitrate toxicity to *O. mykiss*. This finding is consistent with other studies of hardness-dependence (Meays and Nordin 2013, Baker et al. 2017).



- The overall sensitivity of *O. mykiss* to nitrate in 2016 was similar to that observed in previous testing of Elk Valley waters, specifically the Phase 1 Mixture Study (Golder and Nautilus 2013). The swim-up proportion in the Phase 1 Mixture Study yielded an IC₂₀ of 25.7 mg/L NO₃-N, which compares favorably with the Fall 2016 pooled IC₂₀ of 25.1 mg/L NO₃-N (Table 14). The survival endpoint also yielded similar effects thresholds between the two programs; the survival endpoint in the Phase 1 Mixture Study yielded an LC₅₀ of 63.3 mg/L NO₃-N in mine-influenced water FR-B, which compares reasonably well with the Fall 2016 pooled LC₅₀ for mine-influenced waters of 98.4 mg/L NO₃-N.
- The three mine influenced waters tested in 2016 exhibited similar sensitivity, indicating that the ameliorative effect of hardness may reach a maximum in the Fording River high hardness conditions, and remain stable at even higher hardness conditions such as those represented by GH_FR1-HH.

4.4 Site Relevance of Nitrate Toxicity Endpoints

The Environmental Monitoring Committee requested discussion of the degree to which the toxicity testing endpoints from nitrate testing is expected to provide protection of the various taxa that compose the aquatic communities in the Elk Valley watershed. Both the published literature on nitrate toxicity and the site-specific testing support the conclusion that the surrogate test species testing in Fall 2016 (e.g., crustaceans and trout) are the most sensitive organisms identified in standardized testing. Several lines of evidence support the conclusion that the benchmarks developed using the surrogate species and test endpoints from the Fall 2016 study will be protective of most, if not all, resident species:

- The literature review of nitrate toxicity used to in support of the EVWQP (Teck 2014; Annex F, Appendix C) demonstrated that *C. dubia* reproduction is a sensitive endpoint relative to other invertebrate tests. In the literature, effect thresholds were identified for five invertebrate species, including the water fleas *C. dubia* and *Daphnia magna*, the amphipod *Hyalella azteca*, the midge *Chironomus dilutus* and the snail *Pomacea paludosa*. The most sensitive endpoints for effects of nitrate on invertebrates were derived from the studies of Baker et al. (2012), Nautilus 2013 and Rescan (2012), and these studies consistently indicated that crustaceans were the most sensitive to nitrate.
- The literature review of nitrate toxicity used to in support of the EVWQP (Teck 2014; Annex F, Appendix C) indicated that salmonids (e.g., rainbow trout, lake trout) are sensitive to nitrate toxicity relative to other tested fish species (e.g., Topeka shiner, fathead minnow), and that fish are more sensitive to nitrate exposure in the early life stages than as adults (Chambers et al. 2001). Therefore, the embryo-alevin exposures to rainbow trout over a chronic test duration, especially when extended to 39-d to encompass development to swim-up stage, are expected to be protective of all fish species.
- The site-specific testing of nitrate toxicity used to in support of the EVWQP (Teck 2014; Annex F) indicated that *C. dubia* reproduction was more sensitive to nitrate than any of the fish endpoints (including the 39-d rainbow trout test referenced above).
- A recent publication (Kellock et al. 2018) provides additional supporting evidence for the use of salmonids as a sensitive indicator of toxicity relative to another fish species. Kellock et al. investigated endocrine disruption in fathead minnows using nitrate exposures similar to ranges tested in the nitrate chronic toxicity study (i.e., up to 57 mg/L N). Body mass, condition factor, gonadal somatic index (GSI), incidence of intersex, and



vitellogenin induction were evaluated. No significant responses to survival or growth endpoints were observed at any concentration, although biochemical indicators such as vitellogenin were affected. This information suggests that rainbow trout, which yield chronic toxicity responses at concentrations lower than those causing adverse effects to fathead minnows, remain more sensitive indicators of nitrate toxicity.

- Species sensitivity distributions (SSDs) were developed in support of the EVWQP (Teck 2014; Annex F, Section 4.1.3), and applied specific recommendations concerning calculation methods, including decision rules for binning toxicological endpoints, as recommended by the Toxicology Working Group of the Technical Advisory Committee. The SSDs were derived using standardized hardness values, with individual toxicity endpoints standardized to 200 mg/L as CaCO₃ (Elk River) and 360 mg/L as CaCO₃ (Fording River) using a pooled slope to adjust to the appropriate hardness. These recommendations culminated in the following HC₅ concentrations (best estimate in mg/L NO₃-N, with lower and upper 95% confidence limits): Elk River: 11 (7 to 17) at a hardness of 200 mg/L as CaCO₃; Fording River: 20 (13 to 31) at a hardness of 360 mg/L as CaCO₃ (Golder 2014). These HC₅ estimates were higher than the benchmarks calculated directly from the most sensitive species (i.e., site-specific *C. dubia* reproduction endpoint data), providing additional evidence of the community-level protectiveness of the latter benchmarks used in SPO development.

The exact proportion of field taxa that would be protected by the site-specific aquatic benchmarks is not known, but is expected to be very high (greater than 95% of taxa based on the SSD analysis). The work conducted to date, which has emphasized the most sensitive known species and endpoints, provides confidence that concentrations below benchmarks would not cause community level effects, and would provide population level responses to a very low proportion of species (possibly zero). In addition, no population level effects are expected for species of high recreational or commercial value.

Sulphate testing for trout embryo-alevins confirmed previously documented sensitivity for this endpoint. The additional replication applied in 2016 was valuable given the high variance previously observed for the survival endpoint. The 2016 results remain broadly consistent with the site-specific Phase 1 Mixture Study and other literature on sulphate toxicity in high hardness waters. Testing at Simon Fraser University by Dr. Chris Kennedy (Meays and Nordin 2013) yielded IC₁₀ and IC₂₀ values for 21-d embryo-alevin survival of 654 mg/L SO₄ and 857 mg/L SO₄, respectively; this study was used as the technical basis for the ENV sulphate guideline. In comparison, the Fall 2016 testing yielded IC₁₀ and IC₂₀ values for 28-d embryo-alevin viability of 637 mg/L SO₄ and 787 mg/L SO₄.

5.0 SULPHATE CHRONIC TOXICITY STUDY

The Sulphate Chronic Toxicity Study consisted of three components, reflective of the test species being considered: an amphibian testing component, an invertebrate test component and a fish test component. Each of these components is discussed in more detail below. Some of the study design components for sulphate were very similar to those discussed in Section 4.0 for nitrate (e.g., same species and protocol identified for both substances). Where this occurs, reference is made to protocol details in Section 4.0; however, differences between programs (e.g., concentration series, sampling locations, sulphate-specific considerations) are described in this section.



5.1 Amphibian Testing

Amphibian testing was required as part of the sulphate chronic testing program; Section 9.8.1 of the Permit lists amphibians as candidate sensitive species for sulphate testing at high hardness. The first stage of amphibian testing entailed completion of a chronic survival, growth and development pilot study with *L. pipiens* exposed to nitrate and sulphate. Pilot study findings of specific relevance to the design of the sulphate study included:

- The results of the pilot study indicated that the testing conditions used in this study were suitable for testing with *L. pipiens*.
- No effects were detected that could be attributed to sulphate at concentrations up to 1,047 mg/L. Testing above this sulphate concentration was therefore recommended for future testing, recognizing that there are solubility constraints to introduction of very high sulphate concentrations.
- There was a statistically significant difference in survival and days to metamorphosis between a soft laboratory water control and reconstituted hard water. The potential for hardness-dependence has implication for the sulphate study design because amendment of water samples with sulphate salts will result in related changes to water hardness.

The detailed study design for additional amphibian testing was developed by Golder and Nautilus (2016) and submitted by Teck on 15 April 2016, and subsequently reviewed by EMC. Studies were initiated in 2016 and 2017, but could not be completed due to control failures, as described in Section 4.1, that affected both the nitrate and sulphate exposure treatments. Therefore, all amphibian tests must be reinitiated in 2018 using new organism cultures. The recommended revisions to the test procedures discussed in Section 4.1 for nitrate would also apply to the sulphate testing program. For the 2018 amphibian testing, exposures will be conducted concurrently for the nitrate and sulphate toxicity testing programs, but these constituents may be investigated in physically segregated test environments.

5.2 Invertebrate Testing

5.2.1 Methods

The test species used to represent the invertebrate community was *C. dubia*, using the Environment Canada three-brood survival and reproduction protocol. The summary of test conditions for this protocol is provided in Appendix B (Table B-2).

The 2016 sulphate testing program for *C. dubia* included:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location on the Elk River upstream of Greenhills Operation (GH_ER2)
 - Elk River upstream of Grave Creek, and downstream of the confluence with the Fording River (EV_ER4)—an area of lower hardness relative to GH_FR1, but higher than reference water hardness
 - Upper Fording River upstream of Josephine Falls, and downstream of Greenhills Creek (GH_FR1) —an area of high hardness under current mine-influenced conditions
- Amendment (spiking) of samples with sulphate additions, covering a range that extends from well below the SPO of 429 mg/L SO₄ to a maximum of 1345 mg/L SO₄.



- Sulphate was introduced using calcium and magnesium salts, and in proportion to observed calcium and magnesium ratios in the Fording River. This resulted in further increases to sample hardness, but in a manner representative of mining influences.

The total measured concentrations of sulphate in the base waters are summarized below. These concentrations reflect the sum of both the sulphate in the collected waters plus sulphate added through the addition of sulphate salts:

- Station GH_ER2—26 mg/L SO₄ (unamended)
- Station EV_ER4—79 (unamended), 360, 472, 615, 790, 1015, and 1345 mg/L SO₄
- Station GH_FR1—227 (unamended), 351, 456, 595, 781, 1030, and 1285 mg/L SO₄

These concentrations closely matched the target concentrations specified in the study design.

5.2.2 Results

Detailed tabulated results of the sulphate toxicity tests using *C. dubia* are provided in Tables 5 through 7 of Appendix A. The site waters showed no adverse effects relative to the negative laboratory controls for this species; the mean reproduction in the negative control was 18.2 neonates, the mean reproduction in upstream reference water was 19.5 neonates, and the mean reproduction in mine exposed unamended site waters ranged from 16.5 to 18.6 neonates. All of these results fall within the typical range of reproduction values for uncontaminated site waters tested in the laboratory.

For tests with sulphate, there were no observations of moderate to large adverse effects to *C. dubia* relative to the unamended samples, resulting in IC₂₅ values that were greater than the highest concentration of sulphate with the two water sources that were tested (i.e., EV_ER4 and GH_FR1). Survival ranged from 97 to 100% in all treatments; the only mortality was a single adult female in one of the GH_FR1 treatments. The incorporation of additional replication for the survival endpoint provided additional confidence that there was no significant mortality across the study.

The concentration-response for both mine-exposed water sources is depicted in Figure 7, and the CETIS summary statistics are presented in Table 15. The reproduction response did not exceed 20% across the entire range of sulphate exposures. When evaluated with ANCOVA, the slopes for the two water sources did not differ significantly (ANCOVA: $p = 0.76$), indicating that the results can be pooled (Figure 8).



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Figure 7: Mean Reproduction of *C. dubia* by Treatment for Tests conducted in Sulphate Supplemented Water in 2016

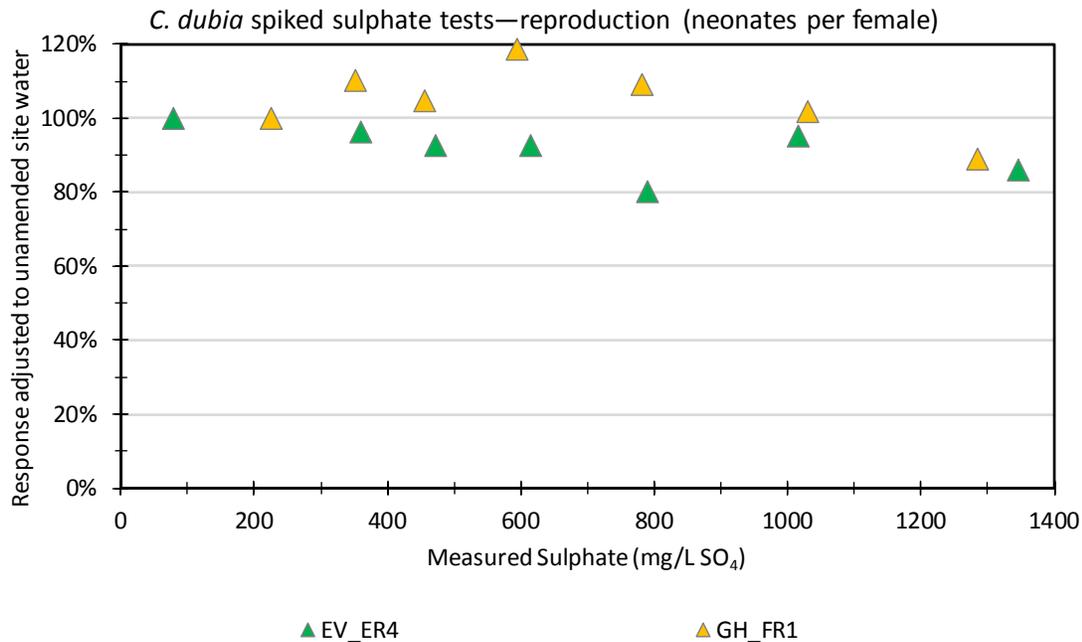


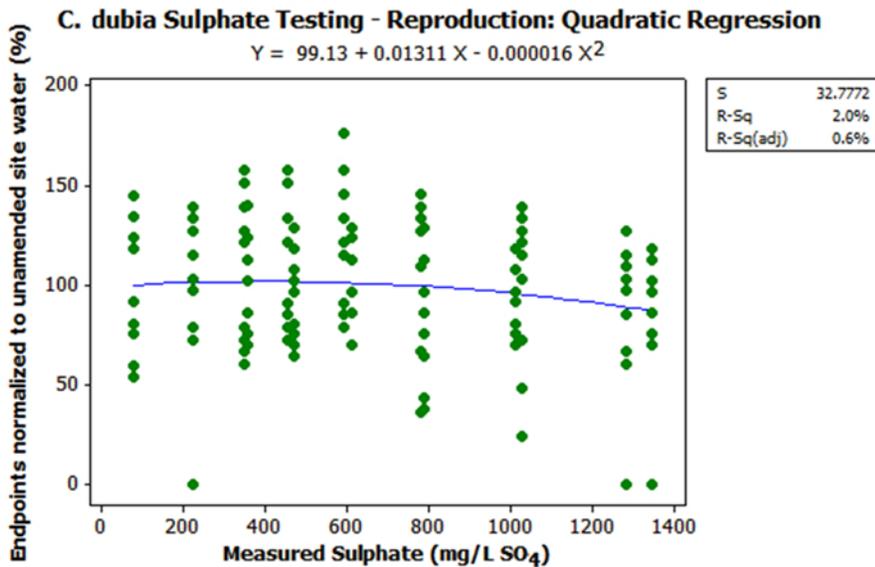
Table 15: CETIS Statistical Endpoints from Individual Water Sources in *C. dubia* Sulphate Tests

Watercourse	Teck WQ Station ID	Survival LC ₂₀ , LC ₂₅ , and LC ₅₀ (mg/L SO ₄)	Reproduction IC ₂₀ (mg/L SO ₄)	Reproduction IC ₂₅ (mg/L SO ₄)	Reproduction IC ₅₀ (mg/L SO ₄)
Fording River	GH_FR1	>1285	>1285	>1285	>1285
Elk River	GH_ER2	NT	NT	NT	NT
	EV_ER4	>1345	>1345	>1345	>1345

NT—Not tested across a concentration range (i.e., reference water only); no adverse effects were observed in GH_ER2 with 26 mg/L SO₄.
 CETIS—Comprehensive Environmental Toxicity Information System (Tidepool 2013).



Figure 8: Reproduction of *C. dubia* (Individual Replicate Data) for Tests conducted in Sulphate Supplemented Water in 2016, with Best Fit Model for Combined Water Sources.



The concentration-response for *C. dubia* reproduction, including the IC_x estimates in Table 15 and the graphical depictions in Figure 7 and Figure 8, indicate several findings of importance:

- The sensitivity of *C. dubia* to sulphate in 2016 was lower than observed in previous testing of Elk Valley waters, with IC₂₀ values for reproduction greater than observed in the Phase 1 Mixture Study or the Fall 2013 Study. The IC₂₀ for sulphate in hard water from the Phase 1 Mixture Study was 595 mg/L SO₄ (Golder and Nautilus 2013) and the corresponding IC₂₀ for sulphate in hard water from the EVWQP (which applied the geometric mean of the lowest unbounded concentration from Fall 2013 and the concentration from Phase 1 Mixture Toxicity Study) was 729 mg/L SO₄. In contrast the Fall 2016 study did not identify a 20% inhibition across the entire range of sulphate (i.e., unbounded IC₂₀ > 1345 mg/L SO₄).
- The observed IC₂₀ values for reproduction in 2016 were higher than literature-based values gleaned from other testing of this species in hard water (Meays and Nordin 2013). Elphick et al. (2011) derived an IC₂₅ for reproduction of *C. dubia* in very hard water (320 mg/L as CaCO₃) of 425 mg/L SO₄.
- The Fall 2016 testing did not identify a significant difference in sensitivity to sulphate based on water source. Although sulphate has demonstrated hardness-dependence for *C. dubia* reproduction, the differences between Elk Valley and Fording River water were not significant in terms of mediating *C. dubia* reproduction with the range of concentrations of sulphate and water hardness tested.

5.3 Fish Testing

5.3.1 Methods

The objective of the fish testing component for sulphate was to further assess the sensitivity of fish to sulphate under high hardness conditions. Previous testing completed in support of the EVWQP (Teck 2014) identified salmonids (specifically rainbow trout embryo-alevin development) as the most sensitive species to sulphate



exposure. The site-specific test results from 28-d embryo-alevin development tests in very high hardness water from the Fording River (Golder and Nautilus 2013) were similar to those documented by ENV (Meays and Nordin 2013) in the development of the water quality guideline for sulphate in high hardness water (429 mg/L SO₄ for water hardness of 181–250 mg/L as CaCO₃). However, high replicate variability was observed with previous testing of *O. mykiss* (Meays and Nordin 2013; Teck 2014), and additional testing was required to reduce uncertainty in the toxicity point estimates.

The test species used to represent fish were the rainbow trout (*Oncorhynchus mykiss*) and the fathead minnow (*Pimephales promelas*). The test methods for each are summarized below:

- Salmonid embryo-alevin test—The summary of test conditions for the rainbow trout embryo-alevin test is provided in Appendix B (Table B-3). The test protocol was modified to incorporate additional replicates (relative to the standard level of replication specified in Environment Canada 1998) to yield narrower confidence limits around the test endpoints. Specifically, the number of replicates was doubled relative to the standard test conditions for this protocol (i.e., 8 test replicates per treatment instead of 4).
- Fathead minnow larval test—The summary of test conditions for the fathead minnow larval development test is provided in Appendix B (Table B-4); the USEPA (1996) and ASTM (2013) protocols entail testing of survival, growth, and development of *P. promelas* larvae. The fathead minnow testing for sulphate also incorporated modification of test procedures to account for the potential interference by microbiological components of the samples. A copper amendment using 10 µg/L was established as a suitable compromise between the effectiveness of the treatment (ability to eliminate microbial interference) and the specificity of the treatment (ability to target microbes without causing toxicity from excess copper). The testing of base waters (without sulphate additions) included experiments with and without copper additions, whereas the site waters amended with additional sulphate all incorporated copper amendments.

The 2016 testing program for both fish species with sulphate included:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location on the Elk River upstream of Greenhills Operation (GH_ER2)
 - Elk River upstream of Grave Creek, and downstream of the confluence with the Fording River (EV_ER4)—an area of lower hardness relative to GH_FR1, but higher than reference water hardness
 - Upper Fording River upstream of Josephine Falls, and downstream of Greenhills Creek (GH_FR1)—an area of high hardness under current mine-influenced conditions
- Amendment (spiking) of samples with sulphate additions, covering a range that extends from well below the SPO of 429 mg/L SO₄ to high concentrations (approximately 1000 mg/L SO₄ for rainbow trout, and 1240 mg/L SO₄ for fathead minnows).
- Sulphate was introduced using calcium and magnesium salts, and in proportion to observed calcium and magnesium ratios in the Fording River. This resulted in further increases to sample hardness, but in a manner representative of mining influences.



The total measured concentrations of sulphate in the base waters are summarized below; these concentrations reflect the sum of both the sulphate in the collected waters plus sulphate added through the addition of sulphate salts:

- Fathead minnow—Station GH_ER2—23.4 mg/L SO₄ (unamended)
- Fathead minnow—Station EV_ER4—77.8 (unamended), 529, 639, 755, 951, 1107, and 1248 mg/L SO₄
- Fathead minnow—GH_FR1—217 (unamended), 456, 556, 683, 870, 1025, and 1234 mg/L SO₄
- Rainbow trout—Station GH_ER2—23.4 mg/L SO₄ (unamended)
- Rainbow trout—EV_ER4—76.5 (unamended), 406, 481, 579, 700, 827, and 1008 mg/L SO₄
- Rainbow trout—GH_FR1—220 (unamended), 399, 479, 571, 685, 833, and 1001 mg/L SO₄

These concentrations closely matched the target concentrations specified in the study design.

5.3.2 Results

Results of the toxicity tests using *O. mykiss* are provided in Tables 15 through 21 of Appendix A. For tests with sulphate, adverse effects relative to the laboratory control were observed on survival and viability with the unamended site waters GH_ER2 and GH_FR1, but not with sample EV_ER4. There were some observations of fungal growth, which may have contributed to the adverse effects observed in these water sources.

For site water GH_FR1, EC₂₀ values for survival and viability of rainbow trout were 818 and 828 mg/L SO₄, respectively. For site water EV_ER4, the EC₂₀ values for survival and viability were 635 and 865 mg/L SO₄, respectively (Table 16). The concentration-response profile (Figure 9) shows a general progression of increased mortality (and associated viability) at increasing sulphate concentrations, but no clear response for the length or weight endpoints.

Results of the sulphate toxicity tests using *P. promelas* are provided in Tables 12 through 14 of Appendix A. The unamended samples (i.e., no copper additions) exhibited significant adverse effects on survival and biomass relative to the laboratory control, consistent with prior findings that have demonstrated microbial effects associated with the site waters. The remaining discussion focuses on the copper-amended treatments only.

One treatment in GH_FR1 site water (479 mg/L SO₄) yielded reduced survival, including two replicates below 60% survival (Figure 10); these results may indicate microbial response in spite of the low-level copper amendment. However, this anomalous result was not observed in higher sulphate treatments or water sources, did not substantially influence the concentration-response statistics, and was retained in the calculation of statistics. The concentration-response profile (Figure 10, Table 17) shows no systematic relationships between increasing sulphate concentration and any of the test endpoints. A minor depression in biomass in site water GH_FR1 was observed at intermediate sulphate concentrations. However, compared to the laboratory control, biomass was similar across all test concentrations up to and including the highest concentration of sulphate tested, without evidence of a monotonic or consistent concentration-response. This apparent effect may have reflected random variability within this test rather than a real adverse response.

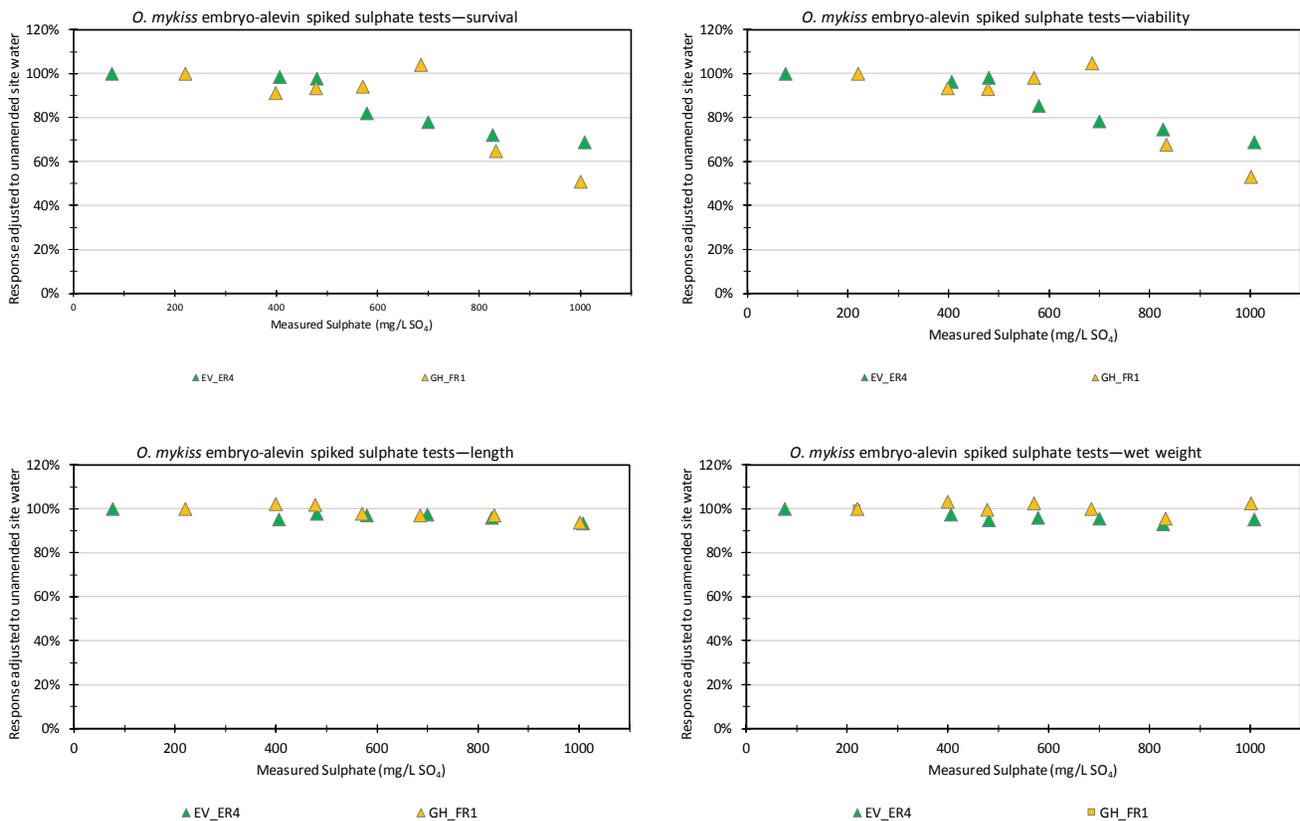


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The ANCOVA analyses identified the following:

- **Rainbow Trout Survival, Viability, Length, and Weight**—The comparison of slopes identified that slopes were not significantly different among locations (Table 18). Both water sources were therefore pooled for all test endpoints. The most sensitive test endpoint was viability, which yielded a pooled IC_{20} of 787 mg/L SO_4 . The viability endpoint was driven mainly by mortalities to alevins, as very few deformed, non-viable fish were observed. The growth endpoints (length, weight) exhibited unbounded IC estimates (i.e., IC_{10} greater than the highest concentration tested of 1008 mg/L SO_4).
- **Fathead Minnow Survival, Hatch Rate, Viability, Length, and Biomass**—The comparison of slopes identified that slopes were not significantly different among locations (Table 19). Both water sources were therefore pooled for all test endpoints. All endpoints exhibited unbounded IC estimates (i.e., IC_{10} greater than the highest concentration tested of 1248 mg/L SO_4).

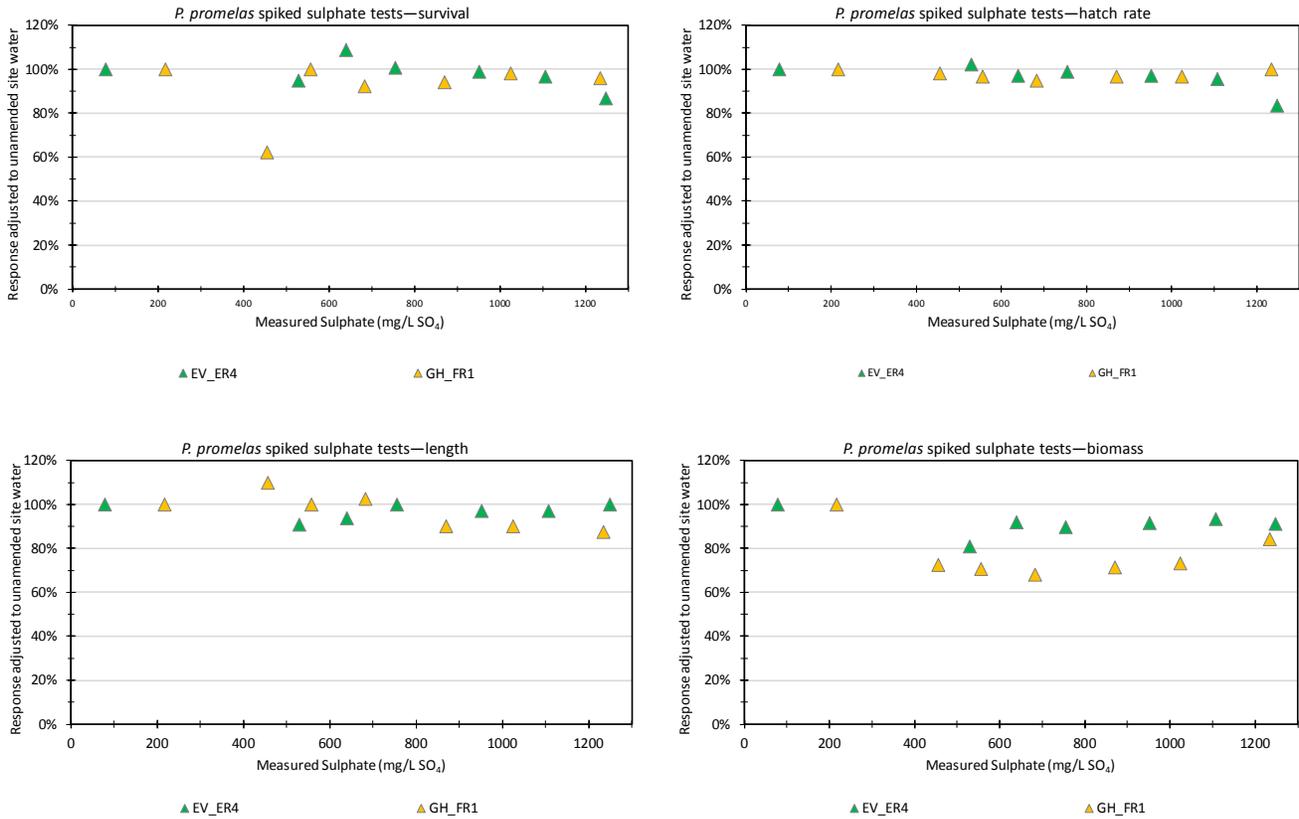
Figure 9: Mean Responses of Rainbow Trout Embryo-Alevins by Treatment for Tests conducted in Sulphate Supplemented Water in 2016.





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Figure 10: Mean Responses of Fathead Minnow Larvae by Treatment for Tests conducted in Sulphate Supplemented Water in 2016.





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Table 16: CETIS Statistical Endpoints for Individual Water Sources from *O. mykiss* Sulphate Tests

Watercourse	Teck WQ Station ID	Survival			Viability		
		EC ₂₀ (mg/L SO ₄)	EC ₂₅ (mg/L SO ₄)	EC ₅₀ (mg/L SO ₄)	EC ₂₀ (mg/L SO ₄)	EC ₂₅ (mg/L SO ₄)	EC ₅₀ (mg/L SO ₄)
Fording River	GH_FR1	818 (n/a–n/a)	851 (n/a–n/a)	993 (n/a–n/a)	828 (n/a–n/a)	861 (n/a–n/a)	>1001
Elk River	GH_ER2	NT	NT	NT	NT	NT	NT
	EV_ER4	635 (508.4–981.1)	792 (543.7–n/a)	>1008	865 (519.8–n/a)	>1008	>1008

Watercourse	Teck WQ Station ID	Length			Weight		
		IC ₂₀ (mg/L SO ₄)	IC ₂₅ (mg/L SO ₄)	IC ₅₀ (mg/L SO ₄)	IC ₂₀ (mg/L SO ₄)	IC ₂₅ (mg/L SO ₄)	IC ₅₀ (mg/L SO ₄)
Fording River	GH_FR1	>1001	>1001	>1001	>1001	>1001	>1001
Elk River	GH_ER2	NT	NT	NT	NT	NT	NT
	EV_ER4	>1008	>1008	>1008	>1008	>1008	>1008

Point estimates shown with 95% confidence limits, where applicable (n/a—confidence limits not applicable).

CETIS—Comprehensive Environmental Toxicity Information System (Tidepool 2013).

NT—Not tested across a concentration range (i.e., tested as reference water only at 23 mg/L SO₄).

Table 17: CETIS Statistical Endpoints for Individual Water Sources from Fathead Minnow Sulphate Tests

Watercourse	Teck WQ Station ID	Survival			Hatch Rate / Normal Development		
		EC ₂₀ (mg/L SO ₄)	EC ₂₅ (mg/L SO ₄)	EC ₅₀ (mg/L SO ₄)	EC ₂₀ (mg/L SO ₄)	EC ₂₅ (mg/L SO ₄)	EC ₅₀ (mg/L SO ₄)
Fording River	GH_FR1	>1234	>1234	>1234	>1234	>1234	>1234
Elk River	GH_ER2	NT	NT	NT	NT	NT	NT
	EV_ER4	>1248	>1248	>1248	>1248	>1248	>1248

Watercourse	Teck WQ Station ID	Length			Biomass		
		IC ₂₀ (mg/L SO ₄)	IC ₂₅ (mg/L SO ₄)	IC ₅₀ (mg/L SO ₄)	IC ₂₀ (mg/L SO ₄)	IC ₂₅ (mg/L SO ₄)	IC ₅₀ (mg/L SO ₄)
Fording River	GH_FR1	>1234	>1234	>1234	379.2* (254–n/a)	435.8* (261–n/a)	>1248.4
Elk River	GH_ER2	NT	NT	NT	NT	NT	NT
	EV_ER4	>1248	>1248	>1248	>1248	>1248	>1248

Point estimates shown with 95% confidence limits, where applicable (n/a—confidence limits not applicable).

CETIS—Comprehensive Environmental Toxicity Information System (Tidepool 2013).

NT—Not tested across a concentration range (i.e., tested as reference water only at 23 mg/L SO₄).

* — Indicates an atypical concentration-response—no adverse effects observed at highest test concentration



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Table 18: ANCOVA Results for *O. mykiss* Toxicity Endpoints—Sulphate Tests in 2016

Endpoint	Calculated EC ₁₀ /IC ₁₀ (mg/L SO ₄)	Calculated EC ₂₀ /IC ₂₀ (mg/L SO ₄)	Calculated EC ₅₀ /IC ₅₀ (mg/L SO ₄)	Comments
Survival				
Both water sources pooled	639	791	>1008	Quadratic model provided best fit
Viability				
Both water sources pooled	637	787	>1008	Quadratic model provided best fit
Length				
Both water sources pooled	>1008	>1008	>1008	Quadratic model provided best fit
Weight				
Both water sources pooled	>1008	>1008	>1008	Quadratic model provided best fit

Table 19: ANCOVA Results for *P. promelas* Toxicity Endpoints—Sulphate Tests in 2016

Endpoint	Calculated EC ₁₀ /IC ₁₀ (mg/L SO ₄)	Calculated EC ₂₀ /IC ₂₀ (mg/L SO ₄)	Calculated EC ₅₀ /IC ₅₀ (mg/L SO ₄)	Comments
Survival				
Both water sources pooled	>1248	>1248	>1248	Quadratic model provided best fit
Hatch Rate				
Both water sources pooled	>1248	>1248	>1248	Quadratic model provided best fit
Normal Development				
Both water sources pooled	>1248	>1248	>1248	Linear model provided best fit
Length				
Both water sources pooled	>1248	>1248	>1248	Quadratic model provided best fit
Biomass				
Both water sources pooled	>1248	>1248	>1248	Linear model provided best fit



The concentration-response for early life stage fish tests, including the EC_x/IC_x estimates in Tables 16 to 19 and the graphical depictions in Figure 9 and Figure 10, indicate several findings of importance:

- The sensitivity to sulphate was greater for rainbow trout embryo-alevins relative to fathead minnow larvae in 2016 testing. This result is not surprising, as the rainbow trout embryo-alevin test yielded the most sensitive fish endpoint in studies summarized by Meays and Nordin (2013) and was used as the basis for the derivation of the BC WQG for sulphate.
- The longer-term test of fathead minnows conducted in 2016 confirmed the findings of 7-day survival and growth test using fathead minnows conducted in Fall 2013 using the Environment Canada (2011) protocol. The longer test duration in 2016 provided additional evidence for the lack of sensitivity. This test species does not appear to be sensitive to sulphate exposures provided that appropriate copper amendments are provided to remove artefact toxicity associated with microbes.
- The sensitivity of rainbow trout to sulphate exposure was similar to what was observed in previous testing of Elk Valley waters, with IC₂₀ values for reproduction that are similar to the Phase 1 Mixture Study. The IC₂₀ for sulphate in hard water from the Phase 1 Mixture Study was 530 mg/L SO₄ (Golder and Nautilus 2013) with wide 95% confidence bands (176–772). The lowest IC₂₀ for testing in 2016 was 635 mg/L (508–981) for amended Elk River water.
- The sensitivity of rainbow trout to sulphate exposure was similar to other literature on sulphate testing in high hardness waters (Meays and Nordin 2013). Studies by Dr. Chris Kennedy yielded IC₂₀ values of 618 SO₄ (580–659) at 100 mg/L hardness, and 857 SO₄ (819–896) at 250 mg/L hardness; the results are in broad agreement with the 2016 site-specific testing.
- The additional replication for the rainbow trout tests in 2016 yielded narrower confidence intervals relative to previous site-specific testing, and provides high confidence that the BC WQG for sulphate in high hardness water (429 mg/L SO₄ for water hardness of 181–250 mg/L as CaCO₃) remains protective for Fording and Elk Valley water sources.
- In the comparison of water sources, neither rainbow trout nor fathead minnow exhibited differences in sensitivity to sulphate over the exposure conditions evaluated in 2016.



6.0 CONCLUSIONS

The supplemental testing conducted in Fall 2016 has successfully addressed residual uncertainties from the EVWQP. With the exception of the amphibian tests, which must be repeated in 2018, the chronic tests described in this report have satisfied the Permit 107517 and RAEMP Approval Condition requirements.

The most sensitive toxicological endpoints observed in 2016 were:

- Nitrate—*C. dubia* reproduction, *O. mykiss* embryo-alevin survival, and *O. mykiss* proportion swim-up
- Sulphate—*O. mykiss* embryo-alevin survival

Other test endpoints were relatively insensitive to nitrate and sulphate exposures across the range of concentrations tested, and often yielded unbounded endpoint estimates.

The benchmarks for protection of aquatic life (which were used in the development of the SPOs) were based upon the most sensitive toxicological endpoints in any site-specific study, and therefore remain protective when the results from this study are considered. In addition, the results of the supplemental nitrate and sulphate toxicity testing provide evidence that the margin of safety of the SPOs may be greater than described in the EVWQP, for three reasons:

- The additional testing has reduced uncertainty through characterization of additional water sources (sampling locations and hardness conditions).
- The additional testing has confirmed that EC_x/IC_x values for all test endpoints are similar to or greater than those considered in SPO development.
- The additional testing has improved precision for individual endpoint values. The Fall 2016 testing, through incorporation of additional test replication, has tightened the confidence bands around the endpoint predictions for some test endpoints.

6.1 Nitrate Findings

The most sensitive endpoints from the Fall 2016 studies match those identified in previous investigations of nitrate toxicity in high hardness waters. However, some test endpoints exhibited lower sensitivity in Fall 2016 relative to previous rounds of testing (e.g., *C. dubia* nitrate sensitivity was lower than observed in the Phase 1 Mixture Study or the Fall 2013 study).

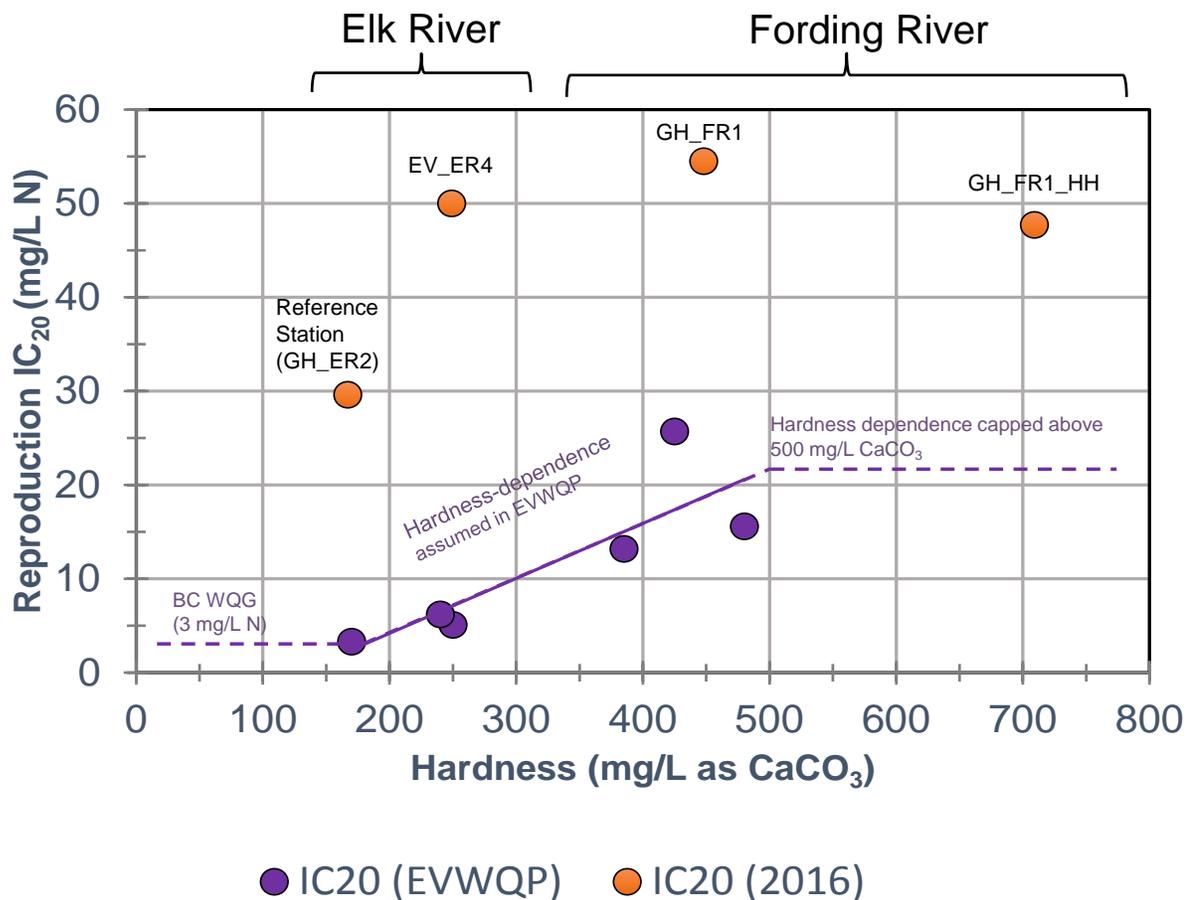
Hardness-dependence was observed for nitrate toxicity, but was mainly limited to differences between the upstream reference water (hardness ~150 mg/L CaCO₃) versus mine-exposed waters (hardness of >250 mg/L CaCO₃). Mine-exposed waters generally behaved similarly to one another, indicating that the ameliorative effect of hardness likely reaches a maximum within the range of conditions observed in the Fording River.

To evaluate whether the pattern of hardness amelioration observed in the Fall 2016 nitrate toxicity study has implications for the protectiveness of the benchmarks and SPOs developed for the Elk Valley Water Quality Plan, the relationship of chronic toxicity to hardness was compared across the two studies. The driver for the SPOs was the most sensitive endpoint from the Fall 2013 chronic toxicity tests, which was the three-brood reproduction endpoint from *C. dubia*. The nitrate benchmarks derived from this endpoint were used to establish hardness-dependent benchmarks for nitrate in Fording and Elk River waters. The Fall 2016 nitrate toxicity study exhibited a



flattening in the hardness-based amelioration of nitrate toxicity; however, the sensitivity remained lower than that observed in Fall 2013 across all hardness levels (Figure 11). Furthermore, application of the equation used to hardness-adjust the Fall 2013 benchmarks to the maximum hardness tested in Fall 2016 (i.e., extrapolation to higher hardness levels) results in predicted toxicity benchmarks that remain lower than the measured IC_x values from Fall 2016 (Figure 11). Therefore, the SPOs developed for the Elk Valley Water Quality Plan (and the benchmarks used to develop those values) remain protective across a wide range of hardness levels.

Figure 11: Comparison of Hardness-Dependence for Most Sensitive Species (*Ceriodaphnia dubia* Reproduction) in Fall 2016 Nitrate Testing to Results from Fall 2013 Testing Conducted in Support of Elk Valley Water Quality Plan.



6.2 Sulphate Findings

The most sensitive endpoints from the Fall 2016 studies (e.g., rainbow trout embryo-alevin survival and viability) match those identified in previous investigations of sulphate toxicity in high hardness waters. However, some test endpoints were relatively insensitive to sulphate exposures across the range of concentrations tested, and often yielded unbounded endpoint estimates. For example, fathead minnows did not result in discernable toxicity up to 1248 mg/L SO₄ (with Cu-amendment).



The additional testing of sulphate toxicity has improved precision for individual endpoint values. For example, the SPO of 429 mg/L SO₄ developed for the EVWQP was set lower than the Level 1 benchmark for all tested species (Table 5). The SPO was set at 429 mg/L SO₄ based, in part, on the high variability for the rainbow trout embryo-alevin test observed in Golder and Nautilus (2013). The Fall 2016 testing, through incorporation of additional test replication, has tightened the confidence bands around the endpoint predictions for this test. The 2016 results remain broadly consistent with the site-specific Phase 1 Mixture Study and other literature on sulphate toxicity in high hardness waters. Testing at Simon Fraser University by Dr. Chris Kennedy (Meays and Nordin 2013) yielded IC₁₀ and IC₂₀ values for 21-d embryo-alevin survival of 654 mg/L SO₄ and 857 mg/L SO₄, respectively; this study was used as the technical basis for the ENV sulphate guideline. In comparison, the Fall 2016 testing yielded IC₁₀ and IC₂₀ values for 28-d embryo-alevin viability of 637 mg/L SO₄ and 787 mg/L SO₄.

6.3 Comparison to EVWQP Benchmarks

Although some variations in sensitivity of test organisms have been observed over time in the testing of Elk Valley water samples, the lower end of the observed range of IC_x values from site-specific testing was used in EVWQP Benchmark development, and results from chronic testing in 2016 further demonstrate their protectiveness. All but one test endpoint in the Fall 2016 study yielded a higher EC₂₀/IC₂₀ value relative to the EVWQP Level 2 benchmarks developed for the same test species, indicating lower sensitivity (Table 20). The only exception was a small difference for rainbow trout embryo-alevin development in hard water representative of Elk River conditions; this difference is not considered meaningful given that:

- The EVWQP benchmark for hard water was specified assuming a water hardness of 200 mg/L as CaCO₃, which is higher than the mean hardness of 174 mg/L as CaCO₃ measured in the GH_ER2 test water in 2016. When the EVWQP Level 2 benchmark of 12 mg/L NO₃-N is adjusted to a hardness of 174 mg/L as CaCO₃, the resulting value (10.4 mg/L NO₃-N) is nearly identical to the Fall 2016 EC₂₀/IC₂₀ benchmark of 10 mg/L NO₃-N.
- The results of rainbow trout embryo-alevin development in all mine-influenced waters in Fall 2016, including station EV_ER4 on the mainstem Elk River, exhibited benchmarks (for both 10% and 20% response magnitudes) that were substantially greater than the corresponding fish benchmarks for Elk River hard water conditions developed for the EVWQP.

In conclusion, the Fall 2016 study confirms that that benchmark levels for nitrate and sulphate previously derived in support of the EVWQP, and the associated SPO values, remain protective of aquatic life. The confidence in this conclusion has been increased through multiple validations with site-specific waters and improved statistical confidence through increased replication.



NITRATE AND SULPHATE CHRONIC TOXICITY

Table 20: Comparison of EVWQP Benchmarks to Results of Fall 2016 Testing

Chronic Test Endpoint for Most Sensitive Species	Substance/ Water Source	Benchmarks from EVWQP Annex F (Teck 2014)		Calculated Benchmarks from Fall 2016 Study ⁽¹⁾	
		Level 1 Benchmark (hardness dependent)	Level 2 Benchmark (hardness dependent)	EC ₁₀ /IC ₁₀ (Level 1 Equivalent)	EC ₂₀ /IC ₂₀ (Level 2 Equivalent)
Rainbow trout embryo-alevin survival/development	Nitrate—Very Hard Waters	16 mg/L NO ₃ -N [H=360 mg/L CaCO ₃]	21 mg/L NO ₃ -N [H=360 mg/L CaCO ₃]	34 mg/L NO ₃ -N ⁽²⁾ [H=248–719 mg/L CaCO ₃]	55 mg/L NO ₃ -N ⁽²⁾ [H=248–719 mg/L CaCO ₃]
Rainbow trout embryo-alevin survival/development	Nitrate—Hard Waters	9 mg/L NO ₃ -N [H=200 mg/L CaCO ₃]	12 mg/L NO ₃ -N [H=200 mg/L CaCO ₃]	5 mg/L NO ₃ -N ⁽³⁾ [H=163–182 mg/L CaCO ₃]	10 mg/L NO ₃ -N ⁽³⁾ [H=163–182 mg/L CaCO ₃]
<i>C. dubia</i> 3-brood reproduction	Nitrate—Very Hard Waters	11 mg/L NO ₃ -N [H=360 mg/L CaCO ₃]	15 mg/L NO ₃ -N [H=360 mg/L CaCO ₃]	51 mg/L NO ₃ -N ⁽²⁾ [H=248–719 mg/L CaCO ₃]	57 mg/L NO ₃ -N ⁽²⁾ [H=248–719 mg/L CaCO ₃]
<i>C. dubia</i> 3-brood reproduction	Nitrate—Hard Waters	3 mg/L NO ₃ -N [H=200 mg/L CaCO ₃]	5 mg/L NO ₃ -N [H=200 mg/L CaCO ₃]	15 mg/L NO ₃ -N ⁽³⁾ [H=163–182 mg/L CaCO ₃]	30 mg/L NO ₃ -N ⁽³⁾ [H=163–182 mg/L CaCO ₃]
Rainbow trout embryo-alevin viability (normal survivors)	Sulphate—Hard to Very Hard Waters	499 mg/L SO ₄ [H>250 mg/L CaCO ₃]	674 mg/L SO ₄ [H>250 mg/L CaCO ₃]	637 mg/L SO ₄ ⁽⁴⁾ [H>250 mg/L CaCO ₃]	787 mg/L SO ₄ ⁽⁴⁾ [H>250 mg/L CaCO ₃]
<i>C. dubia</i> 3-brood reproduction	Sulphate—Hard to Very Hard Waters	625 mg/L SO ₄ [H>250 mg/L CaCO ₃]	729 mg/L SO ₄ [H>250 mg/L CaCO ₃]	1297 mg/L SO ₄ ⁽⁴⁾ [H>250 mg/L CaCO ₃]	>1345 mg/L SO ₄ ⁽⁴⁾ [H>250 mg/L CaCO ₃]

H = hardness conditions for which test result was derived; where a range is shown for the nitrate testing, it is derived from the range of measured hardness values observed in the weekly sample measurements from Fall 2016. For sulphate testing, the hardness associated with the test results was higher than in the unamended waters (due to addition of calcium sulphate and magnesium sulphate), the latter ranged from 206–480 mg/L as CaCO₃ in mine-influenced waters in 2013, and 248–482 mg/L as CaCO₃ in mine-influenced waters in 2016.

- (1) Values represent the 2016 results from reference station GH_ER2 (Elk River; hard waters) and all mine influenced waters combined (Fording River; very hard waters), and therefore have hardness levels slightly different from the defaults used in the EVWQP for Fording River (360 mg/L as CaCO₃) and Elk River (200 mg/L as CaCO₃). Therefore, comparisons are approximate.
- (2) Value is the pooled model estimate from ANCOVA for all mine-influenced waters (EV_ER4, GH_FR1, and GH_FR1-HH) tested in 2016 for nitrate toxicity.
- (3) Value is the model estimate from ANCOVA for the Elk River reference water GH_ER2 tested in 2016 for nitrate toxicity.
- (4) Value is the pooled model estimate from ANCOVA for both mine-influenced site waters (EV_ER4 and GH_FR1) tested in 2016 for sulphate toxicity.



7.0 CLOSURE

We trust that the above provides sufficient information for your present needs. If you have any questions, please contact the undersigned.

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8.0 REFERENCES

- Baker, J., G. Gilron, B.A. Chalmers, and J.R. Elphick. 2012. Evaluation of the effect of water hardness on the toxicity of nitrate to aquatic organisms. Prepared by Nautilus Environmental (Burnaby BC), Cardero Coal Ltd (Vancouver BC) and Mining Association of British Columbia (Vancouver BC). *Chemosphere* 168:435–440.
- BC MOE (British Columbia Ministry of Environment). 2014. Ambient Water Quality Guidelines for Selenium—Technical Report Update. Water Protection and Sustainability Branch, Environmental Sustainability and Strategic Policy Division, British Columbia Ministry of Environment. April 2014.
- BC MOE. 2017. British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection & Sustainability Branch, Ministry of Environment. June 2017.
- Chapman PM, Adams WJ, Brooks ML, Delos CG, Luoma SN, Maher WA, Ohlendorf HM, Presser TS, Shaw DP (eds). 2010. Ecological Assessment of Selenium in the Aquatic Environment. SETAC Press, Pensacola, FL, USA.
- Conley, J.M., D.H. Funk, and D.B. Buchwalter. 2009. Selenium bioaccumulation and maternal transfer in the mayfly *Centroptilum triangulifer* in a life-cycle, periphyton-biofilm trophic assay. *Environmental Science and Technology* 43:7952–7957.
- Elphick, J.R., M. Davies, G. Gilron, E. Canaria, B. Lo, and H.C. Bailey. 2011. An aquatic toxicological evaluation of sulfate: The case for considering hardness as a modifying factor in setting water quality guidelines. *Environmental Toxicology and Chemistry* 30(1):247–253.
- Environment Canada. 1997. Biological Test Method: Test for Survival and Growth in Sediment Using the Freshwater Amphipod *Hyalella azteca*. EPS 1/RM/33. December 1997. Environment Canada, Science and Technology Branch, Ottawa, ON.
- Environment Canada. 1998. Biological Test Method: Toxicity Tests Using Early Life Stages of Salmonid Fish (Rainbow Trout). Second Edition. EPS/1/RM/28, July 1998.
- Environment Canada. 2005. Guidance Document of Statistical Methods for Environmental Toxicology Tests. Method Development and Applications Section, Environmental Technology Centre, Environment Canada, Ottawa, Ontario.
- Environment Canada. 2007. Biological test method: test of reproduction and survival using the cladoceran *Ceriodaphnia dubia*. Environmental Protection Series. Report EPS 1/RM/21, Second Edition. Environment Canada, Science and Technology Branch, Ottawa, ON.
- Environment Canada. 2011. Biological test method: test of larval growth and survival using fathead minnows. Second Edition. EPS/1/RM/22. Environment Canada, Science and Technology Branch, Ottawa, ON. February 2011.
- Environment Canada. 2013. Biological Test Method: Test for Survival and Growth in Sediment Using the Freshwater Amphipod *Hyalella azteca*. EPS 1/RM/33 Second edition. January 2013. Environment Canada, Science and Technology Branch, Ottawa, ON.



NITRATE AND SULPHATE CHRONIC TOXICITY

- Golder (Golder Associates Ltd.) and Nautilus (Nautilus Environmental Ltd.). 2013. Phase I Report: Elk Valley Mixture Toxicity Study. Report Number 13-1349-0006. July 2013.
- Golder. 2014. Elk Valley Water Quality Plan – Species Sensitivity Distributions for Nitrate. Technical memorandum prepared by Golder Associates for Teck Coal Limited. Project No. 13-1349-0006 / 2700 / 2707. 6 June 2014.
- Golder. 2015a. Final Study Design to Address Section 9.8.2 of Permit 107517. Submitted to Carla Fraser and Mark Digel (Teck Coal Ltd.). 30 April 2015. Project No. 1523293-3000-3002.
- Golder. 2015b. Section 9.8.2 of Permit 107517—Response to Ministry Feedback on Study Design. Submitted to Nick Manklow and Carla Fraser (Teck Coal Ltd.). 30 April 2015. Project No. 1523293-3000-3002.
- Golder. 2016a. Interpretive Report—2015 Chronic Toxicity Testing Program. Submitted to Nick Manklow (Teck Coal Ltd.). March 2016. Project No. 1523293-3030.
- Golder. 2016b. Final Study Design—Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements. Submitted to Nick Manklow (Teck Coal Ltd.). 5 August 2016. Project No. 1523293-3200.
- Golder (Golder Associates Ltd.) and Nautilus (Nautilus Environmental Inc.). 2016. 2016 Study Design—Amphibian Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements. Submitted to Nick Manklow (Teck Coal Ltd.). Project No. 1523293-3040. 15 April 2016.
- Kellock KA, Moore AP, Bringolf RB. 2018. Chronic nitrate exposure alters reproductive physiology in fathead minnows. *Environmental Pollution* 232:322–328.
- Lazorchak, J.M. and M.E. Smith. 2007. Rainbow Trout (*Oncorhynchus mykiss*) and Brook Trout (*Salvelinus fontinalis*) 7-Day Survival and Growth Test Method. *Archives of Environmental Contamination and Toxicology* 53:397–405.
- McGurk, M.D., F. Landry, A. Tang, and C.C. Hanks. 2006. Acute and chronic toxicity of nitrate to early life stages of lake trout (*Salvelinus namaycush*) and lake whitefish (*Coregonus clupeaformis*). *Environmental Toxicology and Chemistry* 25:2187–2196.
- Meays, C. and R. Nordin. 2013. Ambient Water Quality Guidelines for Sulphate—Technical Appendix Update. Water Protection & Sustainability Branch, Environmental Sustainability and Strategic Policy Division, BC Ministry of Environment. April 2013.
- Mebane, C.A. 2010. Cadmium risks to freshwater life: Derivation and validation of low-effect criteria values using laboratory and field studies (version 1.2): U.S. Geological Survey Scientific Investigations Report 2006 5245, 130 p.
- Nautilus. 2013. Evaluation of the role of hardness in modifying the toxicity of nitrate to freshwater organisms. Revised final report. Prepared for the Mining Association of BC. Burnaby, BC, Canada. 3 February 2013.
- Nautilus. 2017. Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements—Laboratory Report. Final Report. Submitted to Teck Coal Ltd., Sparwood, BC. 23 December 2017.



NITRATE AND SULPHATE CHRONIC TOXICITY

- Rescan (Rescan Environmental Services Ltd.). 2012. EKATI Diamond Mine: Site-Specific Water Quality Objective for Nitrate, 2012. Prepared for BHP Billiton Canada Inc. by Rescan Environmental Services Ltd. Yellowknife, Northwest Territories.
- Suter, G.W. II, B.W. Cornaby, C.T. Hadden, R.N. Hull, M. Stack, and F.A. Zafran. 1995. An approach for balancing health and ecological risks at hazardous waste sites. *Risk Analysis* 15: 221–231.
- Teck (Teck Coal Ltd.). Area Based Management Plan (ABMP) - the "Elk Valley Water Quality Plan." Submitted to Ministry of Environment, 22 July 2014 (Approved 18 November 2014).
- Teck. 2016. Reference: Amphibian Chronic Toxicity Testing—Failed Laboratory Control Performance Criterion #2. Submitted by Nick Manklow (Lead, Adaptive Water Management, Teck Coal Limited) to Lana Miller (Environmental Impact Assessment Section Head—Mining Operations, Ministry of Environment). August 2016.
- Tidepool (Tidepool Scientific Software). 2013. CETIS comprehensive environmental toxicity information system, version 1.8.7.16 Tidepool Scientific Software, McKinleyville, CA. 275 pp.
- USEPA (United States Environmental Protection Agency). 1996. Ecological Effects Test Guidelines OPPTS 850.1400 Fish Early-Life Stage Toxicity Test. Prevention, Pesticides and Toxic Substances (7101). EPA 712-C-96-121. April 1996.
- USEPA. 2016. Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater 2016. United States Environmental Protection Agency, Office of Water, Office of Science and Technology, Washington, DC, USA. EPA 822-R-16-006. June 2016.
- Xie, L., D.H. Funk, and D.B. Buchwalter. 2010. Trophic transfer of Cd from natural periphyton to the grazing mayfly *Centroptilum triangulifer* in a life cycle test. *Environmental Pollution* 158:272–277.

APPENDIX A

Nautilus Environmental Laboratory Report



Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements – Laboratory Report

Final Report

December 23, 2017

Submitted to: **Teck Coal Ltd.**
Sparwood, BC

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- APPENDIX D – Analytical Chemistry
- APPENDIX E – Chain-of-custody forms

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This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

SUMMARY

Sample Information and Test Types

Sample ID	GH_ER2, EV_ER4, GH_FR1
Sample collection date	Approximately weekly collections between Oct. 25 and Dec. 6, 2016
Sample receipt date	Approximately weekly collections between Oct. 26 and Dec. 7, 2016
Sample receipt temperature	Ranging from 0 to 18°C
Test types	<i>Ceriodaphnia dubia</i> survival and reproduction
	Fathead minnow (<i>Pimephales promelas</i>) survival and growth
	Rainbow trout (<i>Oncorhynchus mykiss</i>) embryo-alevin

Summary of Results

Endpoint	IC25 or EC25 values for sulphate (mg/L SO ₄)	
	EV_ER4	GH_FR1
<i>Ceriodaphnia dubia</i> survival	>1345	>1285
<i>Ceriodaphnia dubia</i> reproduction	>1345	>1285
<i>Pimephales promelas</i> hatch	>1248	>1234
<i>Pimephales promelas</i> survival	>1248	>1234
<i>Pimephales promelas</i> normal development	>1248	>1234
<i>Pimephales promelas</i> biomass	>1248	435.8 (260.8 - n/a) *
<i>Pimephales promelas</i> length	>1248	>1234
<i>Oncorhynchus mykiss</i> survival	792.1 (543.7 - n/a)	850.5 (n/a)
<i>Oncorhynchus mykiss</i> viability	865.2 (519.8 - n/a)	860.5 (n/a)
<i>Oncorhynchus mykiss</i> length	>1008	>1001
<i>Oncorhynchus mykiss</i> wet weight	>1008	>1001

Point estimates shown with 95% confidence limits, where applicable.

* Anomalous dose-response observed; see results section for discussion.

Endpoint	IC25 or EC25 values for nitrate (mg/L NO ₃ -N)			
	GH_ER2	EV_ER4	GH_FR1	GH_FR1_HH
<i>Ceriodaphnia dubia</i> survival	>43.8	>49.5	>73.4	>73.9
<i>Ceriodaphnia dubia</i> reproduction	37.3 (22.6 - n/a)	>49.5	56.7 (48.5 - 59.8)	51.9 (44.8 - 58.1)
<i>Oncorhynchus mykiss</i> survival	17.2 (8.0 - 23.0)	>69.3	64.0 (1.9 - n/a)	67.2 (n/a - n/a)
<i>Oncorhynchus mykiss</i> swim-up	>45.0	>69.3	39.1 (6.1 - 67.6)	23.6 (5.7 - n/a)
<i>Oncorhynchus mykiss</i> length	>45.0	>69.3	>74.5	>110.6
<i>Oncorhynchus mykiss</i> wet weight	>45.0	>69.3	>74.5	>110.6

Point estimates shown with 95% confidence limits, where applicable.

1.0 INTRODUCTION

Nautilus Environmental conducted a laboratory study to evaluate the sensitivity of freshwater organisms to nitrate- and sulphate-amended site water collected from the Elk Valley. This work was initiated by Teck Coal Ltd (Teck) as part of the response to a condition in the Regional Aquatics Effects Monitoring Program (RAEMP) approval letter (issued by the BC Ministry of Environment and Sustainability (ENV) on November 14, 2014) to study the effects of nitrate, and Section 9.8.1 of Environmental Management Act Permit 107517 to study the effects of sulphate, on aquatic life. A detailed study design for this work titled *Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements* (Golder, 2016) was submitted by Teck to ENV on August 5, 2016 and was approved by ENV on October 3, 2016. The species that were tested were a cladoceran (*Ceriodaphnia dubia*), the fathead minnow (*Pimephales promelas*) and rainbow trout (*Oncorhynchus mykiss*). All three species were used in the sulphate study, while only the cladoceran and rainbow trout were used in the nitrate study. Water was collected from the Fording River and Elk River, and amended with a range of concentrations of either nitrate or sulphate.

The *P. promelas* test was conducted at the Nautilus Environmental laboratory in Calgary, AB; the other toxicity tests were conducted at the Burnaby, BC location. Analytical chemistry was conducted by ALS Environmental, Burnaby, BC.

This report describes the methods and results of the toxicity tests. Copies of laboratory data sheets and statistical analyses are provided in Appendices A to C. Water quality analyses were conducted on amended site water; results of analytical chemistry are provided in Appendix D. The chain-of-custody forms are provided in Appendix E.

2.0 METHODS

2.1 Site water collection and preparation

Water was collected from stations EV_ER4 (order station ER2 – EMS 200027) and GH_FR1 (order station FR4 – EMS 200378) and GH_ER2 (reference site - EMS 0200389) by Teck Coal on seven occasions between October 25 and December 6, 2016 at approximately weekly intervals and used for the site water exposures (Table 1). The waters were collected in 200-L plastic containers and were transported overnight to the laboratory. Temperatures of the waters upon receipt ranged from 0 to 18°C.

In addition to the three waters, an additional water was prepared using site water GH_FR1 (collected from order station FR4) amended in the laboratory with salts to higher hardness (approximately 700 mg/L as CaCO₃) using a mixture of CaSO₄·2H₂O and MgSO₄·7H₂O. The hardness-adjusted site water was identified as GH_FR1_HH. These four site waters were amended with nitrate or sulphate to achieve a range of test concentrations.

Table 1. Summary of sample locations.

EMS ID	Order Station	Site ID	Site Description
200027	ER2	EV_ER4	Elk River downstream of Fording River – Order Station
200378	FR4	GH_FR1	Fording River downstream of Greenhills Creek – Order Station
0200389		GH_ER2	Elk River upstream of Greenhills Operation – Reference site

Upon weekly receipt of freshly-collected site waters, nitrate and sulphate concentrations were measured in the waters, and then the target concentrations were prepared by addition of NaNO₃ for nitrate, and a mixture of CaSO₄·2H₂O and MgSO₄·7H₂O for sulphate, to achieve the target doses, after taking into consideration the concentrations of nitrate and sulphate that were already present in the waters. Subsamples were collected from all test concentrations at the beginning of each week (i.e., with each new batch of samples), as well as at termination of the tests, and analyzed for nitrate or sulphate, as appropriate; statistical analyses were conducted on the basis of the average of the measured concentrations. Test endpoints were calculated based on comparison of the results to the unamended site waters using CETIS (Tidepool Scientific Software, 2013). Each of the site water samples were also analyzed for total dissolved solids, alkalinity, ammonia, chloride, nitrate, nitrite, phosphorus and metals (Appendix D).

Point estimates presented in the body of this report for sublethal endpoints are generally limited to IC₂₅ or EC₂₅ values, since these effect levels are commonly used in environmental monitoring; however, other point estimates such as the IC₂₀ or EC₂₀ values are provided in the statistical analyses presented in the Appendices.

2.2 Toxicity test methods

Methods for the toxicity tests using *C. dubia*, *P. promelas* and *O. mykiss* are summarized in Tables 2, 3 and 4, respectively. Laboratory control water was 20% Perrier water prepared with deionized water for *C. dubia*; dechlorinated City of Calgary municipal tap water for *P. promelas*; and dechlorinated Metro Vancouver municipal tap water for *O. mykiss*.

Fathead minnows are known to be susceptible to adverse effects caused by fungi and microbes (Grothe and Johnson, 1996; Kszos et al. 1997; Downey et al. 2000). These effects have been termed “sporadic mortality phenomenon”, and are associated with mortalities that generally occur beginning on day 4 of the 7-day test with this species (Downey et al. 2000). Samples from the Elk Valley have exhibited effects in the laboratory consistent with sporadic mortality phenomenon in previous tests. Consequently, the site waters were supplemented with a low dose of copper (10 µg/L) in the *P. promelas* tests prior to preparing the test concentrations in order to inhibit microbial growth in these samples from causing adverse effects on the fish and confounding the results. This concentration of copper was present in all test concentrations. For comparison, unamended site waters were also tested concurrently with each of the three test waters. Statistical endpoints for this species were calculated based on comparison of the results to the site waters that were amended with copper.

In an effort to increase statistical sensitivity for the mortality endpoint, replication in the *C. dubia* tests was increased from 10 to 30. Reproduction of only 10 of test organisms was monitored, while survival was recorded for all 30 organisms. For *O. mykiss*, Environment Canada specifies that the minimum number of replicates for this test type is four, which is the number used for the nitrate exposure. However, due to variability in results observed in previous work, eight replicates were used in the sulphate exposure in an effort to yield narrower confidence limits around test endpoints. The test duration of the *O. mykiss* exposure to nitrate was lengthened to include full adsorption of the yolk sac (approximately 39 days). The purpose of this modification was to generate test results that would provide a more suitable comparison to previous site-specific testing of nitrate in Fording River water, which was performed with a similar test duration, and because the most sensitive endpoint that has been reported for nitrate was a delay in yolk absorption (McGurk et al., 2006). The *O. mykiss* exposure to sulphate was terminated seven days after 50% of control organisms hatched (28 days), consistent with the Environment Canada (1998) method.

Table 2. Summary of test conditions: 7-d *Ceriodaphnia dubia* survival and reproduction test.

Test species	<i>Ceriodaphnia dubia</i>
Organism source	In-house culture
Organism age	<24 h old neonates produced within 12 h
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20 mL test tube
Test volume	15 mL
Test solution depth	10 cm
Test concentrations	Various (see results tables)
Test replicates	30 per treatment
Number of organisms	1 per replicate
Control/dilution water	20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	<i>Pseudokirchneriella subcapitata</i> and YCT
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction checked daily
Test protocol	Environment Canada (2007), EPS 1/RM/21
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods
Reference toxicant	Sodium chloride (NaCl)

Table 3. Summary of test conditions: *Pimephales promelas* survival and growth test.

Test organism	<i>Pimephales promelas</i>
Test organism source	Aquatox, Hot Springs, AR
Test organism age	<24 hours
Test type	Static renewal
Test duration	Until 28 days post hatch
Test vessel	1-L plastic container
Test volume	1 L
Test concentrations	Various (see results tables)
Test replicates	4 per treatment
Number of organisms	10 per replicate
Control water	Dechlorinated City of Calgary municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice a day, after hatch, with newly hatched brine shrimp (<i>Artemia nauplii</i>)
Light intensity	100 – 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	Provided post hatch (<100 bubbles/min)
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity measured upon arrival; survival checked daily
Test protocol	US EPA (1996) and ASTM (2013)
Statistical software	CETIS Version 1.8.7
Test endpoint	Hatch, survival, length, biomass, normal development (which assesses incidence of deformities)
Test acceptability criteria for controls	>66% hatch; ≥70% post-hatch survival
Reference toxicant	Sodium chloride (NaCl)

Table 4. Summary of test conditions: rainbow trout (*Oncorhynchus mykiss*) embryo alevin test.

Test species	<i>Oncorhynchus mykiss</i>
Organism source	Vancouver Island Trout Hatchery, Duncan, BC
Organism age	<30 minutes post fertilization, <24 hour old gametes
Test type	Static renewal
Test duration	28 days for sulphate tests; 39 days for nitrate tests
Test vessel	2-L plastic containers
Test volume	2 L
Test solution depth	17 cm
Test concentrations	Various (see results tables)
Test replicates	8 per treatment for sulphate; 4 per treatment for nitrate
Number of organisms	30 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24 hours dark
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/28; Canaria et al. (1999)
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival, viability (which assesses incidence of deformities), proportion with fully absorbed yolk (nitrate tests only), length, wet weight
Test acceptability criteria for controls	≥65% normal hatched fish
Reference toxicant	Sodium dodecyl sulphate (SDS)

3.0 RESULTS

Results of the toxicity tests using *C. dubia* are provided in Tables 5 through 11. The site waters showed no adverse effects relative to the laboratory controls for this species.

For tests with sulphate, there were no adverse effects observed using *C. dubia* relative to the unamended samples, resulting in IC25 values that were greater than the highest concentration of sulphate with the two water types that were tested (i.e., EV_ER4 and GH_FR1).

For tests with nitrate, there were no adverse effects relative to the unamended samples observed on survival of *C. dubia* with any of the four site waters that were tested. Reproduction was inhibited in site waters GH_ER2, GH_FR1 and hardness-adjusted site water GH_FR1_HH; the IC25 values were 37.3, 56.7 and 51.9 mg/L NO₃-N, respectively. There were no adverse reproduction effects observed in the test with site water EV_ER4, resulting in an IC25 of >49.5 mg/L NO₃-N.

Results of the sulphate toxicity tests using *P. promelas* are provided in Tables 12 through 14. The non-copper-amended samples exhibited adverse effects on survival and biomass relative to the laboratory control, consistent with prior findings that have demonstrated microbial effects associated with the site waters. Copper-amendment of the samples substantially reduced or removed the adverse responses associated with microbial growth that occurs naturally in the site water samples.

With the exception of biomass in site water GH_FR1, there were no adverse effects observed on any of the five endpoints (hatch, survival, biomass, length and normal development) with either of the site waters that were tested with added sulphate (i.e., EV_ER4 and GH_FR1). In site water GH_FR1, an IC25 for biomass was calculated as 435.8 mg/L SO₄. However, biomass was similar across all sulphate-amended test concentrations up to, and including the highest concentration of sulphate tested, without evidence of a monotonic dose response. Thus, this apparent effect may have reflected random variability within this test rather than a real adverse response.

Results of the toxicity tests using *O. mykiss* are provided in Tables 15 through 21. For tests with sulphate, adverse effects relative to the laboratory control were observed on survival and viability with the unamended site waters GH_ER2 and GH_FR1, but not with sample EV_ER4; adverse effects also occurred in some of the unamended samples in the nitrate exposures, although the pattern was not consistent between water types. There were some observations of fungal growth, which may have contributed to the adverse effects observed in these site waters;

presence of fungal growth did not show any apparent patterns with respect to exposure concentrations, but tended to increase over time in affected replicates.

For site water GH_FR1, EC25 values for survival and viability of rainbow trout were 850.5 and 860.5 mg/L SO₄, respectively. For site water EV_ER4, the EC25 values for survival and viability were 792.1 and 865.2 mg/L SO₄, respectively.

For tests with nitrate, there were no adverse effects on survival of rainbow trout relative to the laboratory control in the unamended site waters GH_ER2, EV_ER4 or GH_FR1; however, the hardness adjusted GH_FR1_HH sample exhibited significantly lower survival and proportion reaching swim-up relative to the control. Sample GH_ER2 was also statistically significantly lower than the control performance for proportion reaching swim-up at test termination.

Adverse effects were observed on survival of *O. mykiss* with nitrate amended site waters GH_ER2, GH_FR1 and hardness adjusted GH_FR1_HH; the resulting EC25 values were 17.2, 64.0 and 67.2 mg/L NO₃-N, respectively. The EC25 for survival in EV_ER4 was greater than the highest concentration tested (>69.3 mg/L NO₃-N). For the proportion of surviving fish that reached swim-up by the end of the exposure, effects were observed in the GH_FR1 and hardness-adjusted GH_FR1_HH samples, with EC25 values of 39.1 and 23.6 mg/L NO₃-N, respectively. Conversely, there were no adverse effects on proportion of fish reaching swim-up in samples GH_ER2 or EV_ER4. No adverse effects were observed on the length and wet weight endpoints in any of the samples.

Table 5. Results: *Ceriodaphnia dubia* test for sulphate in site water GH_ER2.

	Measured (mg/L SO₄)	Survival (%)	Reproduction (# young/ female) (Mean ± SD)
Laboratory control	6.59	100	18.2 ± 6.1
GH_ER2	26.0	100	19.5 ± 6.5

SD = Standard Deviation

Table 6. Results: *Ceriodaphnia dubia* test for sulphate in site water EV_ER4.

	Measured (mg/L SO4)	Survival (%)	Reproduction (# young/ female) (Mean ± SD)
Laboratory control	6.59	100	18.2 ± 6.1
EV_ER4	79.1	100	18.6 ± 6.0
	359.5	100	17.9 ± 4.4
	472.0	100	17.2 ± 4.0
	614.5	100	17.2 ± 4.3
	790.0	100	14.9 ± 6.1
	1015	100	17.7 ± 3.6
	1345	100	16.0 ± 6.3
Test endpoint (mg/L SO4)			
	LC50	> 1345	
	IC25		> 1345
	IC50		> 1345

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

Table 7. Results: *Ceriodaphnia dubia* test for sulphate in site water GH_FR1.

	Measured (mg/L SO4)	Survival (%)	Reproduction (# young/ female) (Mean ± SD)
Laboratory control	6.59	100	18.2 ± 6.1
GH_FR1	226.5	100	16.5 ± 6.9
	351.0	100	18.2 ± 6.1
	455.5	100	17.3 ± 5.4
	595.0	96.7	19.6 ± 5.6
	781.0	100	18.0 ± 6.3
	1030	100	16.8 ± 6.6
	1285	100	14.7 ± 6.4
Test endpoint (mg/L SO4)			
	LC50	> 1285	
	IC25		> 1285
	IC50		> 1285

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

Table 8. Results: *Ceriodaphnia dubia* test for nitrate in site water GH_ER2.

	Measured (mg/L NO ₃ -N)	Survival (%)	Reproduction (# young/ female) (Mean ± SD)
Laboratory control	0.42	100	19.9 ± 1.3
GH_ER2	0.1	100	28.8 ± 2.4
	3.4	100	26.8 ± 4.9
	5.2	100	27.5 ± 2.4
	9.1	100	26.3 ± 5.9
	15.1	100	26.0 ± 2.8
	24.0	100	24.3 ± 5.1
	43.8	96.7	20.6 ± 3.8
Test endpoint (mg/L NO₃-N)			
	LC50	>43.8	
	IC25 (95% CL)		37.3 (22.6 – n/a)
	IC50		>43.8

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, n/a = Not Available.

Table 9. Results: *Ceriodaphnia dubia* test for nitrate in site water EV_ER4.

	Measured (mg/L NO ₃ -N)	Survival (%)	Reproduction (# young/ female) (Mean ± SD)
Laboratory control	0.42	100	19.9 ± 1.3
EV_ER4	2.9	100	25.9 ± 2.8
	5.2	100	26.3 ± 3.7
	8.1	90	23.4 ± 4.2
	12.1	100	24.7 ± 5.1
	19.6	100	25.7 ± 1.3
	30.9	96.7	24.7 ± 2.6
	49.5	96.7	21.9 ± 5.9
Test endpoint (mg/L NO₃-N)			
	LC50	>49.5	
	IC25		>49.5
	IC50		>49.5

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

Table 10. Results: *Ceriodaphnia dubia* test for nitrate in site water GH_FR1.

	Measured (mg/L NO ₃ -N)	Survival (%)	Reproduction (# young/ female) (Mean ± SD)
Laboratory control	0.42	100	19.9 ± 1.3
GH_FR1	9.8	100	19.8 ± 1.9
	14.3	100	21.2 ± 1.2
	20.6	96.7	22.0 ± 1.4
	25.4	100	21.1 ± 1.4
	38.1	96.7	19.2 ± 2.7
	53.8	100	17.1 ± 4.4
	73.4	96.7	9.2 ± 3.2
Test endpoint (mg/L NO₃-N)			
	LC50	>73.4	
	IC25 (95% CL)		56.7 (48.5 – 59.8)
	IC50 (95% CL)		69.7 (65.8 – n/a)

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits, n/a = Not Available.

Table 11. Results: *Ceriodaphnia dubia* test for nitrate in hardness-adjusted site water GH_FR1_HH.

	Measured (mg/L NO ₃ -N)	Survival (%)	Reproduction (# young/ female) (Mean ± SD)
Laboratory control	0.42	100	19.9 ± 1.3
GH_FR1_HH	10.5	100	19.8 ± 1.0
	14.4	100	22.1 ± 1.4
	20.4	100	18.7 ± 1.6
	27.2	100	19.7 ± 1.6
	38.2	100	20.3 ± 1.9
	52.4	100	15.6 ± 5.9
	73.9	100	7.9 ± 3.4
Test endpoint (mg/L NO₃-N)			
	LC50	>73.9	
	IC25 (95% CL)		51.9 (44.8 – 58.1)
	IC50 (95% CL)		65.9 (58.2 – 72.3)

SD = Standard Deviation, LC = Lethal Concentration, IC = Inhibition Concentration, CL = Confidence Limits.

Table 12. Results: fathead minnow test in site water GH_ER2.

	Measured (mg/L SO4)	Hatch rate (%) (Mean ± SD)	Survival (%) (Mean ± SD)	Normal Development (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)	Length (mm) (Mean ± SD)
Laboratory control	73.1	98.3 ± 3.3	89.7 ± 3.6	100.0 ± 0.0	0.90 ± 0.12	9.2 ± 0.5
Laboratory control + Cu		100.0 ± 0.0	85.0 ± 6.4	100.0 ± 0.0	0.95 ± 0.04	9.2 ± 1.0
GH_ER2	23.4	98.3 ± 3.3	13.3 ± 18.9 *	100.0 ± 0.0	0.20 ± 0.23 *	9.0 ± 1.4
GH_ER2 + Cu		98.3 ± 3.3	86.7 ± 7.7	100.0 ± 0.0	0.85 ± 0.06 #	7.8 ± 0.5 #

SD = Standard Deviation.

* Significantly different from GH_ER2 + Cu

Significantly different from Laboratory control + Cu

Table 13. Results: fathead minnow test for sulphate in Cu-amended site water EV_ER4.

	Measured (mg/L SO4)	Hatch rate (%) (Mean ± SD)	Survival (%) (Mean ± SD)	Normal Development (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)	Length (mm) (Mean ± SD)
Laboratory control	73.1	98.3 ± 3.3	89.7 ± 3.6	100.0 ± 0.0	0.90 ± 0.12	9.2 ± 0.5
Laboratory control + Cu		100.0 ± 0.0	85.0 ± 6.4	100.0 ± 0.0	0.95 ± 0.04	9.2 ± 1.0
EV_ER4	77.8	88.3 ± 11.4	51.7 ± 32.8	100.0 ± 0.0	0.55 ± 0.13	8.2 ± 1.3
EV_ER4 + Cu		97.8 ± 3.8	84.4 ± 3.8	100.0 ± 0.0	0.84 ± 0.02	8.0 ± 0.0
	528.7	100.0 ± 0.0	80.0 ± 9.4	95.6 ± 5.0	0.67 ± 0.05	7.2 ± 0.5
	639.3	95.0 ± 6.4	91.7 ± 12.6	100.0 ± 0.0	0.77 ± 0.04	7.5 ± 0.6
	755.7	96.7 ± 3.8	85.0 ± 6.4	100.0 ± 0.0	0.75 ± 0.02	8.0 ± 0.0
	951.4	95.0 ± 10.0	83.3 ± 11.6	100.0 ± 0.0	0.77 ± 0.06	7.8 ± 0.5
	1107	93.3 ± 5.4	81.7 ± 6.4	100.0 ± 0.0	0.78 ± 0.06	7.8 ± 0.5
	1248	81.7 ± 10.0	73.3 ± 5.4	100.0 ± 0.0	0.76 ± 0.11	8.0 ± 0.0
Test endpoint (mg/L SO4)						
EC25		>1248	>1248	>1248	--	--
EC50		>1248	>1248	>1248	--	--
IC25		--	--	--	>1248	>1248
IC50		--	--	--	>1248	>1248

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration.

Table 14. Results: fathead minnow test for sulphate in Cu-amended site water GH_FR1.

	Measured (mg/L SO₄)	Hatch rate (%) (Mean ± SD)	Survival (%) (Mean ± SD)	Normal Development (%) (Mean ± SD)	Biomass (mg) (Mean ± SD)	Length (mm) (Mean ± SD)
Laboratory control	73.1	98.3 ± 3.3	89.7 ± 3.6	100.0 ± 0.0	0.90 ± 0.12	9.2 ± 0.5
Laboratory control + Cu		100.0 ± 0.0	85.0 ± 6.4	100.0 ± 0.0	0.95 ± 0.04	9.2 ± 1.0
GH_FR1	217.1	93.3 ± 9.4	21.7 ± 6.4	100.0 ± 0.0	0.37 ± 0.05	10.0 ± 0.8
GH_FR1 + Cu		100.0 ± 0.0	83.3 ± 8.6	100.0 ± 0.0	1.02 ± 0.45	10.0 ± 0.0
	455.9	98.3 ± 3.3	51.7 ± 30.5	100.0 ± 0.0	0.74 ± 0.06	11.0 ± 2.0
	556.3	96.7 ± 6.7	83.3 ± 8.6	100.0 ± 0.0	0.72 ± 0.05	10.0 ± 0.0
	682.7	95.0 ± 6.4	76.7 ± 6.7	100.0 ± 0.0	0.70 ± 0.06	10.2 ± 0.5
	869.9	96.7 ± 6.7	78.3 ± 17.5	100.0 ± 0.0	0.73 ± 0.07	9.0 ± 0.0
	1025	96.7 ± 6.7	81.7 ± 3.3	100.0 ± 0.0	0.75 ± 0.02	9.0 ± 0.0
	1234	100.0 ± 0.0	80.0 ± 9.4	100.0 ± 0.0	0.86 ± 0.14	8.8 ± 0.5
Test endpoint (mg/L SO₄)						
EC25		>1234	>1234	>1234	--	--
EC50		>1234	>1234	>1234	--	--
IC25 (95% CL)		--	--	--	435.8 (260.8 – n/a) *	>1234
IC50		--	--	--	>1234	>1234

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration, CL = Confidence Limits, n/a = Not Available.

* Anomalous dose-response observed; see results section for discussion.

Table 15. Results: *Oncorhynchus mykiss* embryo-alevin test in site water GH_ER2.

	Measured (mg/L SO4)	Survival (%) (Mean ± SD)	Viability (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory control	0.89	79.0 ± 10.5	71.5 ± 15.1	18.0 ± 1.3	98.1 ± 13.2
GH_ER2	23.4	69.0 ± 19.5*	61.4 ± 21.2*	16.9 ± 1.1	96.6 ± 9.2

SD = Standard Deviation.

* Result was significantly different compared to the laboratory control.

Table 16. Results: *Oncorhynchus mykiss* embryo-alevin test for sulphate in site water EV_ER4.

	Measured (mg/L SO4)	Survival (%) (Mean ± SD)	Viability (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory control	0.89	79.0 ± 10.5	71.5 ± 15.1	18.0 ± 1.3	98.1 ± 13.2
EV_ER4	76.5	79.0 ± 13.5	72.3 ± 19.4	17.7 ± 1.2	100.5 ± 13.8
	406.3	77.8 ± 14.5	69.7 ± 19.2	16.9 ± 1.2	97.9 ± 14.2
	480.7	77.4 ± 19.1	71.0 ± 23.2	17.4 ± 1.2	95.3 ± 11.8
	579.2	64.9 ± 28.4	61.7 ± 29.6	17.2 ± 1.8	96.5 ± 16.4
	700.2	61.6 ± 29.2	56.8 ± 31.9	17.3 ± 1.6	96.0 ± 11.8
	826.8	56.9 ± 37.3	54.0 ± 38.0	17.0 ± 1.5	93.5 ± 10.8
	1008	54.4 ± 24.2	49.8 ± 25.7	16.6 ± 1.0	95.8 ± 10.6
Test endpoint (mg/L SO4)					
	EC25	792.1 (543.7 – n/a)	865.2 (519.8 – n/a)		
	EC50	>1008	>1008		
	IC25			>1008	>1008
	IC50			>1008	>1008

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration.

Table 17. Results: *Oncorhynchus mykiss* embryo-alevin test for sulphate in site water GH_FR1.

	Measured (mg/L SO₄)	Survival (%) (Mean ± SD)	Viability (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory control	0.89	79.0 ± 10.5	71.5 ± 15.1	18.0 ± 1.3	98.1 ± 13.2
GH_FR1	220.2	62.6 ± 19.3*	58.4 ± 19.2*	18.3 ± 1.5	94.4 ± 10.8
	399.0	57.1 ± 28.7	54.6 ± 29.7	18.8 ± 0.8	97.4 ± 11.8
	478.5	58.4 ± 21.4	54.2 ± 21.2	18.6 ± 0.8	94.0 ± 13.1
	570.7	59.0 ± 22.6	57.3 ± 23.6	18.0 ± 0.9	96.8 ± 25.2
	684.7	65.2 ± 19.3	61.2 ± 22.2	17.8 ± 1.0	94.5 ± 12.8
	832.5	40.5 ± 35.6	39.6 ± 35.4	17.8 ± 1.1	90.0 ± 14.4
	1001	31.8 ± 29.6	30.9 ± 29.7	17.2 ± 1.6	96.9 ± 23.4
Test endpoint (mg/L SO₄)					
	EC25 (95% CL)	850.5 (n/a – n/a)	860.5 (n/a – n/a)		
	EC50 (95% CL)	993.4 (n/a – n/a)	>1001.0		
	IC25			>1001	>1001
	IC50			>1001	>1001

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration, CL = Confidence Limits, n/a = Not Available.

* Result was significantly different compared to the laboratory control.

Table 18. Results: *Oncorhynchus mykiss* embryo to swim-up test for nitrate in site water GH_ER2.

	Measured (mg/L NO₃-N)	Survival (%) (Mean ± SD)	Percent swimup (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory control	0.1	66.9 ± 27.9	92.1 ± 11.2	21.8 ± 1.4	117.2 ± 22.1
GH_ER2	0.1	80.5 ± 10.9	74.5 ± 15.1 *	23.1 ± 1.1	115.6 ± 8.3
	3.1	73.0 ± 19.6	74.5 ± 26.5	22.3 ± 1.1	110.0 ± 12.7
	5.1	63.8 ± 25.0	67.7 ± 28.3	22.5 ± 1.9	111.7 ± 13.6
	8.9	72.2 ± 16.9	74.4 ± 16.4	21.7 ± 1.7	108.3 ± 21.5
	14.4	64.0 ± 9.6	61.0 ± 23.7	20.5 ± 0.8	103.4 ± 7.4
	25.8	31.2 ± 21.9	61.1 ± 41.9	19.5 ± 1.5	91.3 ± 9.5
	45.0	11.4 ± 7.3	62.5 ± 53.0	18.6 ± 1.8	90.6 ± 11.9
Test endpoint (mg/L NO₃-N)					
	EC25 (95% CL)	17.2 (8.0 – 23.0)	>45.0	--	--
	EC50 (95% CL)	25.2 (16.7 – 31.7)	>45.0	--	--
	IC25	--	--	>45.0	>45.0
	IC50	--	--	>45.0	>45.0

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration, CL = Confidence Limits.

* Result was significantly different compared to the laboratory control (comparisons only made between laboratory and site water controls).

Table 19. Results: *Oncorhynchus mykiss* embryo to swim-up test for nitrate in site water EV_ER4.

	Measured (mg/L NO₃-N)	Survival (%) (Mean ± SD)	Percent swimup (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory control	0.1	66.9 ± 27.9	92.1 ± 11.2	21.8 ± 1.4	117.2 ± 22.1
EV_ER4	2.9	61.0 ± 28.5	92.5 ± 8.7	24.0 ± 0.7	127.9 ± 15.3
	5.1	81.5 ± 8.2	80.5 ± 15.9	23.2 ± 1.0	124.0 ± 9.9
	9.0	65.4 ± 27.1	84.5 ± 16.2	23.1 ± 1.4	118.4 ± 10.3
	14.7	78.9 ± 14.4	77.1 ± 17.9	22.4 ± 1.3	119.7 ± 11.3
	25.4	75.8 ± 14.8	94.0 ± 4.7	22.7 ± 1.1	123.9 ± 11.0
	42.7	64.1 ± 14.3	72.6 ± 25.4	21.4 ± 1.3	110.5 ± 13.0
	69.3	59.2 ± 33.3	70.7 ± 21.6	20.4 ± 1.7	105.4 ± 13.2
<hr/>					
	Test endpoint (mg/L NO₃-N)				
	EC25	>69.3	>69.3	--	--
	EC50	>69.3	>69.3	--	--
	IC25	--	--	>69.3	>69.3
	IC50	--	--	>69.3	>69.3

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration.

Table 20. Results: *Oncorhynchus mykiss* embryo to swim-up test for nitrate in site water GH_FR1.

	Measured (mg/L NO₃-N)	Survival (%) (Mean ± SD)	Percent swimup (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory control	0.1	66.9 ± 27.9	92.1 ± 11.2	21.8 ± 1.4	117.2 ± 22.1
GH_FR1	10.2	63.1 ± 16.0	88.1 ± 9.6	22.0 ± 0.7	109.3 ± 10.0
	14.1	60.7 ± 29.3	89.1 ± 7.8	21.9 ± 1.4	109.2 ± 11.7
	20.2	69.8 ± 22.1	82.7 ± 13.2	22.4 ± 1.5	115.5 ± 15.0
	27.5	63.3 ± 30.4	70.3 ± 23.6	21.7 ± 1.7	111.8 ± 18.4
	38.4	55.2 ± 25.0	59.3 ± 31.3	21.0 ± 1.3	106.0 ± 11.1
	53.6	57.9 ± 29.7	66.0 ± 20.4	19.9 ± 1.3	96.9 ± 14.2
	74.5	40.5 ± 23.9	43.6 ± 31.6	18.7 ± 1.8	92.6 ± 23.7
Test endpoint (mg/L NO₃-N)					
	EC25 (95% CL)	64.0 (1.9 – n/a)	39.1 (6.1 – 67.6)	--	--
	EC50	>74.5	>74.5	--	--
	IC25	--	--	>74.5	>74.5
	IC50	--	--	>74.5	>74.5

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration, CL = Confidence Limits, n/a = Not Available.

Table 21. Results: *Oncorhynchus mykiss* embryo to swim-up test for nitrate in hardness-adjusted site water GH_FR1_HH.

	Measured (mg/L NO₃-N)	Survival (%) (Mean ± SD)	Percent swimup (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet Weight (mg) (Mean ± SD)
Laboratory control	0.1	66.9 ± 27.9	92.1 ± 11.2	21.8 ± 1.4	117.2 ± 22.1
GH_FR1_HH	10.2	32.8 ± 16.9 *	65.8 ± 29.7 *	21.7 ± 0.4	117.0 ± 11.9
	14.9	28.3 ± 17.9	51.1 ± 29.7	20.8 ± 1.2	111.5 ± 16.6
	22.3	33.3 ± 7.6	53.1 ± 27.4	20.3 ± 0.9	107.4 ± 14.7
	34.7	35.4 ± 25.3	31.5 ± 10.7	18.8 ± 0.7	98.3 ± 10.2
	49.3	28.0 ± 18.6	54.6 ± 0.0	17.9 ± 1.4	89.8 ± 13.1
	72.9	20.8 ± 26.0	46.6 ± 25.6	18.8 ± 1.3	91.3 ± 9.5
	110.6	15.5 ± 2.9	40.0 ± 28.3	18.2 ± 1.2	91.5 ± 9.4
Test endpoint (mg/L NO₃-N)					
	EC25 (95% CL)	67.2 (n/a – n/a)	23.6 (5.7 – n/a)	--	--
	EC50 (95% CL)	103.4 (n/a – n/a)	>110.6	--	--
	IC25	--	--	>110.6	>110.6
	IC50	--	--	>110.6	>110.6

SD = Standard Deviation, EC = Effective Concentration, IC = Inhibition Concentration, CL = Confidence Limits, n/a = Not Available.

* Result was significantly different compared to the laboratory control (comparisons only made between laboratory and site water controls).

4.0 QA/QC

The health histories of the test organisms used in the exposures were acceptable and met the requirements of the test protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocols throughout the tests. There were no deviations from the test methodologies, other than planned modifications described in Section 2. Uncertainty associated with these tests is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

Results of the reference toxicant tests conducted during the testing program are summarized in Table 22. Results for these tests fell within the acceptable range for organism performance of mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was appropriate.

While the rainbow trout embryo control organisms met test validity criteria, it should be noted that survival was lower than expected when compared to previous testing of these waters. Independent of treatments, a significant number of mortalities were observed in a number of replicates during days 13 to 24 of the tests in both the sulphate and nitrate exposures. These incidents coincided with observations of fungal growth on dead embryos. High mortality in replicates did not correspond to poor egg quality and were more likely due to characteristics of these site waters (e.g. microbial growth, as observed during fathead minnow tests).

Table 22. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
<i>C. dubia</i>	Survival (LC50): 2.1 g/L NaCl	2.0 (1.8 – 2.3)	5	November 15, 2016
	Reproduction (IC50): 1.6 g/L NaCl	1.5 (1.2 – 2.0)	13	
<i>P. promelas</i>	Survival (LC50): 2.8 g/L NaCl	2.9 (2.8 – 3.0)	9	December 7, 2016
	Biomass (IC25): 2.6 g/L NaCl	2.7 (2.6 – 2.9)	11	
<i>O. mykiss</i>	Viability (EC50): 7.5 mg/L SDS	4.0 (2.1 – 7.6)	38	November 1, 2016

SD = Standard Deviation, CV = Coefficient of Variation, LC = Lethal Concentration, IC = Inhibition Concentration, EC = Effect Concentration

5.0 REFERENCES

- ASTM. 2013. Standard guide for conducting early life-stage toxicity tests with fishes. E1241-05, 29 p.
- ASTM. 1980. Standard practice for conducting acute toxicity tests with fishes, macroinvertebrates and amphibians. E729-80, 25p
- Downey PJ, Flemming K, Guinn R, Chapman N, Varner P, Cooney JD. 2000. Sporadic mortality in chronic toxicity tests using *Pimephales promelas* (Rafinesque): Cases of characterization and control. Environ Toxicol Chem 19:248-255.
- Environment Canada. 2007. Biological test method: test of reproduction and survival using the cladoceran *Ceriodaphnia dubia*. EPS 1/RM/21, Second Edition, February 2007.
- Environment Canada. 1998. Biological test method: toxicity tests using early life stages of salmonid fish (rainbow trout). Environmental Protection Series EPS 1/RM/28. Second Edition, July 1998. Environment Canada, Method Development and Application Section, Environmental Technology Centre, Ottawa, ON. 102 pp.
- Golder. 2016. Final Study Design - Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements. Submitted to Nick Manklow (Teck Coal Ltd.). 5 August 2016. Project No. 1523293-3200.
- Grothe DR, Johnson DE. 1996. Bacterial interference in whole-effluent toxicity tests. Environ Toxicol Chem 15:761-764.
- Kszos LA, Stewart AJ, Sumner JR. 1997. Evidence that variability in ambient fathead minnow short-term chronic tests is due to pathogenic infection. Environ Toxicol Chem 6:351-356
- McGurk MD, Landry F, Tang A, Hanks CC . 2006. Acute and chronic toxicity of nitrate to early life stages of lake trout (*Salvelinus namaycush*) and lake whitefish (*Coregonus clupeaformis*). Environ Toxicol Chem 25:2187-2196.
- Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.8.7.16 Tidepool Scientific Software, McKinleyville, CA. 275 pp.
- USEPA. 1996. Ecological Effects Test Guidelines. OPPTS 850.1400 Fish Early-Life Stage Toxicity Test. EPA-712-C-96-121, Public Draft.

APPENDIX A – *Ceriodaphnia dubia* Toxicity Test Data

Ceriodaphnia dubia Summary Sheet

Client: Treek Coal
 Work Order No.: 161182

Start Date/Time: Nov 2/16 @ 1200h
 Set up by: EMM

Sample Information:

Sample ID: GH_ER2_WS_2016-10-25_N
 Sample Date: Oct 25/16
 Date Received: Oct 25/16
 Sample Volume: 2x200L

Test Validity Criteria:

- 1) Mean survival of first generation controls is $\geq 80\%$
- 2) At least 60% of controls have produced three broods within 8 days
- 3) An average of ≥ 15 live young produced per surviving female in the control solutions during the first three broods.
- 4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1 ; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 102016A + 102016B
 Age of young (Day 0): <24-h (within 12-h)
 Avg No. young in first 3 broods of previous 7 d: 36
 Mortality (%) in previous 7 d: 2.5
 Individual female # used ≥ 8 young on test day

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40

NaCl Reference Toxicant Results:

Reference Toxicant ID: Cd151
 Stock Solution ID: 16 NaCl
 Date Initiated: Nov 15/16

7-d LC50 (95% CL): 2.1 (1.5-3.2) g/L NaCl
 7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.3) g/L NaCl CV (%): 5
 7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

	Survival (%)	Reproduction (Mean \pm SD)
Negative Control	100	18.2 \pm 6.1
GH_ER2_WS_2016-10-25_N	100	19.5 \pm 6.5
		\pm

Reviewed by: Jon

Date reviewed: Feb. 10/17

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: GH-FR2 Sulphate
 Work Order #: 161182

Start Date & Time: NOV 21 12:00
 Stop Date & Time: NOV 21 18:00
 Test Species: Ceriodaphnia dubia

V
1200
8th

Concentration	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
lab ctrl														
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	25.0	
DO (mg/L)	8.0	7.4	8.0	8.0	8.0	7.6	8.0	7.5	5.1	7.4	8.0	7.5		
pH	8.1	8.1	8.0	8.0	8.0	8.1	8.0	7.2	7.1	8.0	8.0	7.8		
Cond. (µS/cm)	220	220		222		222		223		223		233		
Initials	EMM	EMM		EMM		EMM		A		EMM		JS		

(unamended)

Concentration	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
GH-FR2														
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	25.0	
DO (mg/L)	8.3	7.6	8.2	7.6	8.3	7.6	8.2	7.5	5.2	7.4	8.2	7.4		
pH	8.1	8.0	8.1	8.1	8.2	8.1	8.2	5.1	5.2	8.0	8.2	8.1		
Cond. (µS/cm)	316	316		314		316		313		314		337		
Initials	EMM	EMM		EMM		EMM		A		EMM		JS		

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

Thermometer: 4 DO meter: 2/1 pH meter: 2 Conductivity meter: 2/1

	Control	GH-FR2		
Hardness*	100	167		
Alkalinity*	98	147		

Analysts: MLT, EMM, AWD, VL
 Reviewed by: JKW
 Date reviewed: Feb. 10/17

Sample Description: clear, colourless, odourless, no particulates

Comments: Broodboard Used: (102016 A → B) (# 1-27, 29-40)

CETIS Summary Report

Report Date: 17 Jan-17 17:13 (p 1 of 1)
 Test Code: 161182 SO4d1 | 05-9249-2817

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 11-3606-5669	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 8h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 0h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
12-9616-9855	Reproduction	26.05	>26.05	NA	26.8%		Equal Variance t Two-Sample Test

Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	10	18.2	13.81	22.59	10	26	1.943	6.143	33.75%	0.0%
26.05		10	19.5	14.89	24.11	8	27	2.04	6.451	33.08%	-7.14%

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
0	① Negative Control	24	11	10	25	24	12	26	17	17	16
26.05		21	8	22	21	23	25	27	12	12	24

① Negative control = 20% Perrier lab water

CETIS Summary Report

Report Date: 17 Jan-17 17:11 (p 1 of 1)
 Test Code: 161182 SO4d1 | 05-9249-2817

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 11-3606-5669	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 8h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 0h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
13-5833-8789	6d Survival Rate	26.05	>26.05	NA	NA		Fisher Exact Test

6d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Negative Control	30	1	1	1	1	1	0	0	0.0%	0.0%
26.05		30	1	1	1	1	1	0	0	0.0%	0.0%

6d 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
0	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
26.05		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
26.05		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 17 Jan-17 17:11 (p 1 of 2)
 Test Code: 161182 SO4d1 | 05-9249-2817

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 13-5833-8789	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 17 Jan-17 17:10	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 11-3606-5669	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 8h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 0h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Negative Control		26.05	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Negative Contr	30	0	30	1	0	0.0%
26.05		30	0	30	1	0	0.0%

6d 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
0	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
26.05		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
26.05		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 17 Jan-17 17:11 (p 2 of 2)
Test Code: 161182 SO4d1 | 05-9249-2817

Ceriodaphnia 7-d Survival and Reproduction Test

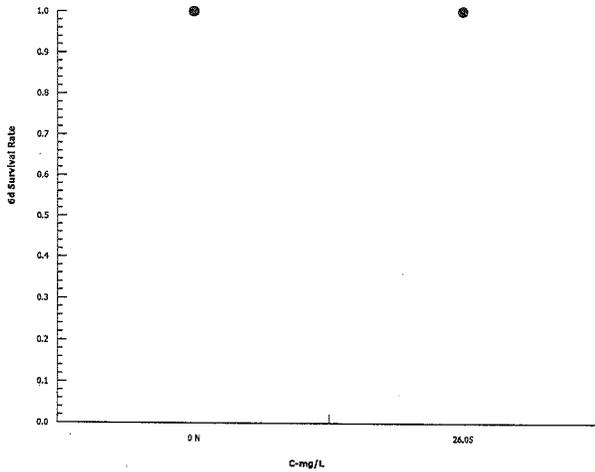
Nautilus Environmental

Analysis ID: 13-5833-8789
Analyzed: 17 Jan-17 17:10

Endpoint: 6d Survival Rate
Analysis: Single 2x2 Contingency Table

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 17 Feb-17 14:35 (p 1 of 1)
 Test Code: 161182 SO4d1 | 05-9249-2817

Ceriodaphnia 7-d Survival and Reproduction Test Nautilus Environmental

Analysis ID: 10-5941-1958	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 17 Feb-17 14:35	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 11-3606-5669	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 8h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 0h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	26.8%	Passes reproduction

Equal Variance t Two-Sample Test

Control	vs	C-mg/L	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Negative Control		26.05	0.4615	1.734	4.885	18	0.3250	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	8.45	8.45	1	0.213	0.6500	Non-Significant Effect
Error	714.1	39.67222	18			
Total	722.55		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.103	6.541	0.8865	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9135	0.866	0.0743	Normal Distribution

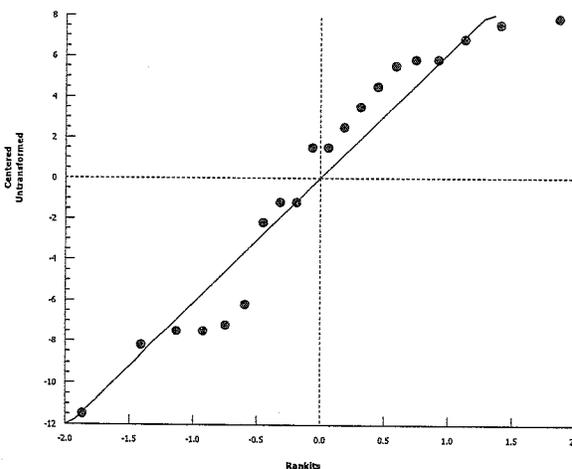
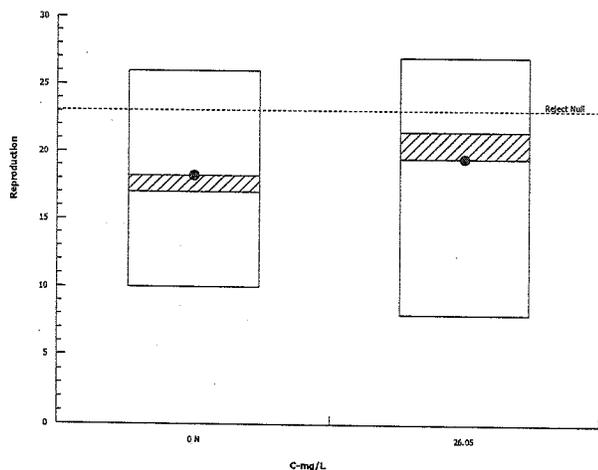
Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Negative Control	10	18.2	13.81	22.59	17	10	26	1.943	33.75%	0.0%
26.05		10	19.5	14.89	24.11	21.5	8	27	2.04	33.08%	-7.14%

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
0	Negative Control	24	11	10	25	24	12	26	17	17	16
26.05		21	8	22	21	23	25	27	12	12	24

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
 Work Order No.: 161182

Start Date/Time: Nov 2/16 @ 12:00h
 Set up by: EMM

Sample Information:

Sample ID: EY_ER4_WS_2016-10-25_N
 Sample Date: Oct 25/16
 Date Received: Oct 26/16
 Sample Volume: 3x200L

Test Validity Criteria:

- 1) Mean survival of first generation controls is $\geq 80\%$
- 2) At least 60% of controls have produced three broods within 8 days
- 3) An average of ≥ 15 live young produced per surviving female in the control solutions during the first three broods.
- 4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T ($^{\circ}$ C) = 25 ± 1 ; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 102016A + 102016B
 Age of young (Day 0): <24-h (within 12-h)
 Avg No. young in first 3 broods of previous 7 d: 36
 Mortality (%) in previous 7 d: 2.5
 Individual female # used ≥ 8 young on test day

1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40
 ↓
32

NaCl Reference Toxicant Results:

Reference Toxicant ID: Ca151
 Stock Solution ID: 16Na02
 Date Initiated: Nov 15/16

The unamended control did not pass repro. < 60% with 3 brood

7-d LC50 (95% CL): 2.1 (1.5-3.0) g/L NaCl
 7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.3) g/L NaCl CV (%): 5
 7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

	Survival	Reproduction
^{MLT} LC50 % (v/v) (95% CL)	>1345.00	
IC25 % (v/v) (95% CL)		>1345.00
IC50 % (v/v) (95% CL)		>1345.00

mg/L SO₄

Reviewed by: JGA

Date reviewed: Feb. 10/17

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: EV-ERY Sulphate
 Work Order #: 161182

Start Date & Time: NOV 21 16 @ 1200h
 Stop Date & Time: NOV 8 16 @ 1630h
 Test Species: Ceriodaphnia dubia

Concentration <i>lab control</i>	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.0	8.0	8.0	8.0	8.0	7.4	8.0	7.5	8.1	8.2	8.0	8.0	7.9	7.5		
pH	8.1	8.0	8.0	8.0	8.0	8.0	8.0	8.2	8.1	8.0	8.0	8.0	7.8			
Cond. (µS/cm)	220	220	222	222	222	222	222	223	223	223	223	233				
Initials	FMM	EM	FMM	FMM	FMM	FMM	FMM	A	FMM	FMM	FMM	JS				

(mg/L SO₄)

Concentration <i>EVERY</i>	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.1	7.4	8.2	7.3	8.1	7.5				
pH	8.3	8.2	8.1	8.0	8.2	8.0	8.1	8.1	8.1	8.0	8.1	8.1				
Cond. (µS/cm)	480	482	483	484	484	484	484	482	489	487	487	487				
Initials	FMM	FMM	FMM	FMM	FMM	FMM	FMM	A	FMM	FMM	FMM	JS				

(mg/L SO₄)

Concentration <i>350</i>	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.1	7.4	8.1	7.3	8.1	7.5				
pH	8.3	8.2	8.1	8.1	8.2	8.1	8.2	8.1	8.2	8.0	8.2	8.0				
Cond. (µS/cm)	919	918	909	910	910	910	910	914	912	925	925	925				
Initials	FMM	FMM	FMM	FMM	FMM	FMM	FMM	A	FMM	FMM	FMM	JS				

(mg/L SO₄)

Concentration <i>455</i>	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.1	7.5	8.2	7.2	8.1	7.4				
pH	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.2	8.0	8.2	8.1				
Cond. (µS/cm)	1090	1090	1087	1091	1091	1091	1091	1095	1094	1116	1116	1116				
Initials	FMM	FMM	FMM	FMM	FMM	FMM	FMM	A	FMM	FMM	FMM	JS				

Thermometer: 4 DO meter: 1/2 pH meter: 2 Conductivity meter: 1/2

	Control	EV-ERY		
Hardness*	102	249		
Alkalinity*	98	163		

Analysts: FMM, MLT, AWP, KL, JS
 Reviewed by: JGU
 Date reviewed: Feb. 10/17

Sample Description: EV-ERY with sulphate (EV-ERY: clear, colourless, odourless, some particulates)

Comments: Broodboard Used: 102016 A → B (#1-31, 33-40) (#1-27, 29-40)

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teek Coal
 Sample ID: EV ER4 Sulphate
 Work Order #: 161182

Start Date & Time: NOV 2/16 @ 1200h
 Stop Date & Time: Nov 8/16 @ 1630h
 Test Species: Ceriodaphnia dubia

(mg/L SO ₄) Concentration 592	Days															
	0		1		2		3		4		5		Finals		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.1	7.6	8.3	7.4	8.1	7.9	8.2	7.2	8.2	7.5				
pH	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.2	8.2	7.9	8.2	8.0				
Cond. (µS/cm)	1284	1281		1254		1269			1273	1271		1305				
Initials	EMM	EMM		EMM		EMM		A	EMM		JS					

(mg/L SO ₄) Concentration 769	Days															
	0		1		2		3		4		5		Finals		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.5	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.1	7.6	8.3	7.4	8.1	7.5	8.1	7.2	8.2	7.4				
pH	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.2	8.2	7.9	8.2	8.0				
Cond. (µS/cm)	1526	1525		1504		1513			1524	1514		1550				
Initials	EMM	EMM		EMM		EMM		A	EMM		JS					

(mg/L SO ₄) Concentration 1000	Days															
	0		1		2		3		4		5		Finals		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.5	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.1	7.6	8.3	7.4	8.1	7.5	8.2	7.3	8.2	7.4				
pH	8.3	8.1	8.2	8.1	8.2	8.1	8.1	8.1	8.2	7.9	8.2	8.0				
Cond. (µS/cm)	1765		1764		1830		1839		1836		1838		1891			
Initials	EMM		EMM		EMM		EMM		A		EMM		JS			

(mg/L SO ₄) Concentration 1300	Days															
	0		1		2		3		4		5		Finals		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.5	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.1	7.6	8.3	7.4	8.1	7.4	8.2	7.3	8.2	7.4				
pH	8.3	8.1	8.2	8.1	8.2	8.0	8.1	8.1	8.2	8.0	8.2	8.0				
Cond. (µS/cm)	2220		2210		2196		2210		2210		2216		2250			
Initials	EMM		EMM		EMM		EMM		A		EMM		JS			

Thermometer: 4 DO meter: 2/1 pH meter: 2 Conductivity meter: 1/2

	Control	EV-ER4		
Hardness*	104	249		
Alkalinity*	98	163		

Analysts: MLT, EMM, KL, AND, JS
 Reviewed by: JBU
 Date reviewed: Feb. 10/17

Sample Description: same as page 1 of 2

Comments: Broodboard Used: 102016 A-B (MLT #1-21, 23-40) (#1-27, 29-40)

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Peck coal
Sample ID: EV-ER4-SC4
Work Order: 161182

Start Date & Time: Nov 2/16 @ 1200h
Stop Date & Time: Nov 8/16 @ 1630h
Set up by: EMM

(EV-ER4 Unamended)

Days	Concentration:											Concentration:											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	4	3	3	3	3	6	2	3	2	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
5	8	✓	11	9	✓	✓	✓	8	8	8	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS
6	12	11	13	13	11	8	11	✓	11	12	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS
7																																	
8																																	
Total	25	15	27	25	14	11	17	10	22	22	EMM																						

Days	Concentration:											Concentration: (350 mg/L SC4)											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	2	4	3	6	4	4	✓	2	2	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
5	11	8	10	11	✓	✓	✓	8	6	4	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS
6	12	13	✓	✓	13	10	9	13	10	13	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS
7																																	
8																																	
Total	26	23	14	14	19	14	13	21	16	19	EMM																						

Days	Concentration:											Concentration: (455 mg/L SC4)											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	2	✓	3	3	3	2	3	4	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
5	8	10	8	9	✓	✓	✓	9	8	8	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS
6	9	10	11	✓	12	12	12	12	9	10	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	SS
7																																	
8																																	
Total	20	22	19	12	15	15	14	24	13	18	EMM																						

Notes: X = mortality.

Sample Description: same as WD sheet
Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

page 1 of 3

Reviewed by: JOh

Date reviewed: Feb. 10/17

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: TECK COAL
 Sample ID: EVERY SC4
 Work Order: 161182

Start Date & Time: NOV 2/16 @ 1200h
 Stop Date & Time: NOV 8/16 @ 1630h
 Set up by: EMM

(592 mg/L SC4)

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	✓	✓	3	4	3	4	2	3	4	3	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	
5	8	8	6	8	9	9	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
6	13	10	9	11	12	✓	11	10	9	13	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7																																			
8																																			
Total	21	18	18	23	24	13	13	13	13	16	EMM																								

(769 mg/L SC4)

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	✓	3	2	3	3	✓	✓	3	2	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	
5	8	9	6	5	9	5	9	✓	✓	2	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
6	13	12	10	✓	✓	11	12	11	6	5	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7																																			
8																																			
Total	21	24	18	8	12	16	21	14	8	7	EMM																								

(1000 mg/L SC4)

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MC
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	2	3	✓	2	✓	✓	2	2	2	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
5	5	6	8	5	6	5	4	✓	9	8	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
6	10	10	10	12	9	9	10	11	12	12	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS
7																																			
8																																			
Total	17	18	22	15	20	14	13	14	22	22	EMM																								

Notes: X = mortality.

Sample Description: same as WD sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Page 2 of 3

Reviewed by: JGK

Date reviewed: Feb. 10/17

CETIS Summary Report

Report Date: 17 Jan-17 16:54 (p 1 of 2)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 11-2010-7369	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 3h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
17-0037-9318	6d Survival Rate	79.1	>79.1	NA	NA		Fisher Exact Test

6d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	30	1	1	1	1	1	0	0	0.0%	0.0%
79.1	Negative Control	30	1	1	1	1	1	0	0	0.0%	0.0%
359.5		30	1	1	1	1	1	0	0	0.0%	0.0%
472		30	1	1	1	1	1	0	0	0.0%	0.0%
614.5		30	1	1	1	1	1	0	0	0.0%	0.0%
790		30	1	1	1	1	1	0	0	0.0%	0.0%
1015		30	1	1	1	1	1	0	0	0.0%	0.0%
1345		30	1	1	1	1	1	0	0	0.0%	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
79.1	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
359.5		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
472		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
614.5		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
790		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1015		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1345		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

CETIS Summary Report

Report Date: 17 Jan-17 16:54 (p 2 of 2)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

6d 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
0	① Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
79.1	② Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
359.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
472		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
614.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
790		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1015		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1345		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

① Lab water = 20%. Deionized lab control
 Negative control = site water EV-ERY (unamended)
 (dilution water)

CETIS Summary Report

Report Date: 17 Jan-17 16:55 (p 1 of 1)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 11-2010-7369	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 3h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
16-7457-4332	Reproduction	IC5	468.8	N/A	1173		Nonlinear Regression
		IC10	963	181	1818		
		IC15	1485	93.66	3128		
		IC20	2040	N/A	4748		
		IC25	2630	N/A	6674		
		IC40	4669	N/A	16080		
		IC50	6336	N/A	N/A		

Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	10	18.2	13.81	22.59	10	26	1.943	6.143	33.75%	0.0%
79.1	Negative Control	10	18.6	14.32	22.88	10	27	1.893	5.985	32.18%	-2.2%
359.5		10	17.9	14.73	21.07	13	26	1.402	4.433	24.77%	1.65%
472		10	17.2	14.32	20.08	12	24	1.272	4.022	23.38%	5.5%
614.5		10	17.2	14.11	20.29	13	24	1.365	4.315	25.09%	5.5%
790		10	14.9	10.54	19.26	7	24	1.929	6.1	40.94%	18.13%
1015		10	17.7	15.11	20.29	13	22	1.146	3.622	20.47%	2.75%
1345		10	16	11.5	20.5	0	22	1.989	6.289	39.31%	12.09%

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
0	Lab Water	24	11	10	25	24	12	26	17	17	16
79.1	Negative Control	23	15	27	25	14	11	17	10	22	22
359.5		26	23	14	14	19	14	13	21	16	19
472		20	22	19	12	15	15	14	24	13	18
614.5		21	18	18	23	24	13	13	13	13	16
790		21	24	18	8	12	16	21	14	8	7
1015		17	18	22	15	20	14	13	14	22	22
1345		21	18	22	13	19	14	19	18	16	0

CETIS Analytical Report

Report Date: 17 Jan-17 16:51 (p 1 of 3)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 08-9944-7528	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 17 Jan-17 16:43	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 11-2010-7369	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 3h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1414348	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	>1345	N/A	N/A
EC10	>1345	N/A	N/A
EC15	>1345	N/A	N/A
EC20	>1345	N/A	N/A
EC25	>1345	N/A	N/A
EC40	>1345	N/A	N/A
EC50	>1345	N/A	N/A

6d Survival Rate Summary

C-mg/L	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
79.1	Negative Control	30	1	1	1	0	0	0.0%	0.0%	30	30
359.5		30	1	1	1	0	0	0.0%	0.0%	30	30
472		30	1	1	1	0	0	0.0%	0.0%	30	30
614.5		30	1	1	1	0	0	0.0%	0.0%	30	30
790		30	1	1	1	0	0	0.0%	0.0%	30	30
1015		30	1	1	1	0	0	0.0%	0.0%	30	30
1345		30	1	1	1	0	0	0.0%	0.0%	30	30

CETIS Analytical Report

Report Date: 17 Jan-17 16:51 (p 2 of 3)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 08-9944-7528
 Analyzed: 17 Jan-17 16:43

Endpoint: 6d Survival Rate
 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
 Official Results: Yes

6d 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
79.1	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
359.5		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
472		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
614.5		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
790		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1015		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1345		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
79.1	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
359.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
472		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
614.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
790		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1015		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1345		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 17 Jan-17 16:51 (p 3 of 3)
Test Code: 161182 SO4b1 | 20-5095-0134

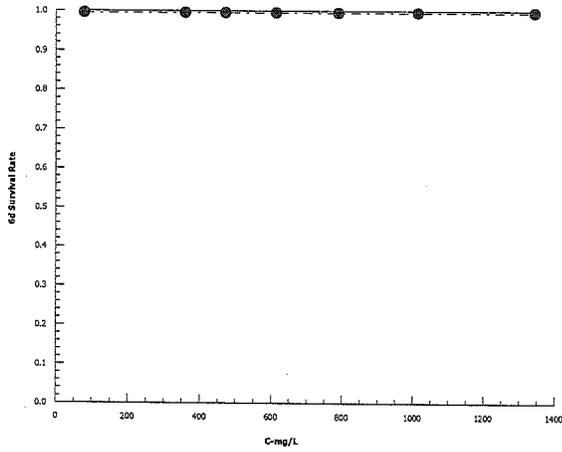
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 08-9944-7528 Endpoint: 6d Survival Rate
Analyzed: 17 Jan-17 16:43 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 17 Jan-17 16:52 (p 1 of 2)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test			Nautilus Environmental		
Analysis ID: 16-7457-4332	Endpoint: Reproduction	CETIS Version: CETISv1.8.7			
Analyzed: 17 Jan-17 16:46	Analysis: Nonlinear Regression	Official Results: Yes			
Batch ID: 11-2010-7369	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran			
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water			
Ending Date: 08 Nov-16 16:30	Species: Ceriodaphnia dubia	Brine:			
Duration: 6d 4h	Source: In-House Culture	Age: <24h			
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal			
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:			
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)				
Sample Age: 8d 3h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N				

Non-Linear Regression Options				
Model Function	X Transform	Y Transform	Weighting Function	PTBS Function
2P Exponential EV [Y=A*exp(log(0.5)*X/D)]	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%)
4	-146.2	296.6	300.9	0.0068	Yes	0.4409	2.361	0.8183	Non-Significant Lack of Fit

Point Estimates			
Level	mg/L	95% LCL	95% UCL
IC5	468.8	N/A	1173
IC10	963	181	1818
IC15	1485	93.66	3128
IC20	2040	N/A	4748
IC25	2630	N/A	6674
IC40	4669	N/A	16080
IC50	6336	N/A	N/A

MLT > 1345.00 mg/L SO4

Regression Parameters							
Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
A	18.35	1.224	15.95	20.75	14.98	<0.0001	Significant Parameter
D	6336	5199	-3854	16530	1.219	0.2272	Non-Significant Parameter

ANOVA Table						
Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	36.40107	36.40107	1	1.475	0.2288	Non-Significant
Lack of Fit	56.74179	11.34836	5	0.4409	0.8183	Non-Significant
Pure Error	1621.5	25.73809	63			
Residual	1678.242	24.68003	68			

Residual Analysis					
Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Variances	Bartlett Equality of Variance	5.2	12.59	0.5184	Equal Variances
	Mod Levene Equality of Variance	0.8234	2.246	0.5561	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9676	0.9654	0.0668	Normal Distribution
	Anderson-Darling A2 Normality	0.6389	2.492	0.0962	Normal Distribution

Reproduction Summary									
C-mg/L	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
79.1	Negative Control	10	18.6	10	27	1.893	5.985	32.18%	0.0%
359.5		10	17.9	13	26	1.402	4.433	24.77%	3.76%
472		10	17.2	12	24	1.272	4.022	23.38%	7.53%
614.5		10	17.2	13	24	1.365	4.315	25.09%	7.53%
790		10	14.9	7	24	1.929	6.1	40.94%	19.89%
1015		10	17.7	13	22	1.146	3.622	20.47%	4.84%
1345		10	16	0	22	1.989	6.289	39.31%	13.98%

CETIS Analytical Report

Report Date: 17 Jan-17 16:52 (p 2 of 2)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

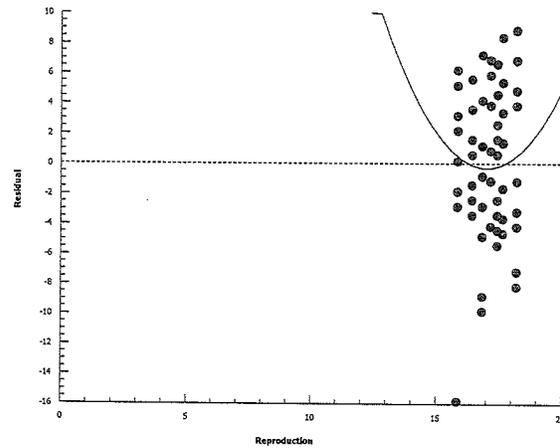
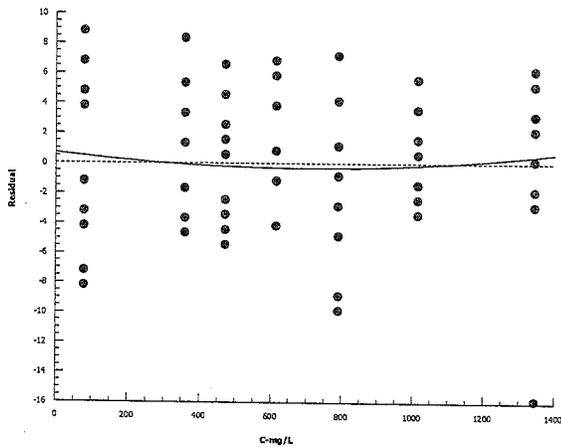
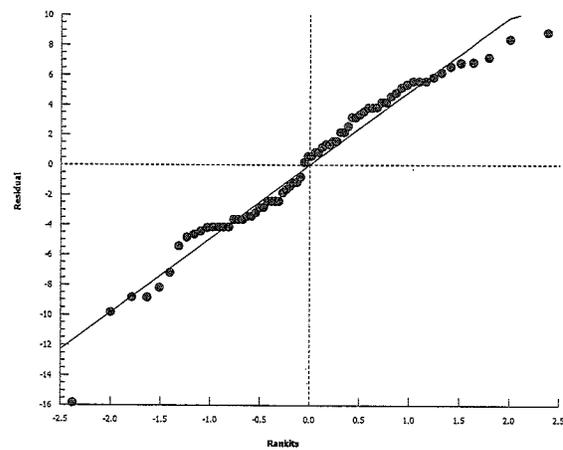
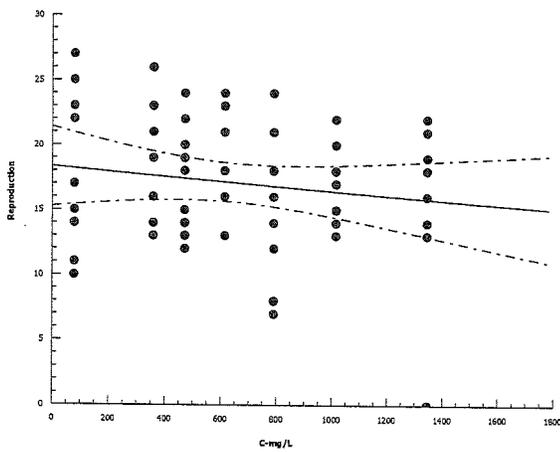
Analysis ID: 16-7457-4332 Endpoint: Reproduction CETIS Version: CETISv1.8.7
 Analyzed: 17 Jan-17 16:46 Analysis: Nonlinear Regression Official Results: Yes

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
79.1	Negative Control	23	15	27	25	14	11	17	10	22	22
359.5		26	23	14	14	19	14	13	21	16	19
472		20	22	19	12	15	15	14	24	13	18
614.5		21	18	18	23	24	13	13	13	13	16
790		21	24	18	8	12	16	21	14	8	7
1015		17	18	22	15	20	14	13	14	22	22
1345		21	18	22	13	19	14	19	18	16	0

Graphics

2P Exponential EV [Y=A*exp(log(0.5)*X/D)]



CETIS Analytical Report

Report Date: 17 Jan-17 16:51 (p 1 of 2)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-0037-9318	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 17 Jan-17 16:51	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 11-2010-7369	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 3h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Water		79.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Lab Water	30	0	30	1	0	0.0%
79.1	Negative Contr	30	0	30	1	0	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
79.1	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
79.1	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 17 Jan-17 16:51 (p 2 of 2)
Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

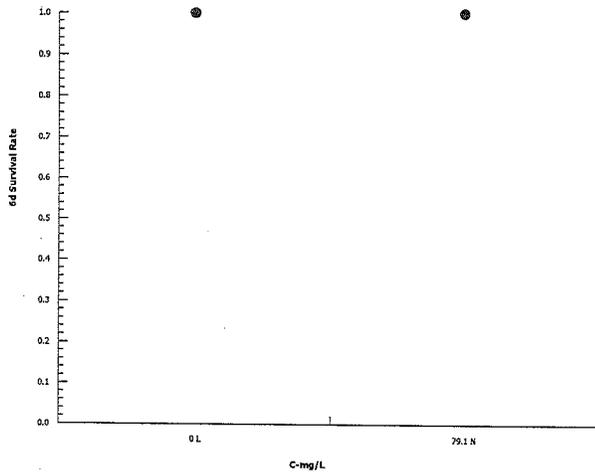
Nautilus Environmental

Analysis ID: 17-0037-9318
Analyzed: 17 Jan-17 16:51

Endpoint: 6d Survival Rate
Analysis: Single 2x2 Contingency Table

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 17 Feb-17 14:34 (p 1 of 1)
 Test Code: 161182 SO4b1 | 20-5095-0134

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-6241-0199	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 17 Feb-17 14:34	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 11-2010-7369	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 3h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	25.8%	Passes reproduction

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Water	79.1	0.1475	1.734	4.703	18	0.4422	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.8	0.8	1	0.02175	0.8844	Non-Significant Effect
Error	662	36.77778	18			
Total	662.8		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.053	6.541	0.9396	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9101	0.866	0.0639	Normal Distribution

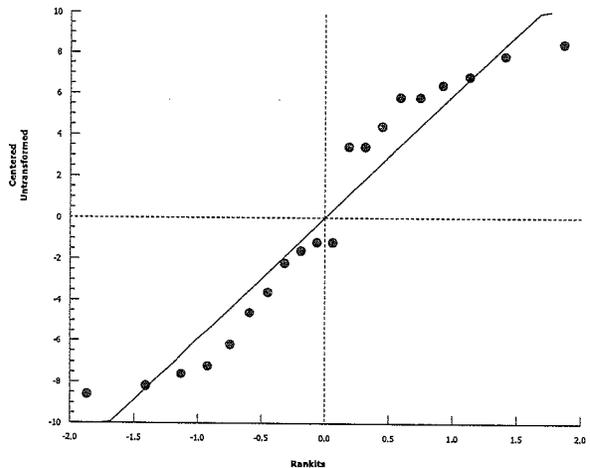
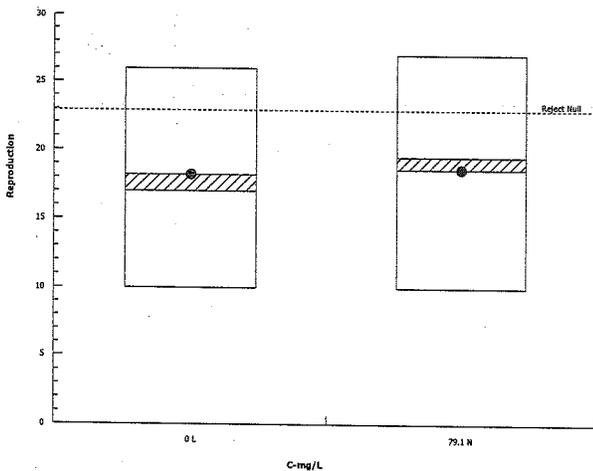
Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Lab Water	10	18.2	13.81	22.59	17	10	26	1.943	33.75%	0.0%
79.1	Negative Control	10	18.6	14.32	22.88	19.5	10	27	1.893	32.18%	-2.2%

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
0	Lab Water	24	11	10	25	24	12	26	17	17	16
79.1	Negative Control	23	15	27	25	14	11	17	10	22	22

Graphics



CETIS Summary Report

Report Date: 18 Jan-17 16:34 (p 1 of 1)
 Test Code: 161182 SO4a | 19-4983-2206

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 05-8372-3831 Test Type: Reproduction-Survival (7d) Analyst: Mimi Tran
 Start Date: 02 Nov-16 12:00 Protocol: EC/EPS 1/RM/21 Diluent: 20% Perrier Water
 Ending Date: 08 Nov-16 20:00 Species: Ceriodaphnia dubia Brine:
 Duration: 6d 8h Source: In-House Culture Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	19-8876-1566	02 Nov-16	02 Nov-16	12h	Teck Coal	
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	8d 3h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	8d 2h (4.2 °C)		
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	8d 0h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		

6d Survival Rate Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	30	1	1	1	1	1	0	0	0.0%	0.0%
EV_ER4	30	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	30	1	1	1	1	1	0	0	0.0%	0.0%
GH_ER2	30	1	1	1	1	1	0	0	0.0%	0.0%

6d Survival Rate Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
EV_ER4	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1

6d Survival Rate Binomials

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_ER4	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Summary Report

Report Date: 18 Jan-17 16:34 (p 1 of 1)
Test Code: 161182 SO4a | 19-4983-2206

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 05-8372-3831 **Test Type:** Reproduction-Survival (7d) **Analyst:** Mimi Tran
Start Date: 02 Nov-16 12:00 **Protocol:** EC/EPS 1/RM/21 **Diluent:** 20% Perrier Water
Ending Date: 08 Nov-16 20:00 **Species:** Ceriodaphnia dubia **Brine:**
Duration: 6d 8h **Source:** In-House Culture **Age:** <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	19-8876-1566	02 Nov-16	02 Nov-16	12h	Teck Coal	
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	8d 3h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	8d 2h (4.2 °C)		
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	8d 0h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		

Reproduction Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	18.2	13.81	22.59	10	26	1.943	6.143	33.75%	0.0%
EV_ER4	10	18.6	14.32	22.88	10	27	1.893	5.985	32.18%	-2.2%
GH_FR1	10	16.5	11.53	21.47	0	23	2.197	6.948	42.11%	9.34%
GH_ER2	10	19.5	14.89	24.11	8	27	2.04	6.451	33.08%	-7.14%

Reproduction Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	24	11	10	25	24	12	26	17	17	16
EV_ER4	23	15	27	25	14	11	17	10	22	22
GH_FR1	17	0	12	22	13	23	16	21	19	22
GH_ER2	21	8	22	21	23	25	27	12	12	24

CETIS Analytical Report

Report Date: 18 Jan-17 16:34 (p 1 of 2)
 Test Code: 161182 SO4a | 19-4983-2206

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 07-8707-6391	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:32	Analysis: STP 2x2 Contingency Tables	Official Results: Yes
Batch ID: 05-8372-3831	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: 20% Perrier Water
Ending Date: 08 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 8h	Source: In-House Culture	Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	19-8876-1566	02 Nov-16	02 Nov-16	12h	Teck Coal	
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	8d 3h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	8d 2h (4.2 °C)		
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	8d 0h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		EV_ER4	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_ER2	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Lab Water	30	0	30	1	0	0.0%
EV_ER4	Unamended Sa	30	0	30	1	0	0.0%
GH_FR1	Receiving Wate	30	0	30	1	0	0.0%
GH_ER2	Upstream Contr	30	0	30	1	0	0.0%

6d Survival Rate Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
EV_ER4	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1

CETIS Analytical Report

Report Date: 18 Jan-17 16:34 (p 2 of 2)
 Test Code: 161182 SO4a | 19-4983-2206

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 07-8707-6391
 Analyzed: 18 Jan-17 16:32

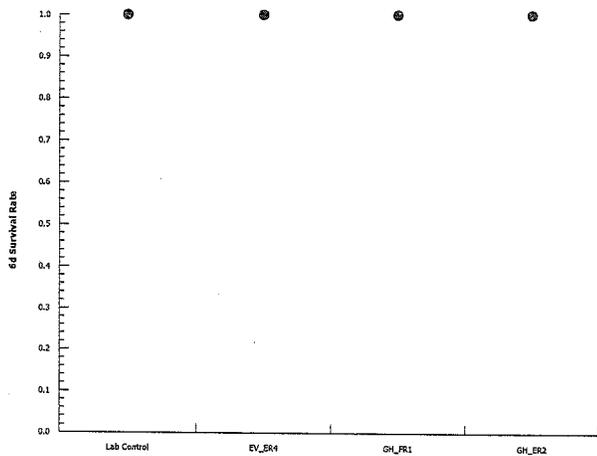
Endpoint: 6d Survival Rate
 Analysis: STP 2x2 Contingency Tables

CETIS Version: CETISv1.8.7
 Official Results: Yes

6d Survival Rate Binomials

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_ER4	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:34 (p 1 of 2)
 Test Code: 161182 SO4a | 19-4983-2206

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-9804-9706 Endpoint: Reproduction CETIS Version: CETISv1.8.7
 Analyzed: 18 Jan-17 16:33 Analysis: Parametric-Control vs Treatments Official Results: Yes

Batch ID: 05-8372-3831 Test Type: Reproduction-Survival (7d) Analyst: Mimi Tran
 Start Date: 02 Nov-16 12:00 Protocol: EC/EPS 1/RM/21 Diluent: 20% Perrier Water
 Ending Date: 08 Nov-16 20:00 Species: Ceriodaphnia dubia Brine:
 Duration: 6d 8h Source: In-House Culture Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	19-8876-1566	02 Nov-16	02 Nov-16	12h	Teck Coal	
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	8d 3h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	8d 2h (4.2 °C)		
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	8d 0h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	33.5%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		EV_ER4	-0.1399	2.133	6.097	18	0.7978	CDF	Non-Significant Effect
		GH_FR1	0.5947	2.133	6.097	18	0.5005	CDF	Non-Significant Effect
		GH_ER2	-0.4548	2.133	6.097	18	0.8832	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	47.4	15.8	3	0.3867	0.7632	Non-Significant Effect
Error	1471	40.86111	36			
Total	1518.4		39			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	0.2259	11.34	0.9733	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9334	0.9236	0.0209	Normal Distribution

Reproduction Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	18.2	13.81	22.59	17	10	26	1.943	33.75%	0.0%
EV_ER4	10	18.6	14.32	22.88	19.5	10	27	1.893	32.18%	-2.2%
GH_FR1	10	16.5	11.53	21.47	18	0	23	2.197	42.11%	9.34%
GH_ER2	10	19.5	14.89	24.11	21.5	8	27	2.04	33.08%	-7.14%

Reproduction Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	24	11	10	25	24	12	26	17	17	16
EV_ER4	23	15	27	25	14	11	17	10	22	22
GH_FR1	17	0	12	22	13	23	16	21	19	22
GH_ER2	21	8	22	21	23	25	27	12	12	24

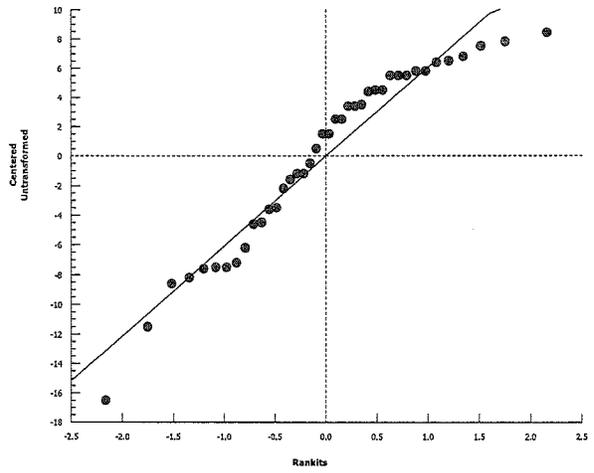
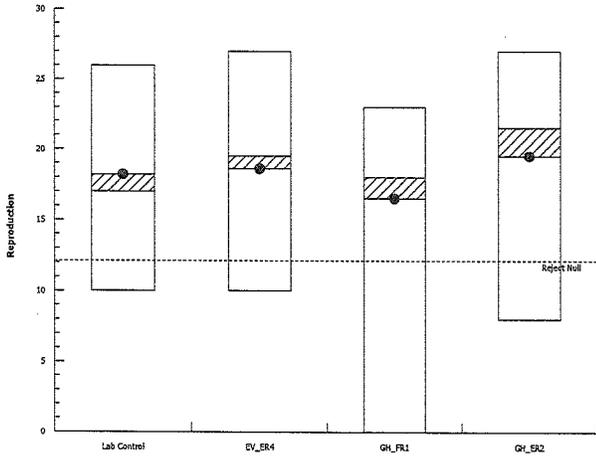
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-9804-9706 Endpoint: Reproduction
Analyzed: 18 Jan-17 16:33 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:35 (p 1 of 2)
 Test Code: 161182 SO4a | 19-4983-2206

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 12-1874-6068 Endpoint: Reproduction CETIS Version: CETISv1.8.7
 Analyzed: 18 Jan-17 16:33 Analysis: Parametric-Control vs Treatments Official Results: Yes

Batch ID: 05-8372-3831 Test Type: Reproduction-Survival (7d) Analyst: Mimi Tran
 Start Date: 02 Nov-16 12:00 Protocol: EC/EPS 1/RM/21 Diluent: 20% Perrier Water
 Ending Date: 08 Nov-16 20:00 Species: Ceriodaphnia dubia Brine:
 Duration: 6d 8h Source: In-House Culture Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	19-8876-1566	02 Nov-16	02 Nov-16	12h	Teck Coal	
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	8d 3h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	8d 2h (4.2 °C)		
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	8d 0h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	33.5%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		EV_ER4	0.1399	2.133	6.097	18	0.6969	CDF	Non-Significant Effect
		GH_FR1	-0.5947	2.133	6.097	18	0.9114	CDF	Non-Significant Effect
		GH_ER2	0.4548	2.133	6.097	18	0.5631	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	47.4	15.8	3	0.3867	0.7632	Non-Significant Effect
Error	1471	40.86111	36			
Total	1518.4		39			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	0.2259	11.34	0.9733	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9334	0.9236	0.0209	Normal Distribution

Reproduction Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	18.2	13.81	22.59	17	10	26	1.943	33.75%	0.0%
EV_ER4	10	18.6	14.32	22.88	19.5	10	27	1.893	32.18%	-2.2%
GH_FR1	10	16.5	11.53	21.47	18	0	23	2.197	42.11%	9.34%
GH_ER2	10	19.5	14.89	24.11	21.5	8	27	2.04	33.08%	-7.14%

Reproduction Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	24	11	10	25	24	12	26	17	17	16
EV_ER4	23	15	27	25	14	11	17	10	22	22
GH_FR1	17	0	12	22	13	23	16	21	19	22
GH_ER2	21	8	22	21	23	25	27	12	12	24

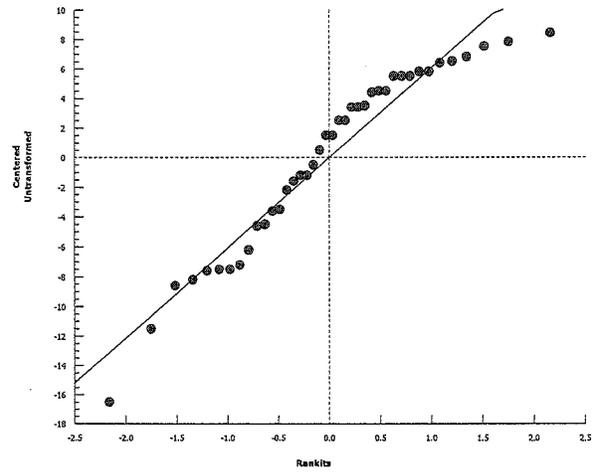
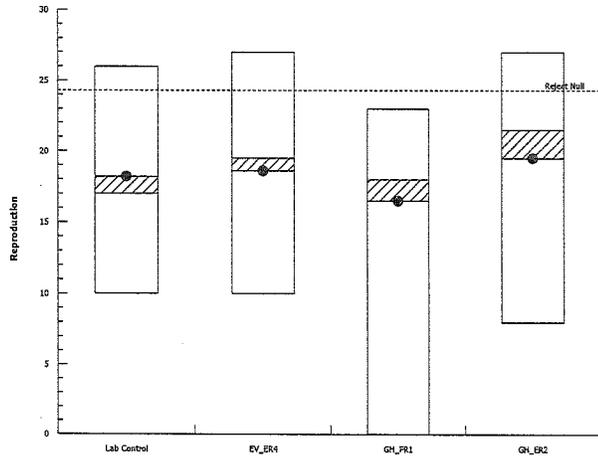
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 12-1874-6068 Endpoint: Reproduction
Analyzed: 18 Jan-17 16:33 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
 Work Order No.: 161182

Start Date/Time: Nov 2/16 @ 1200h
 Set up by: EMM

Sample Information:

Sample ID: GH-FRI-WS-2016-10-25-N
 Sample Date: Oct 25/16
 Date Received: Oct 26/16
 Sample Volume: 4x200L

Test Validity Criteria:

- 1) Mean survival of first generation controls is $\geq 80\%$
- 2) At least 60% of controls have produced three broods within 8 days
- 3) An average of ≥ 15 live young produced per surviving female in the control solutions during the first three broods.
- 4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T ($^{\circ}$ C) = 25 ± 1 ; DO (mg/L) = 3.3 to 8.4; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 102016A + 102016B
 Age of young (Day 0): <24-h (within 12-h)
 Avg No. young in first 3 broods of previous 7 d: 36
 Mortality (%) in previous 7 d: 2.5
 Individual female # used ≥ 8 young on test day: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,33,34,35,36,37,38,39,40
MEI
✓
38

NaCl Reference Toxicant Results:

Reference Toxicant ID: CD151
 Stock Solution ID: 16NaCl
 Date Initiated: NOV 15/16

7-d LC50 (95% CL): 2.1 (1.5-3.0) g/L NaCl
 7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.3) g/L NaCl CV (%): 5
 7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	> 1285.00	
IC25 % (v/v) (95% CL)		> 1285.00
IC50 % (v/v) (95% CL)		> 1285.00

mg/L SO₄

Reviewed by: JGK

Date reviewed: Feb. 10/17

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: GH-FRI Sulphate
 Work Order #: 161182

Start Date & Time: NOV 2/16 @ 1200h
 Stop Date & Time: NOV 8/16 @ 1600h
 Test Species: Ceriodaphnia dubia

Concentration lab	Days													
	0	1		2		3		4		5		Finals		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.0	8.0	8.0	7.5	8.0	7.3	8.0	7.5	2.5	2.5	7.3	8.0	7.5	
pH	8.1	8.0	8.0	7.9	8.0	7.9	8.0	7.2	7.1	8.0	8.0	7.8		
Cond. (µS/cm)	220	220		222		222		223		223		233		
Initials	EMM	EMM		EMM		EMM		A		EMM		JS		

① 7.4

(unamended) Concentration GH-FRI	Days													
	0	1		2		3		4		5		Finals		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.3	7.5	8.1	7.5	8.3	7.3	8.1	7.2	7.1	7.2	8.1	7.5		
pH	8.3	8.2	8.1	8.1	8.2	7.9	8.2	7.2	7.2	7.9	8.2	8.1		
Cond. (µS/cm)	799	798		796		797		802		800		828		
Initials	EMM	EMM		EMM		EMM		A		EMM		JS		

mg/L SO ₄ Concentration 350	Days													
	0	1		2		3		4		5		Finals		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.1	7.3	7.2	7.2	8.1	7.5		
pH	8.4	8.2	8.1	8.1	8.2	7.9	8.2	7.0	7.2	8.0	8.2	8.1		
Cond. (µS/cm)	981	980		980		973		968		974		976		
Initials	EMM	EMM		EMM		EMM		A		EMM		JS		

mg/L SO ₄ Concentration 455	Days													
	0	1		2		3		4		5		Finals		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.3	7.5	8.2	7.5	8.3	7.4	8.1	7.5	7.2	7.2	8.2	7.4		
pH	8.4	8.2	8.2	8.1	8.2	7.9	8.2	7.0	7.2	8.0	8.2	8.0		
Cond. (µS/cm)	1150	1153		1154		1161		1165		1162		1159		
Initials	EMM	EMM		EMM		EMM		A		EMM		JS		

① 1156

Thermometer: 4 DO meter: 1/2 pH meter: 2 Conductivity meter: 1/2

	Control	GH-FRI		
Hardness*	100	448		
Alkalinity*	98	193		

* mg/L as CaCO₃

Analysts: EMM, KL, ALW, MLT, JS
 Reviewed by: JOU
 Date reviewed: Feb. 10/17

Sample Description: GH-FRI with sulphate (GH-FRI: clear, colourless, odourless, some particulates)

Comments: Broodboard Used: 102016 A → B (#1-31, 33-40) (#1-27, 29-40)

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: GH-FR1 Sulphate
 Work Order #: 161182

Start Date & Time: NOV 2/16 @ 12:00h
 Stop Date & Time: Nov 8/16 @ 16:00h
 Test Species: Ceriodaphnia dubia

mg/L SO ₄ Concentration 592	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.1	7.5	8.2	7.2	8.2	7.4				
pH	8.3	8.2	8.2	8.1	8.3	8.0	8.2	8.0	8.2	8.0	8.2	8.0				
Cond. (µS/cm)	1351	1352		1354		1327		1331		1329		1352				
Initials	FMM	FMM		FMM		FMM		A		FMM		JS				

01327m

mg/L SO ₄ Concentration 769	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.1	7.5	8.2	7.2	8.2	7.4				
pH	8.3	8.1	8.2	8.1	8.3	8.0	8.3	8.0	8.2	7.9	8.2	8.0				
Cond. (µS/cm)	1622	1621		1630		1602		1601		1600		1623				
Initials	FMM	FMM		FMM		FMM		A		FMM		JS				

mg/L SO ₄ Concentration 1000	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.1	7.5	8.2	7.2	8.2	7.4				
pH	8.3	8.1	8.2	8.1	8.3	8.0	8.3	8.1	8.3	8.0	8.2	8.1				
Cond. (µS/cm)	1858	1858		1885		1895		1908		1899		1932				
Initials	FMM	FMM		FMM		FMM		A		FMM		JS				

mg/L SO ₄ Concentration 1300	Days															
	0		1		2		3		4		5		Final 6		7	
	init.	old	new	old	new	final										
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.3	7.5	8.2	7.6	8.3	7.4	8.2	7.4	8.2	7.3	8.2	7.4				
pH	8.3	8.1	8.2	8.1	8.3	8.1	8.3	8.1	8.3	8.0	8.2	8.1				
Cond. (µS/cm)	2130	2130		2230		2250		2300		2310		2076				
Initials	FMM	FMM		FMM		FMM		A		FMM		JS				

Thermometer: 4 DO meter: 1/2 pH meter: 2 Conductivity meter: 1/2

	Control	GH-FR1		
Hardness*	100	448		
Alkalinity*	98	193		

Analysts: ULT, FMM, KL, AUD, JS
 Reviewed by: JOU
 Date reviewed: Feb. 10/17

* mg/L as CaCO₃

Sample Description: Same as page 1 of 2

Comments: Broodboard Used: 102016 A 78 (M1) (#1-31, 33-40) (#1-27, 29-40)

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Teck coal
 Sample ID: GHR21 304
 Work Order: 161182

Start Date & Time: Nov 2/16 @ 1200h
 Stop Date & Time: Nov 8/16 @ 1600h
 Set up by: EMM

Days	Concentration: <u>lab control</u>												Concentration:												Concentration:											
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init			
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT			
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
3	✓	✓	✓	3	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
4	4	3	4	✓	4	3	3	✓	3	4	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A			
5	9	8	6	9	8	✓	10	2	5	4	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS			
6	11	✓	✓	13	12	9	13	11	9	8	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS			
7																																				
8																																				
Total	24	11	10	25	24	17	20	17	17	16	EMM																									

(GHR21 unamended)

Days	Concentration:												Concentration:												Concentration:											
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init			
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT			
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
3	3	✓	✓	✓	✓	✓	✓	4	4	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
4	4	✓	4	3	3	3	4	6	4	3	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A			
5	4	✓	✓	9	10	9	✓	✓	4	9	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS			
6	10	✓	8	10	✓	11	12	11	11	10	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS			
7																																				
8																																				
Total	14	0	10	22	13	23	16	21	19	27	EMM																									

350 mg/L SO₄

Days	Concentration:												Concentration:												Concentration:											
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init			
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT			
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
4	3	4	✓	3	✓	2	2	3	2	3	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A			
5	8	12	8	11	✓	✓	✓	6	11	9	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS			
6	10	10	13	11	10	9	10	11	✓	11	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	JS			
7																																				
8																																				
Total	21	26	21	25	10	11	17	20	13	23	EMM																									

Notes: X = mortality.

Sample Description: same as WQ sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

page 1 of 3

Reviewed by: JOU

Date reviewed: Feb. 10/17

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Peck coal
 Sample ID: GHFRT SC4
 Work Order: 161182

Start Date & Time: NOV 2/16 @ 1200h
 Stop Date & Time: NOV 8/16 @ 1600h
 Set up by: EMM

(455 mg/L SC4)

Days	Concentration:											Concentration:											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	3	4	3	3	3	3	3	3	4	AS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	9	11	✓	10	✓	✓	8	2	✓	9	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
6	8	12	9	12	10	11	10	11	✓	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
7																																	
8																																	
Total	20	26	13	25	15	13	22	12	14	13	EMM																						

(592 mg/L SC4)

Days	Concentration:											Concentration:											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	3	3	3	2	3	3	✓	4	AS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
5	10	11	✓	10	6	10	7	5	10	SS	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
6	16	✓	12	10	12	13	12	14	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
7					SS																												
8																																	
Total	29	14	15	13	24	20	26	27	19	14	EMM																						

(769 mg/L SC4)

Days	Concentration:											Concentration:											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	3	3	3	✓	2	3	✓	3	AS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
5	8	6	8	9	✓	5	6	6	8	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
6	12	13	11	12	8	16	✓	15	15	✓	SS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
7																																	
8																																	
Total	18	23	22	24	11	21	6	23	21	11	EMM																						

Notes: X = mortality.

Sample Description: same as WS sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Page 2 of 3

Reviewed by: Joh

Date reviewed: Feb. 10/17

CETIS Summary Report

Report Date: 17 Jan-17 17:21 (p 1 of 2)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 05-4630-3252	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 2h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
13-2574-0886	6d Survival Rate	EC5	>1285	N/A	N/A		Linear Interpolation (ICPIN)
		EC10	>1285	N/A	N/A		
		EC15	>1285	N/A	N/A		
		EC20	>1285	N/A	N/A		
		EC25	>1285	N/A	N/A		
		EC40	>1285	N/A	N/A		
		EC50	>1285	N/A	N/A		

6d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	30	1	1	1	1	1	0	0	0.0%	0.0%
226.5	Negative Control	30	1	1	1	1	1	0	0	0.0%	0.0%
351		30	1	1	1	1	1	0	0	0.0%	0.0%
455.5		30	1	1	1	1	1	0	0	0.0%	0.0%
595		30	0.9667	0.8985	1	0	1	0.03333	0.1826	18.89%	3.33%
781		30	1	1	1	1	1	0	0	0.0%	0.0%
1030		30	1	1	1	1	1	0	0	0.0%	0.0%
1285		30	1	1	1	1	1	0	0	0.0%	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
226.5	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
351		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
455.5		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
595		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	0	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
781		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1030		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1285		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

CETIS Summary Report

Report Date: 17 Jan-17 17:21 (p 2 of 2)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

6d 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
0	① Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
226.5	② Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
351		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
455.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
595		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
781		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1030		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1285		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

① Lab water = 20% Perrier lab control water

② Negative control = site water GH-FRI (unamended)
 (dilution water)

CETIS Summary Report

Report Date: 17 Jan-17 17:21 (p 1 of 1)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 05-4630-3252	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 2h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
02-4399-6551	Reproduction	IC5	974.5	279.3	N/A		Linear Interpolation (ICPIN)
		IC10	1106	344.5	N/A		
		IC15	1215	693.8	N/A		
		IC20	>1285	N/A	N/A		
		IC25	>1285	N/A	N/A		
		IC40	>1285	N/A	N/A		
		IC50	>1285	N/A	N/A		

Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	10	18.2	13.81	22.59	10	26	1.943	6.143	33.75%	0.0%
226.5	Negative Control	10	16.5	11.53	21.47	0	23	2.197	6.948	42.11%	9.34%
351		10	18.2	13.84	22.56	10	26	1.925	6.088	33.45%	0.0%
455.5		10	17.3	13.42	21.18	12	26	1.713	5.417	31.31%	4.95%
595		10	19.6	15.59	23.61	13	29	1.771	5.602	28.58%	-7.69%
781		10	18	13.46	22.54	6	24	2.006	6.342	35.23%	1.1%
1030		10	16.8	12.09	21.51	4	23	2.081	6.579	39.16%	7.69%
1285		10	14.7	10.13	19.27	0	21	2.022	6.395	43.51%	19.23%

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
0	Lab Water	24	11	10	25	24	12	26	17	17	16
226.5	Negative Control	17	0	12	22	13	23	16	21	19	22
351		21	26	21	25	10	11	12	20	13	23
455.5		20	26	13	25	15	13	22	12	14	13
595		29	14	15	13	24	20	26	22	19	14
781		18	23	22	24	11	21	6	23	21	11
1030		19	8	20	4	17	22	22	23	21	12
1285		10	16	21	21	17	18	11	19	14	0

CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 1 of 3)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 13-2574-0886	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 17 Jan-17 17:17	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 05-4630-3252	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 2h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1922470	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	>1285	N/A	N/A
EC10	>1285	N/A	N/A
EC15	>1285	N/A	N/A
EC20	>1285	N/A	N/A
EC25	>1285	N/A	N/A
EC40	>1285	N/A	N/A
EC50	>1285	N/A	N/A

6d Survival Rate Summary

C-mg/L	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
226.5	Negative Control	30	1	1	1	0	0	0.0%	0.0%	30	30
351		30	1	1	1	0	0	0.0%	0.0%	30	30
455.5		30	1	1	1	0	0	0.0%	0.0%	30	30
595		30	0.9667	0	1	0.03333	0.1826	18.89%	3.33%	29	30
781		30	1	1	1	0	0	0.0%	0.0%	30	30
1030		30	1	1	1	0	0	0.0%	0.0%	30	30
1285		30	1	1	1	0	0	0.0%	0.0%	30	30

CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 2 of 3)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 13-2574-0886 Endpoint: 6d Survival Rate CETIS Version: CETISv1.8.7
 Analyzed: 17 Jan-17 17:17 Analysis: Linear Interpolation (ICPIN) Official Results: Yes

6d 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
226.5	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
351		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
455.5		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
595		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	0	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
781		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1030		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
1285		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
226.5	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
351		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
455.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
595		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
781		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1030		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
1285		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 3 of 3)
Test Code: 161182 SO4c1 | 12-3079-1436

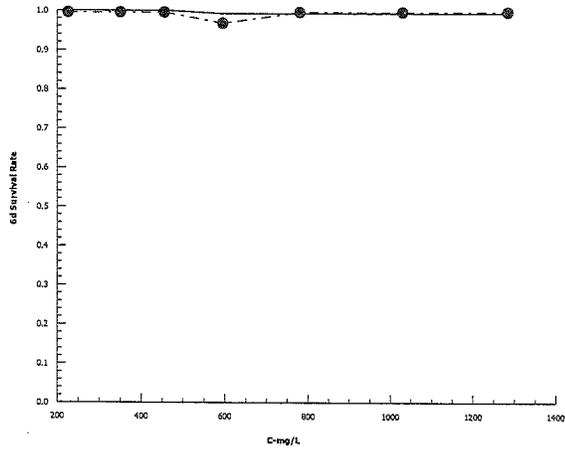
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 13-2574-0886 Endpoint: 6d Survival Rate
Analyzed: 17 Jan-17 17:17 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 1 of 2)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 02-4399-6551	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 17 Jan-17 17:18	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 05-4630-3252	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 2h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	238452	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	974.5	279.3	N/A
IC10	1106	344.5	N/A
IC15	1215	693.8	N/A
IC20	>1285	N/A	N/A
IC25	>1285	N/A	N/A
IC40	>1285	N/A	N/A
IC50	>1285	N/A	N/A

Reproduction Summary

C-mg/L	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
226.5	Negative Control	10	16.5	0	23	2.197	6.948	42.11%	0.0%
351		10	18.2	10	26	1.925	6.088	33.45%	-10.3%
455.5		10	17.3	12	26	1.713	5.417	31.31%	-4.85%
595		10	19.6	13	29	1.771	5.602	28.58%	-18.79%
781		10	18	6	24	2.006	6.342	35.23%	-9.09%
1030		10	16.8	4	23	2.081	6.579	39.16%	-1.82%
1285		10	14.7	0	21	2.022	6.395	43.51%	10.91%

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
226.5	Negative Control	17	0	12	22	13	23	16	21	19	22
351		21	26	21	25	10	11	12	20	13	23
455.5		20	26	13	25	15	13	22	12	14	13
595		29	14	15	13	24	20	26	22	19	14
781		18	23	22	24	11	21	6	23	21	11
1030		19	8	20	4	17	22	22	23	21	12
1285		10	16	21	21	17	18	11	19	14	0

CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 2 of 2)
Test Code: 161182 SO4c1 | 12-3079-1436

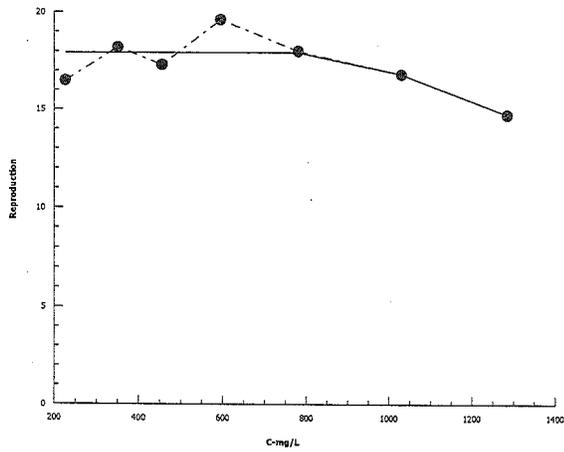
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 02-4399-6551 Endpoint: Reproduction
Analyzed: 17 Jan-17 17:18 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 15:52 (p 1 of 2)
 Test Code: 161182SO4c1(adj | 04-3499-1081)

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 15-4443-3397 Endpoint: Reproduction CETIS Version: CETISv1.8.7
 Analyzed: 18 Jan-17 15:51 Analysis: Linear Interpolation (ICPIN) Official Results: Yes

Batch ID: 00-4965-3536 Test Type: Reproduction-Survival (7d) Analyst: Mimi Tran
 Start Date: 02 Nov-16 12:00 Protocol: EC/EPS 1/RM/21 Diluent: Site Water
 Ending Date: 08 Nov-16 16:00 Species: Ceriodaphnia dubia Brine:
 Duration: 6d 4h Source: In-House Culture Age: <24h

Sample ID: 02-0044-4943 Code: GH_FR1 Client: Teck Coal
 Sample Date: 25 Oct-16 10:30 Material: Water Sample Project:
 Receive Date: 26 Oct-16 08:44 Source: Teck Coal (TECK COAL)
 Sample Age: 8d 2h (4.2 °C) Station: GH_FR1_WS_2016-10-25_N

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	43389	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	1140	255.4	N/A
IC10	1262	288	N/A
IC15	>1285	N/A	N/A
IC20	>1285	N/A	N/A
IC25	>1285	N/A	N/A
IC40	>1285	N/A	N/A
IC50	>1285	N/A	N/A

Reproduction Summary

C-mg/L	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
226.5	Negative Control	10	16.5	0	23	2.197	6.948	42.11%	0.0%
351		10	16.5	0	23	2.197	6.948	42.11%	0.0%
455.5		10	16.5	0	23	2.197	6.948	42.11%	0.0%
595		10	16.5	0	23	2.197	6.948	42.11%	0.0%
781		10	16.5	0	23	2.197	6.948	42.11%	0.0%
1030		10	16.5	0	23	2.197	6.948	42.11%	0.0%
1285		10	14.7	0	21	2.022	6.395	43.51%	10.91%

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
226.5	Negative Control	17	0	12	22	13	23	16	21	19	22
351		17	0	12	22	13	23	16	21	19	22
455.5		17	0	12	22	13	23	16	21	19	22
595		17	0	12	22	13	23	16	21	19	22
781		17	0	12	22	13	23	16	21	19	22
1030		17	0	12	22	13	23	16	21	19	22
1285		10	16	21	21	17	18	11	19	14	0

CETIS Analytical Report

Report Date: 18 Jan-17 15:52 (p 2 of 2)

Test Code: 161182SO4c1(adj | 04-3499-1081)

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 15-4443-3397

Endpoint: Reproduction

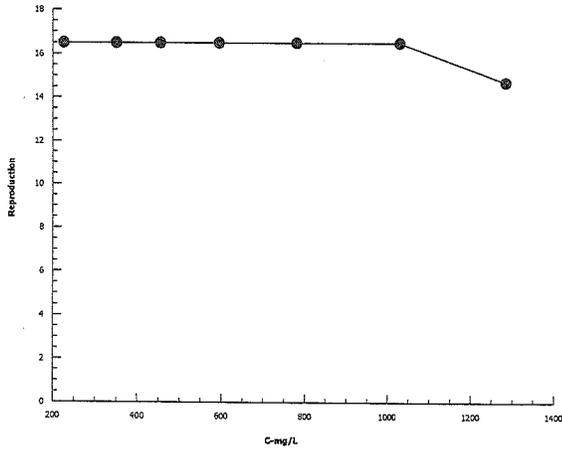
CETIS Version: CETISv1.8.7

Analyzed: 18 Jan-17 15:51

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 1 of 2)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 06-1946-3171	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 17 Jan-17 17:21	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 05-4630-3252	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 2h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Water		226.5	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Lab Water	30	0	30	1	0	0.0%
226.5	Negative Contr	30	0	30	1	0	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
226.5	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
226.5	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 2 of 2)

Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 06-1946-3171

Endpoint: 6d Survival Rate

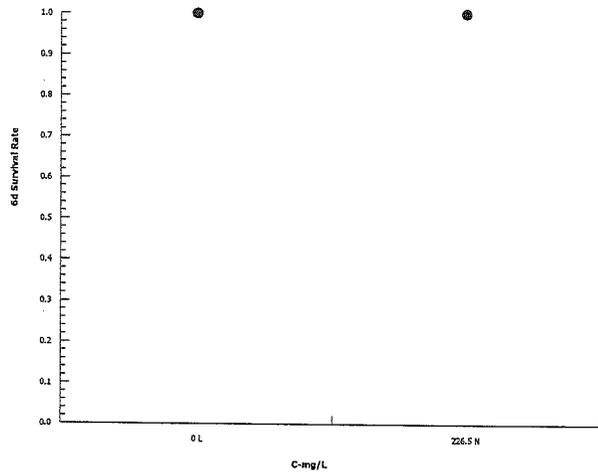
CETIS Version: CETISv1.8.7

Analyzed: 17 Jan-17 17:21

Analysis: Single 2x2 Contingency Table

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 17 Jan-17 17:21 (p 1 of 1)
 Test Code: 161182 SO4c1 | 12-3079-1436

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 12-6455-8954	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 17 Jan-17 17:20	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 05-4630-3252	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 02 Nov-16 12:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 08 Nov-16 16:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 4h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 8d 2h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	27.9%	Passes reproduction

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Water	226.5	0.5797	1.734	5.086	18	0.2847	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	14.45	14.45	1	0.336	0.5693	Non-Significant Effect
Error	774.1	43.00555	18			
Total	788.55		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.279	6.541	0.7195	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.916	0.866	0.0831	Normal Distribution

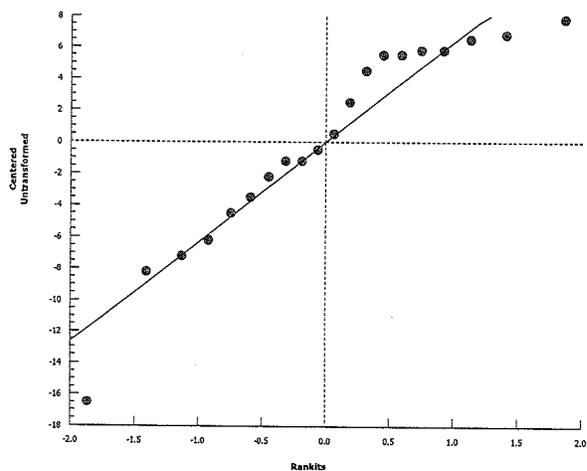
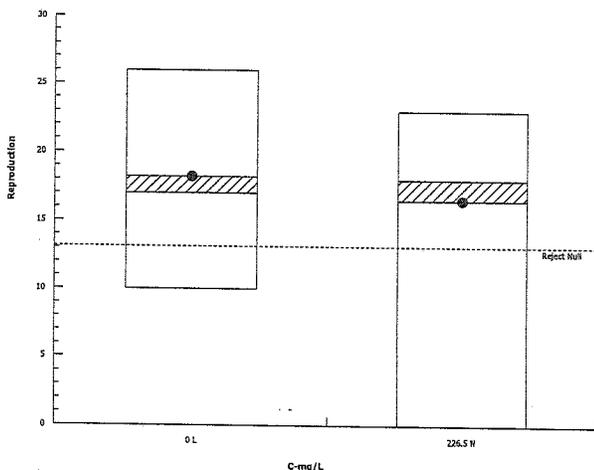
Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Lab Water	10	18.2	13.81	22.59	17	10	26	1.943	33.75%	0.0%
226.5	Negative Control	10	16.5	11.53	21.47	18	0	23	2.197	42.11%	9.34%

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
0	Lab Water	24	11	10	25	24	12	26	17	17	16
226.5	Negative Control	17	0	12	22	13	23	16	21	19	22

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck Coal
 Work Order No.: 161182

Start Date/Time: Nov 1/16 @ 1400h
 Set up by: EMM

Sample Information:

Sample ID: GH_ER2_WS_2016-10-25_N
 Sample Date: Oct 25/16
 Date Received: Oct 25/16
 Sample Volume: 2x200L

Test Validity Criteria:

- 1) Mean survival of first generation controls is $\geq 80\%$
- 2) At least 60% of controls have produced three broods within 8 days
- 3) An average of ≥ 15 live young produced per surviving female in the control solutions during the first three broods.
- 4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T ($^{\circ}$ C) = 25 ± 1 ; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 102016A + 102016B + 102016C + 102016D
 Age of young (Day 0): <24-h (within 12-h)
 Avg No. young in first 3 broods of previous 7 d: 31
 Mortality (%) in previous 7 d: 2.5

Individual female # used ≥ 8 young on test day A+B: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40

NaCl Reference Toxicant Results:

C+D: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40

Reference Toxicant ID: cd151
 Stock Solution ID: 16NAD2
 Date Initiated: Nov 15/16

7-d LC50 (95% CL): 2.1 (1.5-3.0) g/L NaCl
 7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.3) g/L NaCl CV (%): 5
 7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

	Survival	Reproduction
LC50 % (v/v) (95% CL)	>43.85	
IC25 % (v/v) (95% CL)		37.32 (22.6 ST - N/A)
IC50 % (v/v) (95% CL)		>43.85

mg/L Na₂-d

Reviewed by: JOh

Date reviewed: Feb. 10/17

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: GH-ER2 nitrate
 Work Order #: 161188

Start Date & Time: NOV 16 @ 1400h
 Stop Date & Time: NOV 16 @ 2000h
 Test Species: Ceriodaphnia dubia

Concentration <i>lab control</i>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.0	7.8	8.0	7.9	8.0	7.6	8.0	7.4	8.0	7.5	8.1	7.5		
pH	8.0	7.7	8.0	7.9	8.0	7.9	8.0	8.0	8.0	8.0	8.1	7.8		
Cond. (µS/cm)	221	220		220		222		222		223		230		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

(unamended) Concentration <i>GH-ER2</i>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.2	7.8	8.3	7.9	8.1	7.6	8.3	7.4	8.2	7.3	8.1	7.5		
pH	8.0	8.0	8.1	8.2	8.2	8.0	8.2	8.0	8.2	8.0	8.2	8.1		
Cond. (µS/cm)	314	316		315		316		316		312		321		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

(mg/L NO ₃ -N) Concentration <i>3</i>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.2	7.9	8.3	7.9	8.1	7.6	8.3	7.4	8.2	7.4	8.1	7.5		
pH	8.0	8.1	8.1	8.1	8.2	8.0	8.2	8.0	8.2	8.0	8.2	8.1		
Cond. (µS/cm)	340	348		346		339		349		339		348		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

(mg/L NO ₃ -N) Concentration <i>5</i>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.2	7.9	8.3	7.9	8.2	7.6	8.2	7.4	8.2	7.4	8.2	7.5		
pH	8.0	8.0	8.1	8.1	8.2	8.0	8.2	8.0	8.2	8.0	8.2	8.1		
Cond. (µS/cm)	357	362		359		350		359		349		360		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

Thermometer: 4 DO meter: 2/1 pH meter: 2 Conductivity meter: 2/1

	Control	GH-ER2		
Hardness*	100	167		
Alkalinity*	98	147		

Analysts: MLT, KI, EMM, AND
 Reviewed by: JLB
 Date reviewed: Feb-10/17

Sample Description: GH-ER2 with nitrate (GH-ER2: clear, colourless, odourless, no particulates)

Comments: Broodboard Used: 102016 A-D (A+B: #1-27, 29-40 C+D: #1-31, 33-40)

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: GH-22 Nitrate
 Work Order #: 161182

Start Date & Time: NOV 16 @ 1400h
 Stop Date & Time: Nov 7/16 @ 2000h
 Test Species: Ceriodaphnia dubia

(mg/L NO ₃ -N) Concentration 9	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.8	8.3	7.9	8.2	7.6	8.2	7.4	8.1	7.4	8.1	7.5		
pH	8.1	8.1	8.1	8.1	8.2	8.0	8.2	8.0	8.2	8.0	8.2	8.1		
Cond. (µS/cm)	388	389		388		376		380		371		382		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLJ		

(mg/L NO ₃ -N) Concentration 15	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.3	7.9	8.2	7.6	8.3	7.4	8.1	7.4	8.2	7.5		
pH	8.1	8.1	8.1	8.1	8.2	8.0	8.2	8.0	8.2	8.0	8.2	8.1		
Cond. (µS/cm)	439	438		439		425		426		423		439		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLJ		

(mg/L NO ₃ -N) Concentration 25	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.3	7.9	8.2	7.6	8.3	7.4	8.2	7.4	8.1	7.5		
pH	8.1	8.1	8.1	8.1	8.2	8.0	8.2	8.0	8.2	8.0	8.2	8.1		
Cond. (µS/cm)	515	520		520		526		521		517		516		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLJ		

(mg/L NO ₃ -N) Concentration 43	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.3	7.9	8.2	7.6	8.2	7.4	8.2	7.4	8.2	7.5		
pH	8.1	8.1	8.2	8.1	8.2	8.0	8.2	8.0	8.2	8.0	8.2	8.1		
Cond. (µS/cm)	662	662		667		670		669		661		670		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLJ		

Thermometer: 4 DO meter: 2/1 pH meter: 2 Conductivity meter: 2/1

	Control	GH-22		
Hardness*	100	167		
Alkalinity*	98	147		

Analysts: EMM, MLJ, KL, AWD
 Reviewed by: JGL
 Date reviewed: Feb. 10/12

Sample Description: Same as page 1 of 2

Comments: Broodboard Used: 102016A7D (same as pg 1 of 2)

Chronic Freshwater Toxicity Test
C. dubia Reproduction Data

Client: Teck coal
Sample ID: GHER2-NO3
Work Order: 161182

Start Date & Time: NOV 16 @ 1400h
Stop Date & Time: NOV 16 @ 2000h
Set up by: EMM

GHER2 Unamended

Days	Concentration:											Concentration:											Concentration:											
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
4	4	5	5	3	4	4	3	4	4	4	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
5	13	13	13	12	12	11	12	7	11	12	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
6	12	14	11	14	13	14	16	12	12	14	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
7																																		
8																																		
Total	29	32	29	29	29	29	31	23	27	30	EMM																							

Days	Concentration:											Concentration:											Concentration:											
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
4	4	4	4	3	3	4	4	5	3	4	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
5	12	12	11	10	14	8	10	10	11	✓	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
6	14	13	16	15	14	14	11	12	13	10	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
7																																		
8																																		
Total	30	29	31	28	31	26	25	27	27	14	EMM																							

3 mg/L NO3-N

Days	Concentration:											Concentration:											Concentration:											
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
4	4	5	3	4	3	3	4	4	4	4	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
5	13	10	10	11	9	10	13	8	10	10	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL
6	14	15	14	13	13	12	14	13	13	12	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7
7																																		
8																																		
Total	31	30	27	28	25	25	31	25	27	26	EMM																							

5 (mg/L NO3-N)

Notes: X = mortality.

Sample Description: Same as W&S sheet

Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Reviewed by: JGM

Date reviewed: Feb. 10/12

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Teck coal
 Sample ID: GHFR2 NO3
 Work Order: 161182

Start Date & Time: NOV 1/16 @ 1400h
 Stop Date & Time: NOV 7/16 @ 2000h
 Set up by: EMM

9 mg/L NO3-N

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	A		B	C	D	E	F	G	H	I	J	A	B		C	D	E	F	G	H	I	J				
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
4	3	3	4	4	3	3	4	4	4	3	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
5	8	10	12	12	11	10	11	12	12	8	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL			
6	12	16	15	13	13	12	13	14	14	8	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
7																																				
8																																				
Total	23	29	31	29	27	25	28	30	30	11	EMM																									

15 mg/L NO3-N

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	A		B	C	D	E	F	G	H	I	J	A	B		C	D	E	F	G	H	I	J				
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
4	4	3	4	4	3	3	4	4	3	4	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
5	10	10	11	12	11	7	8	9	7	11	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL			
6	13	12	12	15	14	12	12	14	12	12	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
7																																				
8																																				
Total	27	25	27	31	28	27	24	27	22	27	EMM																									

25 (mg/L NO3-N)

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	A		B	C	D	E	F	G	H	I	J	A	B		C	D	E	F	G	H	I	J				
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM			
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
4	4	4	4	3	4	4	4	3	3	4	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ML7			
5	8	11	7	12	11	10	10	4	8	8	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	KL			
6	13	16	14	10	12	8	14	13	13	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM				
7																																				
8																																				
Total	25	31	25	25	27	26	17	27	20	25	EMM																									

Notes: X = mortality.

Sample Description: same as WQ sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Page 2 of 3

Reviewed by: Joh

Date reviewed: Feb. 10/17

CETIS Summary Report

Report Date: 19 Jan-17 17:08 (p 1 of 2)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 21-0886-4547	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 2h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
00-2895-0277	6d Survival Rate	EC5	>43.85	N/A	N/A		Linear Interpolation (ICPIN)
		EC10	>43.85	N/A	N/A		
		EC15	>43.85	N/A	N/A		
		EC20	>43.85	N/A	N/A		
		EC25	>43.85	N/A	N/A		
		EC40	>43.85	N/A	N/A		
		EC50	>43.85	N/A	N/A		

6d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	30	1	1	1	1	1	0	0	0.0%	0.0%
0.14	Negative Control	30	1	1	1	1	1	0	0	0.0%	0.0%
3.44		30	1	1	1	1	1	0	0	0.0%	0.0%
5.23		30	1	1	1	1	1	0	0	0.0%	0.0%
9.06		30	1	1	1	1	1	0	0	0.0%	0.0%
15.1		30	1	1	1	1	1	0	0	0.0%	0.0%
24.05		30	1	1	1	1	1	0	0	0.0%	0.0%
43.85		30	0.9667	0.8985	1	0	1	0.03333	0.1826	18.89%	3.33%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
0.14	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
3.44		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
5.23		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
9.06		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
15.1		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
24.05		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
43.85		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	0	1	1	1	1
		1	1	1	1	1	1	1	1	1	

CETIS Summary Report

Report Date: 19 Jan-17 17:08 (p 2 of 2)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

6d 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
0	① Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
0.14	① Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.44		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
5.23		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
9.06		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
15.1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
24.05		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
43.85		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

① Lab water = 20% ^{lab} Premier control
 negative control = site water (dilution water) GH-ERJ (unamended)

CETIS Summary Report

Report Date: 19 Jan-17 17:08 (p 1 of 1)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 21-0886-4547	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 2h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
12-6513-9231	Reproduction	IC5	2.734	0.9217	13.8		Linear Interpolation (ICPIN)
		IC10	15.44	2.239	26.21		
		IC15	22.9	7.972	31.91		
		IC20	29.55	18.48	42.52		
		IC25	37.32	22.57	N/A		
		IC40	>43.85	N/A	N/A		
		IC50	>43.85	N/A	N/A		

Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	18	22	0.4069	1.287	6.47%	0.0%
0.14	Negative Control	10	28.8	27.05	30.55	23	32	0.7717	2.44	8.47%	-44.72%
3.44		10	26.8	23.27	30.33	14	31	1.562	4.94	18.43%	-34.67%
5.23		10	27.5	25.77	29.23	25	31	0.7638	2.415	8.78%	-38.19%
9.06		10	26.3	22.07	30.53	11	31	1.868	5.908	22.46%	-32.16%
15.1		10	26	24	28	22	31	0.8819	2.789	10.73%	-30.65%
24.05		10	24.3	20.65	27.95	12	31	1.613	5.1	20.99%	-22.11%
43.85		10	20.6	17.86	23.34	11	25	1.213	3.836	18.62%	-3.52%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
0.14	Negative Control	29	32	29	29	29	29	31	23	27	30
3.44		30	29	31	28	31	26	25	27	27	14
5.23		31	30	27	28	25	25	31	25	27	26
9.06		23	29	31	29	27	25	28	30	30	11
15.1		27	25	27	31	28	22	24	27	22	27
24.05		25	31	25	25	27	26	12	27	20	25
43.85		22	22	22	22	21	20	23	11	25	18

CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 1 of 3)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 00-2895-0277	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 19 Jan-17 17:06	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 21-0886-4547	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 2h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	5432	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	>43.85	N/A	N/A
EC10	>43.85	N/A	N/A
EC15	>43.85	N/A	N/A
EC20	>43.85	N/A	N/A
EC25	>43.85	N/A	N/A
EC40	>43.85	N/A	N/A
EC50	>43.85	N/A	N/A

6d Survival Rate Summary

C-mg/L	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0.14	Negative Control	30	1	1	1	0	0	0.0%	0.0%	30	30
3.44		30	1	1	1	0	0	0.0%	0.0%	30	30
5.23		30	1	1	1	0	0	0.0%	0.0%	30	30
9.06		30	1	1	1	0	0	0.0%	0.0%	30	30
15.1		30	1	1	1	0	0	0.0%	0.0%	30	30
24.05		30	1	1	1	0	0	0.0%	0.0%	30	30
43.85		30	0.9667	0	1	0.03333	0.1826	18.89%	3.33%	29	30

CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 2 of 3)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 00-2895-0277
 Analyzed: 19 Jan-17 17:06

Endpoint: 6d Survival Rate
 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
 Official Results: Yes

6d 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
0.14	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
3.44		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
5.23		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
9.06		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
15.1		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
24.05		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
43.85		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	0	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0.14	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
3.44		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
5.23		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
9.06		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
15.1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
24.05		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
43.85		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 3 of 3)
Test Code: 161182 NO3-Nb | 11-9360-5136

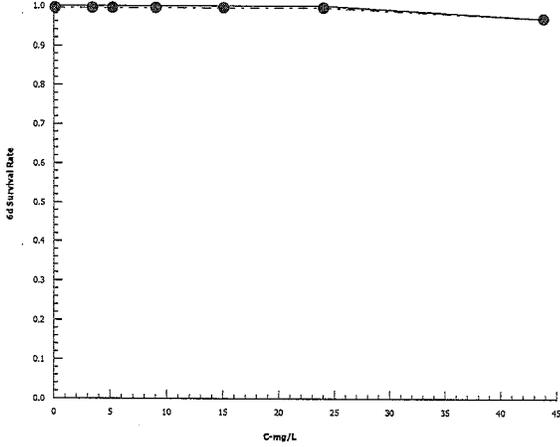
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 00-2895-0277 Endpoint: 6d Survival Rate
Analyzed: 19 Jan-17 17:06 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 1 of 2)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 12-6513-9231	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 19 Jan-17 17:07	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 21-0886-4547	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 2h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	362379	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	2.734	0.9217	13.8
IC10	15.44	2.239	26.21
IC15	22.9	7.972	31.91
IC20	29.55	18.48	42.52
IC25	37.32	22.57	N/A
IC40	>43.85	N/A	N/A
IC50	>43.85	N/A	N/A

Reproduction Summary

C-mg/L	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0.14	Negative Control	10	28.8	23	32	0.7717	2.44	8.47%	0.0%
3.44		10	26.8	14	31	1.562	4.94	18.43%	6.94%
5.23		10	27.5	25	31	0.7638	2.415	8.78%	4.51%
9.06		10	26.3	11	31	1.868	5.908	22.46%	8.68%
15.1		10	26	22	31	0.8819	2.789	10.73%	9.72%
24.05		10	24.3	12	31	1.613	5.1	20.99%	15.63%
43.85		10	20.6	11	25	1.213	3.836	18.62%	28.47%

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
0.14	Negative Control	29	32	29	29	29	29	31	23	27	30
3.44		30	29	31	28	31	26	25	27	27	14
5.23		31	30	27	28	25	25	31	25	27	26
9.06		23	29	31	29	27	25	28	30	30	11
15.1		27	25	27	31	28	22	24	27	22	27
24.05		25	31	25	25	27	26	12	27	20	25
43.85		22	22	22	22	21	20	23	11	25	18

CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 2 of 2)
Test Code: 161182 NO3-Nb | 11-9360-5136

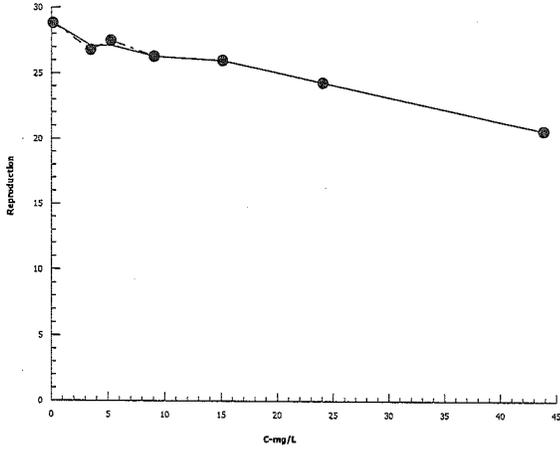
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 12-6513-9231 Endpoint: Reproduction
Analyzed: 19 Jan-17 17:07 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 1 of 2)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 11-6015-1371	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 19 Jan-17 17:06	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 21-0886-4547	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 2h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Water		0.14	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Lab Water	30	0	30	1	0	0.0%
0.14	Negative Contr	30	0	30	1	0	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
0.14	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
0.14	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 2 of 2)
Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

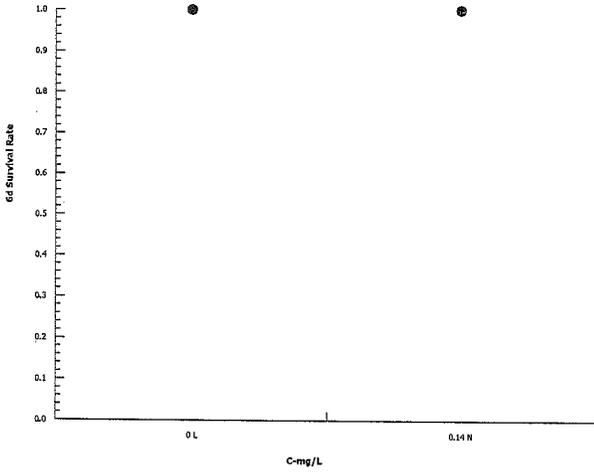
Nautilus Environmental

Analysis ID: 11-6015-1371
Analyzed: 19 Jan-17 17:06

Endpoint: 6d Survival Rate
Analysis: Single 2x2 Contingency Table

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 19 Jan-17 17:08 (p 1 of 1)
 Test Code: 161182 NO3-Nb | 11-9360-5136

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 18-4608-1133	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 19 Jan-17 17:07	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 21-0886-4547	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 2h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	7.6%	Fails reproduction

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Water	0.14*	10.2	1.734	1.513	18	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	396.05	396.05	1	104.1	<0.0001	Significant Effect
Error	68.5	3.805556	18			
Total	464.55		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	3.597	6.541	0.0701	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8947	0.866	0.0328	Normal Distribution

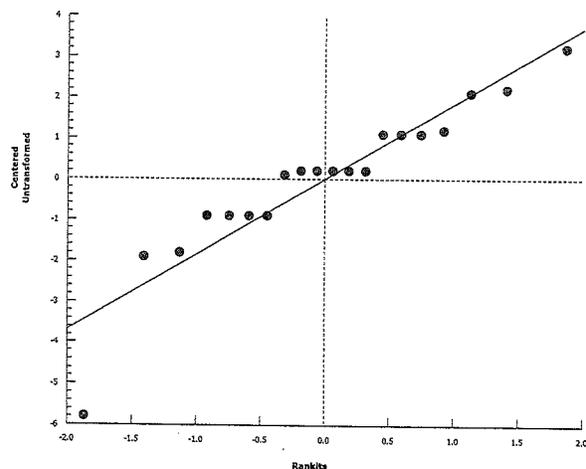
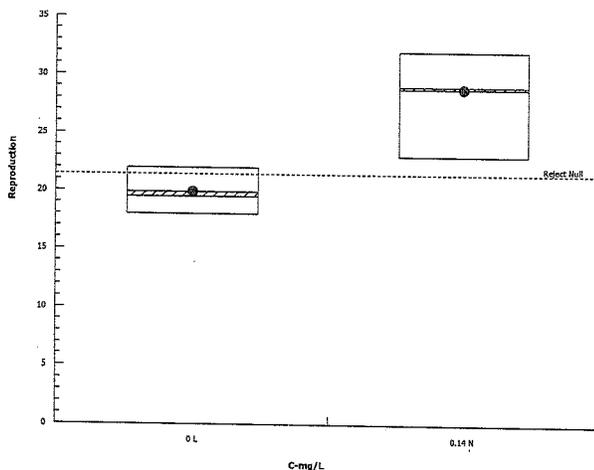
Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	19.5	18	22	0.4069	6.47%	0.0%
0.14	Negative Control	10	28.8	27.05	30.55	29	23	32	0.7717	8.47%	-44.72%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
0.14	Negative Control	29	32	29	29	29	29	31	23	27	30

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck coal
 Work Order No.: 161182

Start Date/Time: NOV 1/16 @ 1400h
 Set up by: EMM

Sample Information:

Sample ID: EV-ERT-WS-2016-10-25-N
 Sample Date: OCT 25/16
 Date Received: OCT 26/16
 Sample Volume: 3x200L

Test Validity Criteria:

- 1) Mean survival of first generation controls is $\geq 80\%$
- 2) At least 60% of controls have produced three broods within 8 days
- 3) An average of ≥ 15 live young produced per surviving female in the control solutions during the first three broods.
- 4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T ($^{\circ}$ C) = 25 ± 1 ; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.:
 Age of young (Day 0):
 Avg No. young in first 3 broods of previous 7 d:
 Mortality (%) in previous 7 d:
 Individual female # used ≥ 8 young on test day

102016A + 102016B + 102016C + 102016D
<24-h (within 12-h)
31
2.5

NaCl Reference Toxicant Results:

Reference Toxicant ID: CO151
 Stock Solution ID: 16NaCl
 Date Initiated: Nov 15/16

A+B: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,
 22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40
 C+D: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,
 21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40

7-d LC50 (95% CL): 2.1 (1.5-3.0) g/L NaCl
 7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.3) g/L NaCl CV (%): 5
 7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

mb	Survival	Reproduction
LC50 % (v/v) (95% CL)	>49.50	
IC25 % (v/v) (95% CL)		>49.50
IC50 % (v/v) (95% CL) mg/L NO ₃ -N		>49.50

Reviewed by: _____

Date reviewed: _____

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck coal
 Sample ID: EV-ER4 (Nitrate)
 Work Order #: 161182

Start Date & Time: NOV 16 @ 1400
 Stop Date & Time: NOV 17 @ 1900
 Test Species: Ceriodaphnia dubia

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

(unamended) Concentration <u>EV-ER4</u>	Days													
	0	1		2		3		4		5		Final 6	7	
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.8	8.3	7.4	8.2	7.3	8.3	7.4	8.1	7.5	7.2	7.5		
pH	8.1	8.1	8.1	8.1	8.2	8.1	8.2	8.0	8.1	8.0	8.1	8.2		
Cond. (µS/cm)	459	468		468		460		465		472		478		
Initials	EMM	EMM		MLT										

(mg/L NO ₃ -N) Concentration <u>5</u>	Days													
	0	1		2		3		4		5		Final 6	7	
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.2	7.8	8.3	7.4	8.2	7.3	8.3	7.4	8.2	7.4	8.2	7.5		
pH	8.1	8.1	8.1	8.1	8.2	8.1	8.2	8.1	8.1	8.0	8.2	8.2		
Cond. (µS/cm)	490	490		491		500		491		485		499		
Initials	EMM	EMM		MLT										

(mg/L NO ₃ -N) Concentration <u>8</u>	Days													
	0	1		2		3		4		5		Final 6	7	
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.3	7.4	8.2	7.3	8.3	7.4	8.2	7.5	8.2	7.5		
pH	8.1	8.1	8.1	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.2	8.2		
Cond. (µS/cm)	518	517		516		518		516		508		519		
Initials	EMM	EMM		MLT										

Thermometer: 4 DO meter: 2/1 pH meter: 2 Conductivity meter: 2/1

	Control	EV-ER4 (100% CV)	
Hardness*	100	249	
Alkalinity*	98	163	

Analysts: MLT, AWD, KL, EMM
 Reviewed by: JGL
 Date reviewed: Feb. 10/17

* mg/L as CaCO₃
 Sample Description: (clear, colourless, odourless, some particulates) EV-ER4 with nitrate ^① same as GH-ER2 W&S sheet

Comments: Broodboard Used: 102016A7D page 1 of 2

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: EV-ERY (Nitrate)
 Work Order #: 161182

Start Date & Time: NOV 16 @ 1400h
 Stop Date & Time: NOV 16 @ 1900h
 Test Species: Ceriodaphnia dubia

(mg/L NO ₂ -N) Concentration 12	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.3	7.4	8.2	7.4	8.3	7.4	8.1	7.5	8.2	7.5		
pH	8.1	8.1	8.1	8.1	8.2	8.1	8.2	8.2	8.2	8.1	8.2	8.2		
Cond. (µS/cm)	550	449	559	548		540		549		550		553		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

(mg/L NO ₃ -N) Concentration 20	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.2	7.4	8.2	7.4	8.2	7.4	8.2	7.4	8.1	7.5		
pH	8.1	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.2	8.2		
Cond. (µS/cm)	612	611		612		620		619		621		613		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

(mg/L NO ₃ -N) Concentration 31	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.2	7.4	8.2	7.3	8.2	7.4	8.1	7.4	8.2	7.5		
pH	8.2	8.1	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.2	8.2		
Cond. (µS/cm)	698	699		707		699		698		697		698		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

(mg/L NO ₃ -N) Concentration 50	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0		
DO (mg/L)	8.1	7.8	8.2	7.4	8.2	7.3	8.2	7.4	8.1	7.5	8.2	7.5		
pH	8.2	8.1	8.3	8.1	8.2	8.0	8.2	8.1	8.2	8.1	8.2	8.1		
Cond. (µS/cm)	850	850		852		871		861		871		832		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

Thermometer: 4 DO meter: 71 pH meter: 2 Conductivity meter: 71

	Control	EV-ERY		
Hardness*	100	249		
Alkalinity*	98	163		

Analysts: MCAUD, KL, EMM
 Reviewed by: JGL
 Date reviewed: Feb. 10/12

* mg/L as CaCO₃
 Sample Description: same as page 1 of 2 page 2 of 2

Comments: Broodboard Used: 102016A → D

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Teck Coal
 Sample ID: EV ER4 (NO3)
 Work Order: 16182

Start Date & Time: NOV 1/16 @ 1400h
 Stop Date & Time: NOV 7/16 @ 1900h
 Set up by: EMM

EV ER4 (unamended) 100% CVU

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	Init		A	B	C	D	E	F	G	H	I	J	Init		A	B	C	D	E	F	G	H	I	J	Init	
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
4	3	4	3	3	4	3	4	4	3	3	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
5	10	9	10	14	11	9	11	10	10	10	W	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	W	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	W	
6	12	11	11	12	15	9	12	11	12	16	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
7																																				
8																																				
Total	25	24	24	29	30	21	27	25	25	29	EMM																									

EV ER4 (5 mg/L NO3-N)

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	Init		A	B	C	D	E	F	G	H	I	J	Init		A	B	C	D	E	F	G	H	I	J	Init	
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
4	4	3	3	4	3	3	3	3	4	4	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
5	10	10	10	12	10	10	10	13	13	6	W	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	W	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	W	
6	12	13	12	13	12	11	13	16	14	9	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
7																																				
8																																				
Total	26	26	25	29	25	24	26	32	31	19	EMM																									

EV ER4 8 (mg/L NO3-N)

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	Init		A	B	C	D	E	F	G	H	I	J	Init		A	B	C	D	E	F	G	H	I	J	Init	
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
4	4	4	3	3	3	3	3	4	3	3	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
5	9	8	9	9	8	9 ^x	9	10	10	11	W	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	W	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	W	
6	12	14	12	12	13	1	13	10	10	13	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	
7																																				
8																																				
Total	25	26	24	24	24	12 ^x	25	24	23	27	EMM																									

Notes: X = mortality.

Sample Description: EV ER4 with nitrate
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Page 1 of 3

Reviewed by: Joh

Date reviewed: Feb. 10/17

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Tack coal
 Sample ID: EVERY (NO3)
 Work Order: 161182

Start Date & Time: NOV 16 @ 1400h
 Stop Date & Time: NOV 26 @ 1900h
 Set up by: EMM

EVERY 12 mg/L NO3

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	A		B	C	D	E	F	G	H	I	J	A	B		C	D	E	F	G	H	I	J				
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
4	3	3	3	3	4	3	4	3	3	3	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
5	10	10	8	11	11	10	11	12	9	7	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
6	12	12	13	16	14	13	14	11	11	11	11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
7																																				
8																																				
Total	13	25	23	27	31	27	28	29	23	21	EMM																									

EVERY 20 mg/L NO3

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	A		B	C	D	E	F	G	H	I	J	A	B		C	D	E	F	G	H	I	J				
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
4	4	3	3	4	2	4	3	4	3	3	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
5	10	10	8	12	10	10	12	9	10	10	10	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
6	12	13	14	12	13	11	13	12	12	11	11	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
7																																				
8																																				
Total	26	26	25	28	25	25	28	25	25	24	EMM																									

EVERY 31 (mg/L NO3-N)

Days	Concentration:											Init	Concentration:											Init	Concentration:											Init
	A	B	C	D	E	F	G	H	I	J	A		B	C	D	E	F	G	H	I	J	A	B		C	D	E	F	G	H	I	J				
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
4	4	3	3	3	4	4	3	4	3	3	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X	ME					
5	5	7	9	10	11	10	10	10	7	12	12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM					
6	11	12	10	13	12	12	12	14	14	12	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	ME					
7																																				
8																																				
Total	20	22	22	26	27	26	25	28	24	27	EMM																				⊗					

Notes: X = mortality.

Sample Description: same as WB sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

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Reviewed by: JGK

Date reviewed: Feb. 10/17

CETIS Summary Report

Report Date: 19 Jan-17 17:17 (p 1 of 2)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 14-1102-1336	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 5h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
03-8496-6487	6d Survival Rate	EC5	>49.5	N/A	N/A		Linear Interpolation (ICPIN)
		EC10	>49.5	N/A	N/A		
		EC15	>49.5	N/A	N/A		
		EC20	>49.5	N/A	N/A		
		EC25	>49.5	N/A	N/A		
		EC40	>49.5	N/A	N/A		
		EC50	>49.5	N/A	N/A		

6d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	30	1	1	1	1	1	0	0	0.0%	0.0%
2.94	Negative Control	30	1	1	1	1	1	0	0	0.0%	0.0%
5.22		30	1	1	1	1	1	0	0	0.0%	0.0%
8.14		30	0.9	0.7861	1	0	1	0.05571	0.3051	33.9%	10.0%
12.1		30	1	1	1	1	1	0	0	0.0%	0.0%
19.55		30	1	1	1	1	1	0	0	0.0%	0.0%
30.9		30	0.9667	0.8985	1	0	1	0.03333	0.1826	18.89%	3.33%
49.5	30	0.9667	0.8985	1	0	1	0.03333	0.1826	18.89%	3.33%	

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
2.94	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
5.22		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
8.14		1	1	1	1	1	0	1	1	1	1
		1	1	1	1	1	0	1	1	1	0
		1	1	1	1	1	1	1	1	1	1
12.1		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
19.55		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
30.9		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
49.5		1	1	1	1	1	1	1	1	1	0
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	0

CETIS Summary Report

Report Date: 19 Jan-17 17:17 (p 2 of 2)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

6d 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
0	① Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
2.94	① Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
5.22		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
8.14		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	0/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
19.55		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
30.9		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
49.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1

① Lab water = 25% Premier lab control
 Negative control = EV-ERT site water (dilution water) (unamended)

CETIS Summary Report

Report Date: 17 Feb-17 13:15 (p 1 of 1)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 14-1102-1336	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 5h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
05-5167-7961	Reproduction	<2.94	2.94	NA	8.51%		Equal Variance t Two-Sample Test

Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	18	22	0.4069	1.287	6.47%	0.0%
2.94	Negative Control	10	25.9	23.89	27.91	21	30	0.8876	2.807	10.84%	-30.15%
5.22		10	26.3	23.64	28.96	19	32	1.174	3.713	14.12%	-32.16%
8.14		10	23.4	20.42	26.38	12	27	1.318	4.169	17.81%	-17.59%
12.1		10	24.7	21.04	28.36	13	31	1.62	5.122	20.74%	-24.12%
19.55		10	25.7	24.74	26.66	24	28	0.423	1.337	5.2%	-29.15%
30.9		10	24.7	22.82	26.58	20	28	0.8307	2.627	10.63%	-24.12%
49.5		10	21.9	17.66	26.14	8	28	1.876	5.934	27.1%	-10.05%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
2.94	Negative Control	25	24	24	29	30	21	27	25	25	29
5.22		26	26	25	29	25	24	26	32	31	19
8.14		25	26	24	24	24	12	25	24	23	27
12.1		13	25	23	27	31	27	28	29	23	21
19.55		26	26	25	28	25	25	28	25	25	24
30.9		20	22	22	26	27	26	25	28	24	27
49.5		16	25	20	23	28	25	25	8	26	23

CETIS Analytical Report

Report Date: 19 Jan-17 17:16 (p 1 of 3)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 03-8496-6487	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 19 Jan-17 17:14	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 14-1102-1336	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 5h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2121126	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	>49.5	N/A	N/A
EC10	>49.5	N/A	N/A
EC15	>49.5	N/A	N/A
EC20	>49.5	N/A	N/A
EC25	>49.5	N/A	N/A
EC40	>49.5	N/A	N/A
EC50	>49.5	N/A	N/A

6d Survival Rate Summary

C-mg/L	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
2.94	Negative Control	30	1	1	1	0	0	0.0%	0.0%	30	30
5.22		30	1	1	1	0	0	0.0%	0.0%	30	30
8.14		30	0.9	0	1	0.05571	0.3051	33.9%	10.0%	27	30
12.1		30	1	1	1	0	0	0.0%	0.0%	30	30
19.55		30	1	1	1	0	0	0.0%	0.0%	30	30
30.9		30	0.9667	0	1	0.03333	0.1826	18.89%	3.33%	29	30
49.5		30	0.9667	0	1	0.03333	0.1826	18.89%	3.33%	29	30

CETIS Analytical Report

Report Date: 19 Jan-17 17:16 (p 2 of 3)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 03-8496-6487 Endpoint: 6d Survival Rate CETIS Version: CETISv1.8.7
 Analyzed: 19 Jan-17 17:14 Analysis: Linear Interpolation (ICPIN) Official Results: Yes

6d 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
2.94	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
5.22		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
8.14		1	1	1	1	1	0	1	1	1	1
		1	1	1	1	1	0	1	1	1	0
		1	1	1	1	1	1	1	1	1	1
12.1		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
19.55		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
30.9		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	0
49.5		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	0

6d 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
2.94	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
5.22		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
8.14		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1	0/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
12.1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
19.55		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
30.9		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
49.5		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1

CETIS Analytical Report

Report Date: 19 Jan-17 17:16 (p 3 of 3)
Test Code: 161182 NO3-Nc | 20-2311-2571

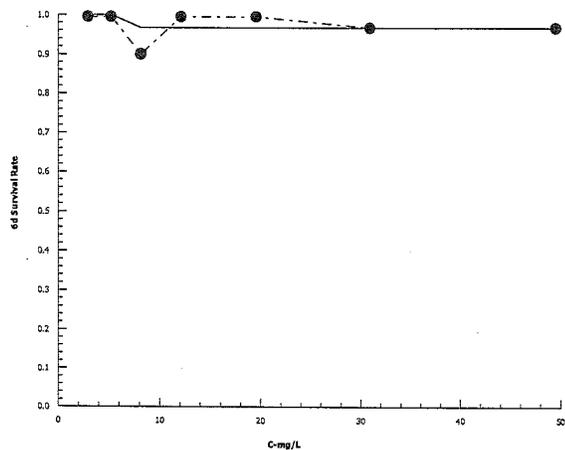
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 03-8496-6487 Endpoint: 6d Survival Rate
Analyzed: 19 Jan-17 17:14 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 17 Feb-17 13:15 (p 1 of 2)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 00-2013-2381	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 17 Feb-17 13:12	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 14-1102-1336	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 5h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1441131	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	7.743	4.171	35.61
IC10	37.63	6.973	N/A
IC15	47.13	33.14	N/A
IC20	>49.5	N/A	N/A
IC25	>49.5	N/A	N/A
IC40	>49.5	N/A	N/A
IC50	>49.5	N/A	N/A

Reproduction Summary

C-mg/L	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
2.94	Negative Control	10	25.9	21	30	0.8876	2.807	10.84%	0.0%
5.22		10	26.3	19	32	1.174	3.713	14.12%	-1.54%
8.14		10	23.4	12	27	1.318	4.169	17.81%	9.65%
12.1		10	24.7	13	31	1.62	5.122	20.74%	4.63%
19.55		10	25.7	24	28	0.423	1.337	5.2%	0.77%
30.9		10	24.7	20	28	0.8307	2.627	10.63%	4.63%
49.5		10	21.9	8	28	1.876	5.934	27.1%	15.44%

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
2.94	Negative Control	25	24	24	29	30	21	27	25	25	29
5.22		26	26	25	29	25	24	26	32	31	19
8.14		25	26	24	24	24	12	25	24	23	27
12.1		13	25	23	27	31	27	28	29	23	21
19.55		26	26	25	28	25	25	28	25	25	24
30.9		20	22	22	26	27	26	25	28	24	27
49.5		16	25	20	23	28	25	25	8	26	23

CETIS Analytical Report

Report Date: 17 Feb-17 13:15 (p 2 of 2)
Test Code: 161182 NO3-Nc | 20-2311-2571

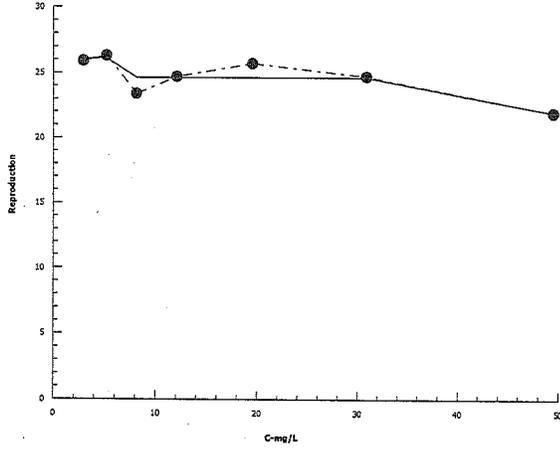
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 00-2013-2381 Endpoint: Reproduction
Analyzed: 17 Feb-17 13:12 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 19 Jan-17 17:19 (p 1 of 2)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 05-5113-5467	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 19 Jan-17 17:14	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 14-1102-1336	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 5h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Water		2.94	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Lab Water	30	0	30	1	0	0.0%
2.94	Negative Contr	30	0	30	1	0	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
2.94	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
2.94	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 19 Jan-17 17:19 (p 2 of 2)
Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

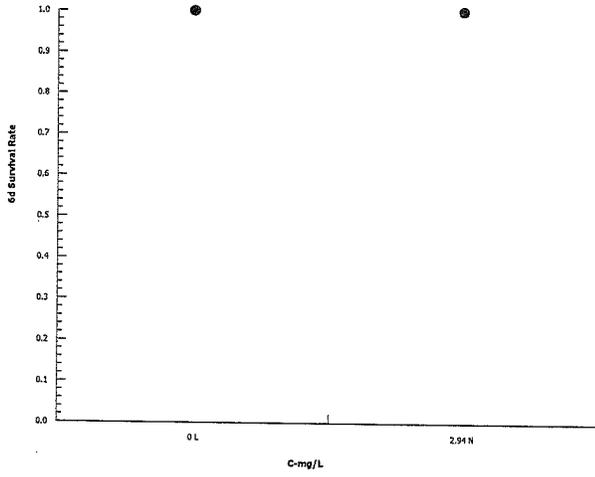
Nautilus Environmental

Analysis ID: 05-5113-5467
Analyzed: 19 Jan-17 17:14

Endpoint: 6d Survival Rate
Analysis: Single 2x2 Contingency Table

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 19 Jan-17 17:17 (p 1 of 1)
 Test Code: 161182 NO3-Nc | 20-2311-2571

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-4209-6306	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 19 Jan-17 17:16	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 14-1102-1336	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 5h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	8.51%	Fails reproduction

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Water	2.94*	6.145	1.734	1.693	18	<0.0001	CDF	Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	180	180	1	37.76	<0.0001	Significant Effect
Error	85.8	4.766667	18			
Total	265.8		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	4.758	6.541	0.0295	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9384	0.866	0.2233	Normal Distribution

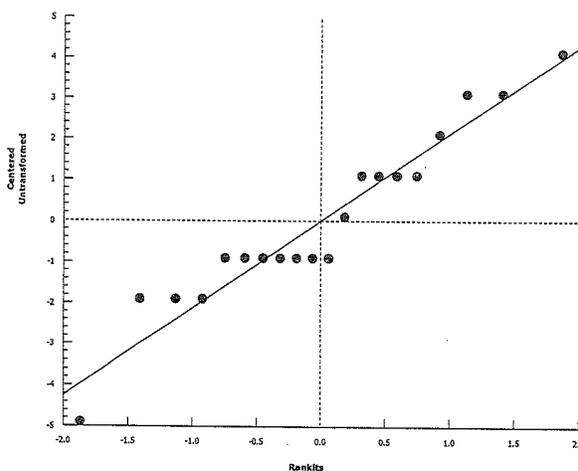
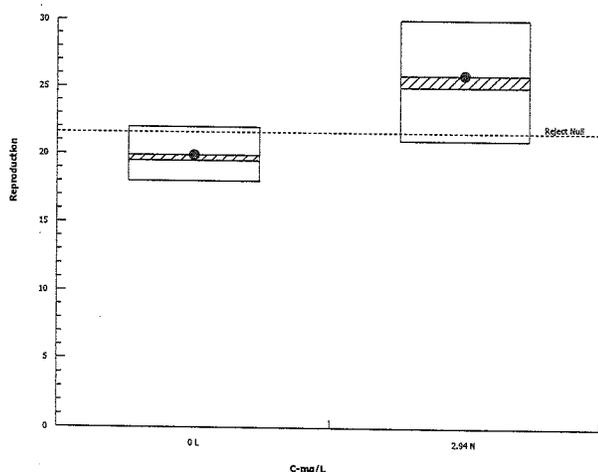
Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	19.5	18	22	0.4069	6.47%	0.0%
2.94	Negative Control	10	25.9	23.89	27.91	25	21	30	0.8876	10.84%	-30.15%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
2.94	Negative Control	25	24	24	29	30	21	27	25	25	29

Graphics



CETIS Summary Report

Report Date: 18 Jan-17 16:44 (p 1 of 2)
 Test Code: 161182 NO3-Na | 20-3966-7886

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 19-7480-8664 Test Type: Reproduction-Survival (7d) Analyst: Mimi Tran
 Start Date: 01 Nov-16 14:00 Protocol: EC/EPS 1/RM/21 Diluent: 20% Perrier Water
 Ending Date: 07 Nov-16 20:00 Species: Ceriodaphnia dubia Brine:
 Duration: 6d 6h Source: In-House Culture Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-7301-9875	01 Nov-16	01 Nov-16	14h	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 2h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 5h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

6d Survival Rate Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	30	1	1	1	1	1	0	0	0.0%	0.0%
GH_ER2	30	1	1	1	1	1	0	0	0.0%	0.0%
EV_ER4	30	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1	30	1	1	1	1	1	0	0	0.0%	0.0%
GH_FR1-HH	30	1	1	1	1	1	0	0	0.0%	0.0%

6d Survival Rate Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
EV_ER4	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_FR1-HH	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1

CETIS Summary Report

Report Date: 18 Jan-17 16:44 (p 2 of 2)
 Test Code: 161182 NO3-Na | 20-3966-7886

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

6d Survival Rate Binomials

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_ER4	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1-HH	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Summary Report

Report Date: 18 Jan-17 16:45 (p 1 of 1)
 Test Code: 161182 NO3-Na | 20-3966-7886

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 19-7480-8664 Test Type: Reproduction-Survival (7d) Analyst: Mimi Tran
 Start Date: 01 Nov-16 14:00 Protocol: EC/EPS 1/RM/21 Diluent: 20% Perrier Water
 Ending Date: 07 Nov-16 20:00 Species: Ceriodaphnia dubia Brine:
 Duration: 6d 6h Source: In-House Culture Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-7301-9875	01 Nov-16	01 Nov-16	14h	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 2h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 5h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Reproduction Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Lab Control	10	19.9	18.98	20.82	18	22	0.4069	1.287	6.47%	0.0%
GH_ER2	10	28.8	27.05	30.55	23	32	0.7717	2.44	8.47%	-44.72%
EV_ER4	10	25.9	23.89	27.91	21	30	0.8876	2.807	10.84%	-30.15%
GH_FR1	10	19.8	18.42	21.18	17	23	0.611	1.932	9.76%	0.5%
GH_FR1-HH	10	19.8	19.06	20.54	19	22	0.3266	1.033	5.22%	0.5%

Reproduction Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	19	20	19	22	21	21	18	19	21	19
GH_ER2	29	32	29	29	29	29	31	23	27	30
EV_ER4	25	24	24	29	30	21	27	25	25	29
GH_FR1	17	23	23	19	20	20	19	19	18	20
GH_FR1-HH	20	19	21	19	22	19	20	19	19	20

CETIS Analytical Report

Report Date: 18 Jan-17 16:44 (p 1 of 2)
 Test Code: 161182 NO3-Na | 20-3966-7886

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 19-4990-2981	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:43	Analysis: STP 2x2 Contingency Tables	Official Results: Yes
Batch ID: 19-7480-8664	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: 20% Perrier Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-7301-9875	01 Nov-16	01 Nov-16	14h	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 2h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 5h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Control		GH_ER2	1	1.0000	Exact	Non-Significant Effect
Lab Control		EV_ER4	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1	1	1.0000	Exact	Non-Significant Effect
Lab Control		GH_FR1-HH	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L		NR	R	NR + R	Prop NR	Prop R	%Effect
Lab Control	Lab Water	30	0	30	1	0	0.0%
GH_ER2	Upstream Contr	30	0	30	1	0	0.0%
EV_ER4	Unamended Sa	30	0	30	1	0	0.0%
GH_FR1	Receiving Wate	30	0	30	1	0	0.0%
GH_FR1-HH	Dilution Water	30	0	30	1	0	0.0%

6d Survival Rate Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_ER2	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
EV_ER4	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_FR1	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
GH_FR1-HH	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1
	1	1	1	1	1	1	1	1	1	1

CETIS Analytical Report

Report Date: 18 Jan-17 16:44 (p 2 of 2)
 Test Code: 161182 NO3-Na | 20-3966-7886

Ceriodaphnia 7-d Survival and Reproduction Test

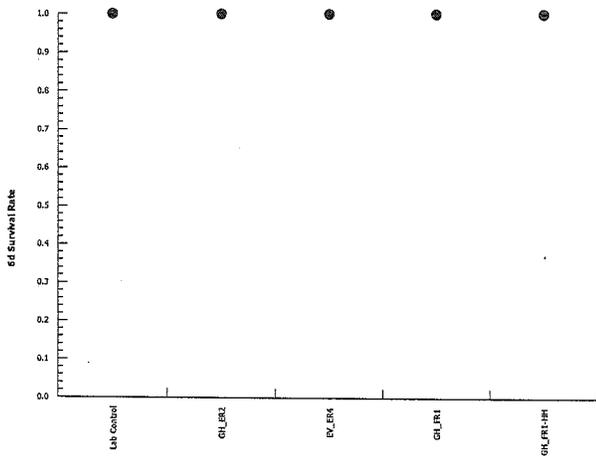
Nautilus Environmental

Analysis ID: 19-4990-2981 Endpoint: 6d Survival Rate CETIS Version: CETISv1.8.7
 Analyzed: 18 Jan-17 16:43 Analysis: STP 2x2 Contingency Tables Official Results: Yes

6d Survival Rate Binomials

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_ER2	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
EV_ER4	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
GH_FR1-HH	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:45 (p 1 of 2)
 Test Code: 161182 NO3-Na | 20-3966-7886

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 09-1038-6762	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:43	Analysis: Parametric-Control vs Treatments	Official Results: Yes
Batch ID: 19-7480-8664	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: 20% Perrier Water
Ending Date: 07 Nov-16 20:00	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 6h	Source: In-House Culture	Age: <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-7301-9875	01 Nov-16	01 Nov-16	14h	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 2h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 5h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	10.1%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		GH_ER2	-9.879	2.222	2.002	18	1.0000	CDF	Non-Significant Effect
		EV_ER4	-6.66	2.222	2.002	18	1.0000	CDF	Non-Significant Effect
		GH_FR1	0.111	2.222	2.002	18	0.7618	CDF	Non-Significant Effect
		GH_FR1-HH	0.111	2.222	2.002	18	0.7618	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	720.12	180.03	4	44.37	<0.0001	Significant Effect
Error	182.6	4.057778	45			
Total	902.72		49			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	10.93	13.28	0.0273	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9371	0.9367	0.0104	Normal Distribution

Reproduction Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	19.9	18.98	20.82	19.5	18	22	0.4069	6.47%	0.0%
GH_ER2	10	28.8	27.05	30.55	29	23	32	0.7717	8.47%	-44.72%
EV_ER4	10	25.9	23.89	27.91	25	21	30	0.8876	10.84%	-30.15%
GH_FR1	10	19.8	18.42	21.18	19.5	17	23	0.611	9.76%	0.5%
GH_FR1-HH	10	19.8	19.06	20.54	19.5	19	22	0.3266	5.22%	0.5%

Reproduction Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	19	20	19	22	21	21	18	19	21	19
GH_ER2	29	32	29	29	29	29	31	23	27	30
EV_ER4	25	24	24	29	30	21	27	25	25	29
GH_FR1	17	23	23	19	20	20	19	19	18	20
GH_FR1-HH	20	19	21	19	22	19	20	19	19	20

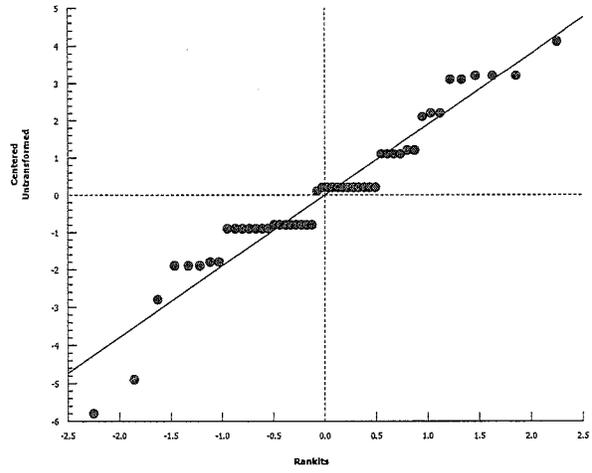
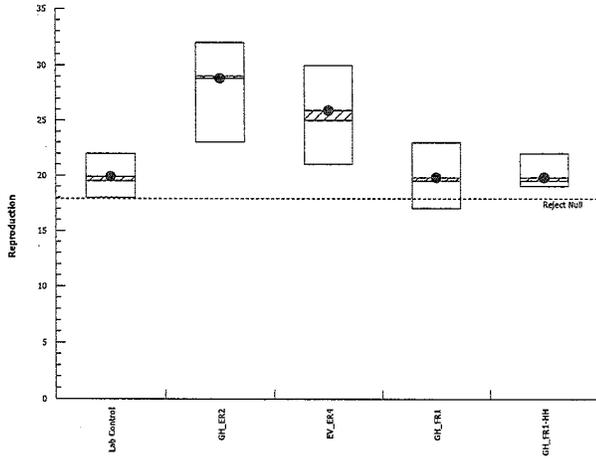
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 09-1038-6762 Endpoint: Reproduction
Analyzed: 18 Jan-17 16:43 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:45 (p 1 of 2)
Test Code: 161182 NO3-Na | 20-3966-7886

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 11-4574-9690 **Endpoint:** Reproduction **CETIS Version:** CETISv1.8.7
Analyzed: 18 Jan-17 16:43 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Batch ID: 19-7480-8664 **Test Type:** Reproduction-Survival (7d) **Analyst:** Mimi Tran
Start Date: 01 Nov-16 14:00 **Protocol:** EC/EPS 1/RM/21 **Diluent:** 20% Perrier Water
Ending Date: 07 Nov-16 20:00 **Species:** Ceriodaphnia dubia **Brine:**
Duration: 6d 6h **Source:** In-House Culture **Age:** <24h

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Lab Control	18-7301-9875	01 Nov-16	01 Nov-16	14h	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 2h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 5h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 4h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Lab Control	Water Sample	Teck Coal	Lab Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C < T	NA	NA	10.1%	

Dunnnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Control		GH_ER2	9.879	2.222	2.002	18	<0.0001	CDF	Significant Effect
		EV_ER4	6.66	2.222	2.002	18	<0.0001	CDF	Significant Effect
		GH_FR1	-0.111	2.222	2.002	18	0.8343	CDF	Non-Significant Effect
		GH_FR1-HH	-0.111	2.222	2.002	18	0.8343	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	720.12	180.03	4	44.37	<0.0001	Significant Effect
Error	182.6	4.057778	45			
Total	902.72		49			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	10.93	13.28	0.0273	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9371	0.9367	0.0104	Normal Distribution

Reproduction Summary

C-mg/L	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Lab Control	10	19.9	18.98	20.82	19.5	18	22	0.4069	6.47%	0.0%
GH_ER2	10	28.8	27.05	30.55	29	23	32	0.7717	8.47%	-44.72%
EV_ER4	10	25.9	23.89	27.91	25	21	30	0.8876	10.84%	-30.15%
GH_FR1	10	19.8	18.42	21.18	19.5	17	23	0.611	9.76%	0.5%
GH_FR1-HH	10	19.8	19.06	20.54	19.5	19	22	0.3266	5.22%	0.5%

Reproduction Detail

C-mg/L	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
Lab Control	19	20	19	22	21	21	18	19	21	19
GH_ER2	29	32	29	29	29	29	31	23	27	30
EV_ER4	25	24	24	29	30	21	27	25	25	29
GH_FR1	17	23	23	19	20	20	19	19	18	20
GH_FR1-HH	20	19	21	19	22	19	20	19	19	20

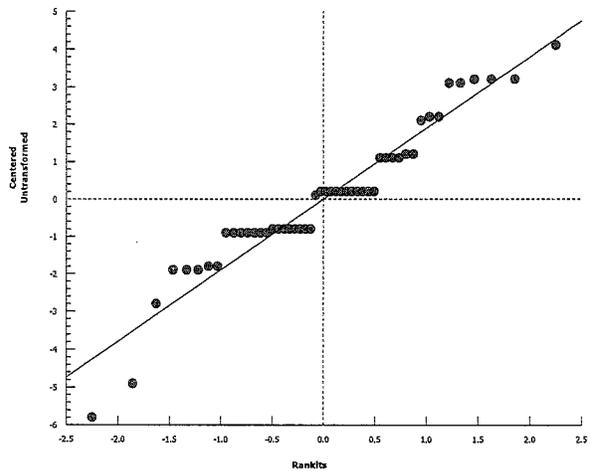
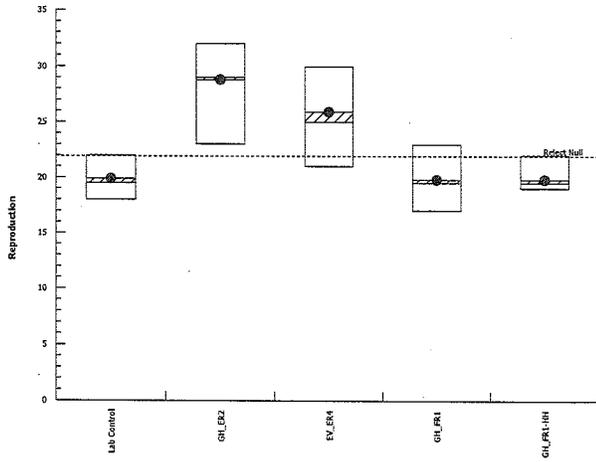
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 11-4574-9690 Endpoint: Reproduction
Analyzed: 18 Jan-17 16:43 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck coal
 Work Order No.: 161182

Start Date/Time: NOV 1/16 @ 1400h
 Set up by: EMM

Sample Information:

Sample ID: GH_FFLWS_2016-10-25-N
 Sample Date: OCT 25/16
 Date Received: OCT 26/16
 Sample Volume: 4X200L

Test Validity Criteria:

- 1) Mean survival of first generation controls is $\geq 80\%$
- 2) At least 60% of controls have produced three broods within 8 days
- 3) An average of ≥ 15 live young produced per surviving female in the control solutions during the first three broods.
- 4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T ($^{\circ}$ C) = 25 ± 1 ; DO (mg/L) = 3.3 to 8.4 ; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.:
 Age of young (Day 0):
 Avg No. young in first 3 broods of previous 7 d:
 Mortality (%) in previous 7 d:
 Individual female # used ≥ 8 young on test day

102016A + 102016B + 102016C + 102016D
<24-h (within 12-h)
31
2.5

A+B: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,
 22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40
 C+D: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,
 21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40

NaCl Reference Toxicant Results:

Reference Toxicant ID: CO151
 Stock Solution ID: 16NaCl
 Date Initiated: NOV 15/16

7-d LC50 (95% CL): 2.1 (1.5-3.0) g/L NaCl
 7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.3) g/L NaCl CV (%): 5
 7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

mg/L	Survival	Reproduction
LC50 % (v/v) (95% CL)	773.40	
IC25 % (v/v) (95% CL)		56.74 (48.48 - 59.79)
IC50 % (v/v) (95% CL)		69.73 (65.75 - N/A)

mg/L NO₃-N

Reviewed by: JGH

Date reviewed: Feb-14/17

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tack Cool
 Sample ID: GH-FR1 (Nitrate)
 Work Order #: 161182

Start Date & Time: Nov 1/16 @ 1400h
 Stop Date & Time: Nov 4/16 @ 1930h
 Test Species: Ceriodaphnia dubia

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

(unamended) Concentration <i>GH-FR1</i>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.3	7.5	8.2	7.9	8.2	7.3	8.1	7.4	8.2	7.5	8.1	
pH	8.0	8.0	8.1	8.2	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.1	
Cond. (µS/cm)	802	810	808	809	808	806	802	802	806	802	802	802	802	
Initials	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	MLT	

(mg/L NO ₃ -N) Concentration <i>14</i>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.3	7.5	8.2	7.9	8.2	7.3	8.1	7.4	8.2	7.5	8.1	
pH	8.0	8.1	8.1	8.2	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.1	
Cond. (µS/cm)	840	839	838	837	839	834	837	839	834	837	837	837	837	
Initials	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	MLT	

(mg/L NO ₃ -N) Concentration <i>20</i>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.3	7.5	8.2	7.9	8.2	7.3	8.1	7.4	8.2	7.5	8.1	
pH	8.0	8.1	8.1	8.2	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1	8.1	
Cond. (µS/cm)	892	894	893	900	901	909	890	890	890	890	890	890	890	
Initials	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	EMM	MLT	

Thermometer: 4 DO meter: 711 pH meter: 2 Conductivity meter: 2A

	Control	GH-FR1		
Hardness*	100	448		
Alkalinity*	98	193		

Analysts: MLT, EMM, AWD, VL
 Reviewed by: Job
 Date reviewed: Feb. 14/17

Sample Description: GH-FR1 with nitrate (clear, colourless, odourless, some particulates)

Comments: Broodboard Used: 102016A7D (A+B: 1-27, 29-40, C+D: 1-31, 33-40)

① same as GH-FR2 Wk sheet

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck coal
 Sample ID: GH-FR1 (Nitrate)
 Work Order #: 161182

Start Date & Time: Nov 16 @ 1400 h
 Stop Date & Time: Nov 16 @ 1430 h
 Test Species: Ceriodaphnia dubia

(mg/L-NO ₃ -N) Concentration <u>27</u>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.3	7.5	8.2	7.3	8.2	7.5	8.1	7.9	8.1	7.5		
pH	8.0	8.1	8.1	8.2	8.3	8.1	8.2	8.1	8.2	8.2	8.2	8.1		
Cond. (µS/cm)	946	946		950		961		959		958		900		
Initials	EMM	EMM		EMM		EMM		EMM		A		ML		

(mg/L-NO ₃ -N) Concentration <u>38</u>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	7.8	8.3	7.5	8.2	7.4	8.2	7.4	8.1	7.5	8.2	7.5		
pH	8.0	8.1	8.1	8.2	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1		
Cond. (µS/cm)	1033	1032		1041		1038		1036		1041		1019		
Initials	EMM	EMM		EMM		EMM		EMM		A		ML		

(mg/L-NO ₃ -N) Concentration <u>54</u>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	8.0	8.3	7.6	8.2	7.4	8.2	7.4	8.1	7.4	8.1	7.5		
pH	8.1	8.1	8.1	8.2	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1		
Cond. (µS/cm)	1033	1154		1152		1210		1200		1162		1140		
Initials	EMM	EMM		EMM		EMM		EMM		A		ML		

(mg/L-NO ₃ -N) Concentration <u>75</u>	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0
DO (mg/L)	8.1	8.0	8.3	7.6	8.2	7.4	8.1	7.4	8.2	7.4	8.1	7.5		
pH	8.1	8.1	8.1	8.2	8.3	8.1	8.2	8.1	8.2	8.1	8.2	8.1		
Cond. (µS/cm)	1315	1320		1303		1320		1321		1334		1297		
Initials	EMM	EMM		EMM		EMM		EMM		A		ML		

Thermometer: 4 DO meter: 21 pH meter: 2 Conductivity meter: 21

	Control	GH-FR1		
Hardness*	100	448		
Alkalinity*	98	193		

Analysts: MT, AW, EMM, KL
 Reviewed by: Joh
 Date reviewed: Feb. 14/17

Sample Description: same as page 1 of 2

Comments: Broodboard Used: 102016A7D

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Teck coal
 Sample ID: GHFR1 NO3
 Work Order: 161182

Start Date & Time: NOV 1/16 @ 1400h
 Stop Date & Time: NOV 7/16 @ 1900h
 Set up by: EMM

GHFR1 unamended

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	4	3	4	4	3	3	4	4	5	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	5	5	4	3	5	5	6	6	5	5	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
6	8	14	16	12	11	12	10	9	9	10	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
7																																			
8																																			
Total	17	23	23	19	20	20	19	19	18	20	EMM																								

(14 mg/L NO3-N)

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	4	4	3	4	4	5	4	4	4	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	5	6	6	5	5	6	5	6	5	5	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
6	12	12	13	12	12	11	10	13	13	11	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
7																																			
8																																			
Total	20	22	23	20	21	21	20	23	22	20	EMM																								

20 (mg/L NO3-N)

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	4	4	3	3	4	3	4	4	3	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	6	5	5	6	6	5	6	5	5	6	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
6	15	12	13	13	12	14	14	13	11	12	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MCT
7																																			
8																																			
Total	25	21	22	22	21	23	23	22	20	21	EMM																								

Notes: X = mortality.

Sample Description: same as WQ sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Page 1 of 3

Reviewed by: JOB

Date reviewed: Feb. 14/17

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Teck coal
 Sample ID: GHFR NO3
 Work Order: 16182

Start Date & Time: NOV 16 @ 1400h
 Stop Date & Time: NOV 21 @ 1930h
 Set up by: EMM

27 mg/L NO3-N

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	4	3	3	3	2	3	3	4	3	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	6	5	5	6	6	5	5	5	6	5	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
6	12	14	14	13	13	11	11	12	13	12	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
7																																			
8																																			
Total	21	23	22	22	22	19	19	20	22	21	EMM																								

38 mg/L NO3-N

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	4	4	3	4	3	2	3	3	3	EMM	✓	✓	✓	✓	✓	✓	X	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	5	6	5	5	5	6	5	5	5	5	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
6	10	12	13	11	11	12	13	12	9	10	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
7																																			
8																																			
Total	18	22	22	19	20	21	20	20	17	13	EMM																								

54 (mg/L NO3-N)

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	4	3	3	3	4	2	4	4	3	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	6	5	6	6	6	✓	✓	6	6	3	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
6	12	10	10	13	8	6	7	8	8	9	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
7																																			
8																																			
Total	22	19	19	22	17	10	9	18	18	17	EMM																								

Notes: X = mortality.

Sample Description: same as WQ sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

Page 2 of 3

Reviewed by: Joh

Date reviewed: Feb. 14/17

CETIS Summary Report

Report Date: 18 Jan-17 16:07 (p 1 of 2)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 09-3571-7373	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
14-4449-2420	6d Survival Rate	9.76	>9.76	NA	NA		Fisher Exact Test

6d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	30	1	1	1	1	1	0	0	0.0%	0.0%
9.76	Negative Control	30	1	1	1	1	1	0	0	0.0%	0.0%
14.3		30	1	1	1	1	1	0	0	0.0%	0.0%
20.6		30	0.9667	0.8985	1	0	1	0.03333	0.1826	18.89%	3.33%
25.4		30	1	1	1	1	1	0	0	0.0%	0.0%
38.1		30	0.9667	0.8985	1	0	1	0.03333	0.1826	18.89%	3.33%
53.85		30	1	1	1	1	1	0	0	0.0%	0.0%
73.4		30	0.9667	0.8985	1	0	1	0.03333	0.1826	18.89%	3.33%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
9.76	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
14.3		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
20.6		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	0
25.4		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
38.1		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	0	1	1	1
		1	1	1	1	1	1	1	1	1	1
53.85		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
73.4		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	0	1

CETIS Summary Report

Report Date: 18 Jan-17 16:07 (p 2 of 2)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

6d 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
0	① Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
9.76	① Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
14.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
20.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
25.4		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
38.1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
53.85		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
73.4		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1

① Lab water = 20% Premier lab control
 negative control = site water (dilution water) GH-PR (unamended)

CETIS Summary Report

Report Date: 18 Jan-17 16:07 (p 1 of 1)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 09-3571-7373	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
07-8123-3094	Reproduction	IC5	32.1	26.24	42.17		Linear Interpolation (ICPIN)
		IC10	39.89	30.99	54.22		
		IC15	47.44	35.41	55.99		
		IC20	54.45	43.3	57.84		
		IC25	56.74	48.48	59.79		
		IC40	64.21	59.88	67.73		
		IC50	69.73	65.75	N/A		

Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	18	22	0.4069	1.287	6.47%	0.0%
9.76	Negative Control	10	19.8	18.42	21.18	17	23	0.611	1.932	9.76%	0.5%
14.3		10	21.2	20.32	22.08	20	23	0.3887	1.229	5.8%	-6.53%
20.6		10	22	20.99	23.01	20	25	0.4472	1.414	6.43%	-10.55%
25.4		10	21.1	20.12	22.08	19	23	0.4333	1.37	6.49%	-6.03%
38.1		10	19.2	17.27	21.13	13	22	0.8537	2.7	14.06%	3.52%
53.85		10	17.1	13.96	20.24	9	22	1.386	4.383	25.63%	14.07%
73.4		10	9.2	6.918	11.48	5	13	1.009	3.19	34.68%	53.77%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
9.76	Negative Control	17	23	23	19	20	20	19	19	18	20
14.3		20	22	23	20	21	21	20	23	22	20
20.6		25	21	22	22	21	23	23	22	20	21
25.4		21	23	22	22	22	19	19	20	22	21
38.1		18	22	22	19	20	21	20	20	17	13
53.85		22	19	19	22	17	10	9	18	18	17
73.4		8	13	13	12	5	13	6	7	7	8

CETIS Analytical Report

Report Date: 18 Jan-17 16:07 (p 1 of 3)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-5397-5177	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:03	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 09-3571-7373	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	201527	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	>73.4	N/A	N/A
EC10	>73.4	N/A	N/A
EC15	>73.4	N/A	N/A
EC20	>73.4	N/A	N/A
EC25	>73.4	N/A	N/A
EC40	>73.4	N/A	N/A
EC50	>73.4	N/A	N/A

6d Survival Rate Summary

Calculated Variate(A/B)

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
9.76	Negative Control	30	1	1	1	0	0	0.0%	0.0%	30	30
14.3		30	1	1	1	0	0	0.0%	0.0%	30	30
20.6		30	0.9667	0	1	0.03333	0.1826	18.89%	3.33%	29	30
25.4		30	1	1	1	0	0	0.0%	0.0%	30	30
38.1		30	0.9667	0	1	0.03333	0.1826	18.89%	3.33%	29	30
53.85		30	1	1	1	0	0	0.0%	0.0%	30	30
73.4		30	0.9667	0	1	0.03333	0.1826	18.89%	3.33%	29	30

CETIS Analytical Report

Report Date: 18 Jan-17 16:07 (p 2 of 3)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 17-5397-5177
 Analyzed: 18 Jan-17 16:03

Endpoint: 6d Survival Rate
 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
 Official Results: Yes

6d 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
9.76	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
14.3		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
20.6		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	0
25.4		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
38.1		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	0	1	1	1
		1	1	1	1	1	1	1	1	1	1
53.85		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
73.4		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	0	1

6d 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
9.76	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
14.3		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
20.6		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1
25.4		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
38.1		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
53.85		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
73.4		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	0/1	1/1

Ceriodaphnia 7-d Survival and Reproduction Test

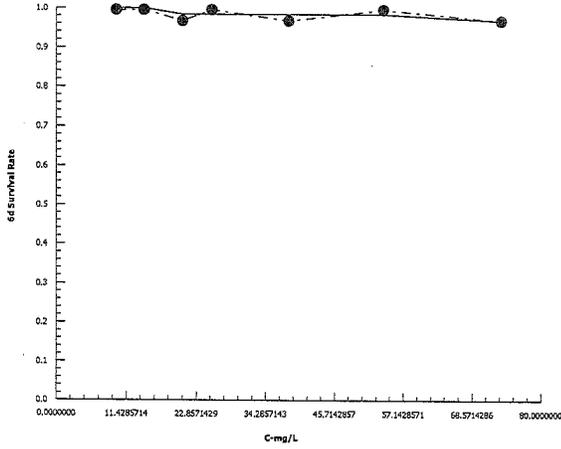
Nautilus Environmental

Analysis ID: 17-5397-5177
Analyzed: 18 Jan-17 16:03

Endpoint: 6d Survival Rate
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:07 (p 1 of 2)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 07-8123-3094	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:04	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 09-3571-7373	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1453641	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	32.1	26.24	42.17
IC10	39.89	30.99	54.22
IC15	47.44	35.41	55.99
IC20	54.45	43.3	57.84
IC25	56.74	48.48	59.79
IC40	64.21	59.88	67.73
IC50	69.73	65.75	N/A

Reproduction Summary

Calculated Variate

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
9.76	Negative Control	10	19.8	17	23	0.611	1.932	9.76%	0.0%
14.3		10	21.2	20	23	0.3887	1.229	5.8%	-7.07%
20.6		10	22	20	25	0.4472	1.414	6.43%	-11.11%
25.4		10	21.1	19	23	0.4333	1.37	6.49%	-6.57%
38.1		10	19.2	13	22	0.8537	2.7	14.06%	3.03%
53.85		10	17.1	9	22	1.386	4.383	25.63%	13.64%
73.4		10	9.2	5	13	1.009	3.19	34.68%	53.54%

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
9.76	Negative Control	17	23	23	19	20	20	19	19	18	20
14.3		20	22	23	20	21	21	20	23	22	20
20.6		25	21	22	22	21	23	23	22	20	21
25.4		21	23	22	22	22	19	19	20	22	21
38.1		18	22	22	19	20	21	20	20	17	13
53.85		22	19	19	22	17	10	9	18	18	17
73.4		8	13	13	12	5	13	6	7	7	8

CETIS Analytical Report

Report Date: 18 Jan-17 16:07 (p 2 of 2)
Test Code: 161182 NO3-Nd | 21-3957-8764

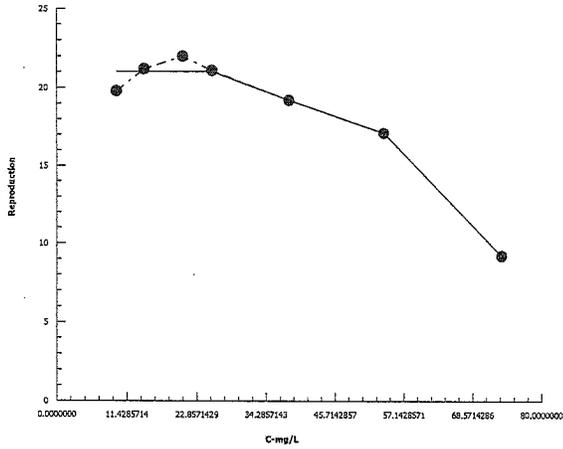
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 07-8123-3094 Endpoint: Reproduction
Analyzed: 18 Jan-17 16:04 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:07 (p 1 of 2)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 14-4449-2420	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:03	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 09-3571-7373	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Water		9.76	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Lab Water	30	0	30	1	0	0.0%
9.76	Negative Contr	30	0	30	1	0	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
9.76	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
9.76	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 18 Jan-17 16:07 (p 2 of 2)
Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

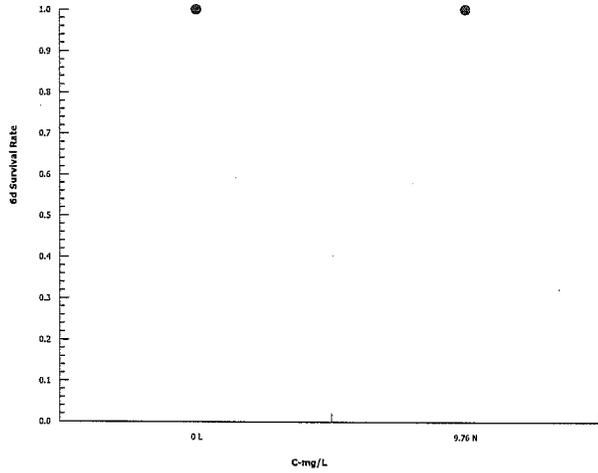
Nautilus Environmental

Analysis ID: 14-4449-2420
Analyzed: 18 Jan-17 16:03

Endpoint: 6d Survival Rate
Analysis: Single 2x2 Contingency Table

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:07 (p 1 of 1)
 Test Code: 161182 NO3-Nd | 21-3957-8764

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 05-5878-4195	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:06	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 09-3571-7373	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	6.4%	Passes reproduction

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Water	9.76	0.1362	1.734	1.273	18	0.4466	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.05	0.05	1	0.01856	0.8932	Non-Significant Effect
Error	48.5	2.694444	18			
Total	48.55		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	2.255	6.541	0.2416	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9358	0.866	0.1999	Normal Distribution

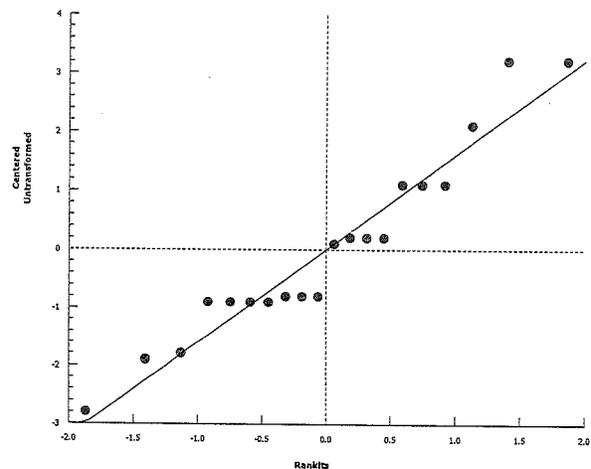
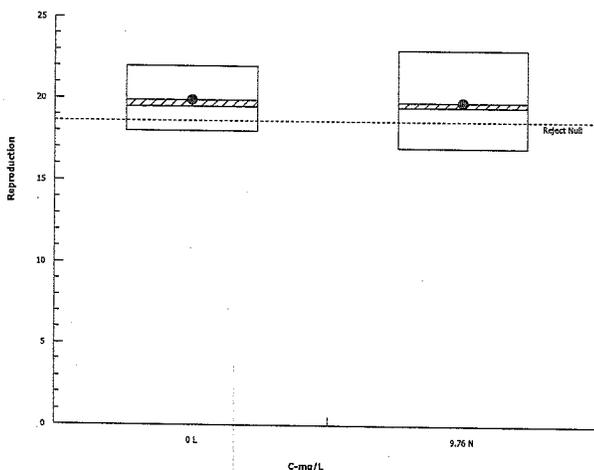
Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	19.5	18	22	0.4069	6.47%	0.0%
9.76	Negative Control	10	19.8	18.42	21.18	19.5	17	23	0.611	9.76%	0.5%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
9.76	Negative Control	17	23	23	19	20	20	19	19	18	20

Graphics



Ceriodaphnia dubia Summary Sheet

Client: Teck coal
 Work Order No.: 161182

Start Date/Time: Nov 1/16 @ 1400h
 Set up by: EMM

Sample Information:

Sample ID: GH_FRL_WS_2016-10-25_N
 Sample Date: Oct 25/16
 Date Received: Oct 26/16
 Sample Volume: 4x 200L
200L

Test Validity Criteria:

- 1) Mean survival of first generation controls is $\geq 80\%$
- 2) At least 60% of controls have produced three broods within 8 days
- 3) An average of ≥ 15 live young produced per surviving female in the control solutions during the first three broods.
- 4) Invalid if ephippia observed in any control solution at any time.

WQ Ranges:

T (°C) = 25 ± 1 ; DO (mg/L) = 3.3 to 8.4; pH = 6.0 to 8.5

Test Organism Information:

Broodstock No.: 102016A + 102016B + 102016C + 102016D
 Age of young (Day 0): <24-h (within 12-h)
 Avg No. young in first 3 broods of previous 7 d: 31
 Mortality (%) in previous 7 d: 2.5
 Individual female # used ≥ 8 young on test day

A+B: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,
 22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40
 C+D: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,
 21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40

NaCl Reference Toxicant Results:

Reference Toxicant ID: CO151
 Stock Solution ID: 16NaCl
 Date Initiated: Nov 15/16

7-d LC50 (95% CL): 2.1 (1.5-3.0) g/L NaCl
 7-d IC50 (95% CL): 1.6 (1.3-1.9) g/L NaCl

7-d LC50 Reference Toxicant Mean and Historical Range: 2.0 (1.8-2.3) g/L NaCl CV (%): 5
 7-d IC50 Reference Toxicant Mean and Historical Range: 1.5 (1.2-2.0) g/L NaCl CV (%): 13

Test Results:

mg/L	Survival	Reproduction
LC50 % (v/v) (95% CL)	773.90	
IC25 % (v/v) (95% CL)		51.88 (44.78 - 58.10)
IC50 % (v/v) (95% CL) mg/L NO₃-N		65.87 (58.18 - 72.33)

Reviewed by: JOU

Date reviewed: Feb. 10/17

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck coal
 Sample ID: GH-FRL-HH Nitrate
 Work Order #: 161182

Start Date & Time: Nov 16 @ 1400h
 Stop Date & Time: Nov 16 @ 1930h
 Test Species: Ceriodaphnia dubia

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

(unamended) Concentration GH-FRL-HH	Days													
	0	1		2		3		4		5		Final 6	7	
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	25.0	
DO (mg/L)	8.1	7.8	8.2	7.3	8.2	7.5	8.1	7.4	8.2	7.5	8.2	7.5	8.0	
pH	8.1	8.1	8.1	8.1	8.2	8.1	8.2	8.0	8.2	7.9	8.2	8.0		
Cond. (µS/cm)	1185	1176		1179		1176		1180		1181		1184		
Initials	EMM	EMM		EMM		EMM		EMM		A		MLT		

(mg/L NO ₃ -N) Concentration 14	Days													
	0	1		2		3		4		5		Final 6	7	
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	25.0	
DO (mg/L)	8.2	7.8	8.2	7.3	8.2	7.5	8.2	7.4	8.1	7.4	8.1	7.5	8.0	
pH	8.1	8.0	8.1	8.1	8.2	8.1	8.2	8.0	8.2	8.0	8.2	8.0		
Cond. (µS/cm)	1219	1215		1218		1212		1216		1222		1215		
Initials	EMM	EMM		EMM		EMM		EMM				MLT		

(mg/L NO ₃ -N) Concentration 20	Days													
	0	1		2		3		4		5		Final 6	7	
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	25.0	
DO (mg/L)	8.2	7.8	8.3	7.3	8.2	7.5	8.2	7.4	8.1	7.4	8.2	7.5	8.0	
pH	8.1	8.0	8.1	8.1	8.2	8.1	8.2	8.0	8.2	8.0	8.2	8.0		
Cond. (µS/cm)	1272	1273		1274		1273		1272		1268		1256		
Initials	EMM	EMM		EMM		EMM		EMM				MLT		

Thermometer: 4 DO meter: 8/1 pH meter: 2 Conductivity meter: 2/1

	Control	GH-FRL-HH		
Hardness*	100	709		
Alkalinity*	98	192		

Analysts: MLT, EMM, AUBILL
 Reviewed by: JGH
 Date reviewed: Feb. 10/17

* mg/L as CaCO₃
 Sample Description: GH-FRL adjusted in house to ~700 mg/L CaCO₃ ① same as GH-FRL worksheet

Comments: Broodboard Used: 102016A-7D (A+B: 1-27, 29-40, C+D: 1-31, 33-40)

Chronic Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Coal
 Sample ID: GH-FRL-HH Nitrate
 Work Order #: 161182

Start Date & Time: Nov 16 a) 1400h
 Stop Date & Time: Nov 16 a) 1430h
 Test Species: Ceriodaphnia dubia

(mg/L NO ₃ -N) Concentration 27	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.1	7.8	8.3	7.6	8.2	7.4	8.2	7.4	8.1	7.5	8.1	7.5		
pH	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.0	8.1	8.0	8.2	8.0		
Cond. (µS/cm)	1324	1323		1325		1338		1329		1325		1310		
Initials	EMM	EMM		EMM		EMM		EMM				MLT		

(mg/L NO ₃ -N) Concentration 38	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.2	7.9	8.3	7.6	8.2	7.4	8.2	7.4	8.1	7.5	8.2	7.5		
pH	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.0	8.1	8.0	8.2	8.0		
Cond. (µS/cm)	1412	1412		1409		1415		1416		1415		1398		
Initials	EMM	EMM		EMM		EMM		EMM				MLT		

(mg/L NO ₃ -N) Concentration 54	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.1	7.9	8.3	7.6	8.2	7.4	8.2	7.4	8.1	7.4	8.2	7.5		
pH	8.1	8.1	8.1	8.1	8.1	8.0	8.1	8.0	8.1	8.0	8.1	8.0		
Cond. (µS/cm)	1533	1539		1536		1568		1560		1568		1506		
Initials	EMM	EMM		EMM		EMM		EMM				MLT		

(mg/L NO ₃ -N) Concentration 75	Days													
	0	1		2		3		4		5		Final 6		7
	init.	old	new	old	new	final								
Temperature (°C)	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	25.0	24.0	
DO (mg/L)	8.1	7.8	8.3	7.6	8.2	7.4	8.2	7.4	8.1	7.4	8.1	7.5		
pH	8.1	8.1	8.1	8.1	8.1	8.0	8.2	8.0	8.1	8.0	8.1	8.0		
Cond. (µS/cm)	1688	1688		1689		1690		1682		1682		1658		
Initials	EMM	EMM		EMM		EMM		EMM				MLT		

Thermometer: 4 DO meter: 2/1 pH meter: 2 Conductivity meter: 2/1

	Control	GH-FRL-HH
Hardness*	102	709
Alkalinity*	98	192

Analysts: MLT, EMM, AWB, KL

Reviewed by: JOB

Date reviewed: Feb - 10/17

Sample Description: same as page 1 of 2

Comments: Broodboard Used: 102016A → D

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Teck coal
 Sample ID: GH FR1-III NO₃
 Work Order: 161182

Start Date & Time: NOV 1/16 @ 1400h
 Stop Date & Time: NOV 7/16 @ 1930h
 Set up by: EMM

lab control

Days	Concentration:											Concentration:											Concentration:												
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	3	3	4	3	3	4	3	3	3	4	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	
5	4	3	3	4	3	3	4	4	3	4	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
6	5	4	5	5	6	5	6	5	6	5	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
7	10	13	11	13	12	13	8	10	12	10	MLT																								
8																																			
Total	19	20	19	22	21	21	18	19	21	19	EMM																								

NO
4
5
6
7

GH FR1-III unamended site control

Days	Concentration:											Concentration:											Concentration:												
	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	Init	A	B	C	D	E	F	G	H	I	J	Init	AK	BL	CM	DN	EO	FP	GG	HH	IS	JT	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	3	4	3	3	4	3	3	3	4	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	3	6	6	5	6	5	6	6	6	6	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
6	12	10	11	11	13	9	12	10	10	10	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
7																																			
8																																			
Total	20	19	21	19	22	19	20	19	19	20	EMM																								

14 (mg/L NO₃-N)

Days	Concentration:											Concentration:											Concentration:												
	AA	BB	CC	DD	EE	FF	GG	HH	II	JJ	Init	A	B	C	D	E	F	G	H	I	J	Init	AK	BL	CM	DN	EO	FP	GG	HH	IS	JT	Init		
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	3	3	3	4	3	3	4	3	4	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	6	5	5	6	6	5	6	6	5	5	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
6	11	13	14	15	14	13	12	14	13	13	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLT
7																																			
8																																			
Total	21	21	22	24	24	21	21	24	21	22	EMM																								

Notes: X = mortality.

Sample Description: same as WQ sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

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Reviewed by: JGB

Date reviewed: Feb. 10/17

**Chronic Freshwater Toxicity Test
C. dubia Reproduction Data**

Client: Teck coal
 Sample ID: GH FR 1-11 NO3
 Work Order: 161182

Start Date & Time: NOV 16 @ 1400h
 Stop Date & Time: NOV 7 16 @ 1930h
 Set up by: EMM

20 (mg/L NO3-N)

Days	Concentration:											Concentration:											Concentration:										
	AA	BB	CC	DD	EE	FF	GA	HI	II	JJ	Init	A	B	C	D	E	F	G	H	I	J	Init	AK	BL	CM	DN	EO	FD	GS	HL	IS	JT	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	3	3	4	4	3	3	3	2	3	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	✓	6	5	5	6	5	6	5	5	6	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
6	10	10	12	10	10	11	11	10	9	11		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLC
7																																	
8																																	
Total	16	19	20	19	20	19	20	18	16	20	EMM																						

27 (mg/L NO3-N)

Days	Concentration:											Concentration:											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	3	3	2	3	3	4	4	3	3	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	6	5	5	5	5	6	5	6	5	5	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
6	10	12	13	12	10	8	10	13	12	12	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLC
7																																	
8																																	
Total	20	20	21	19	18	17	19	23	20	20	EMM																						

35 (mg/L NO3-N)

Days	Concentration:											Concentration:											Concentration:										
	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init	A	B	C	D	E	F	G	H	I	J	Init
1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
4	4	4	3	3	3	4	3	4	2	4	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	EMM
5	6	5	5	6	5	6	5	5	5	5	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A
6	12	14	13	12	12	10	11	11	9	12	EMM	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	MLC
7																																	
8																																	
Total	22	23	21	21	20	20	19	20	16	21	EMM																						

Notes: X = mortality.

Sample Description: same as w/b sheet
 Comments: Total # Young only based on the first 3 Broods. Fourth and subsequent broods not included in total count.

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Reviewed by: Jou

Date reviewed: Feb. 10/17

CETIS Summary Report

Report Date: 18 Jan-17 16:14 (p 1 of 2)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 20-1135-3637	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
08-7043-6435	6d Survival Rate	EC5	>73.9	N/A	N/A		Linear Interpolation (ICPIN)
		EC10	>73.9	N/A	N/A		
		EC15	>73.9	N/A	N/A		
		EC20	>73.9	N/A	N/A		
		EC25	>73.9	N/A	N/A		
		EC40	>73.9	N/A	N/A		
		EC50	>73.9	N/A	N/A		

6d Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	30	1	1	1	1	1	0	0	0.0%	0.0%
10.5	Negative Control	30	1	1	1	1	1	0	0	0.0%	0.0%
14.35		30	1	1	1	1	1	0	0	0.0%	0.0%
20.4		30	1	1	1	1	1	0	0	0.0%	0.0%
27.15		30	1	1	1	1	1	0	0	0.0%	0.0%
38.15		30	1	1	1	1	1	0	0	0.0%	0.0%
52.35		30	1	1	1	1	1	0	0	0.0%	0.0%
73.9		30	1	1	1	1	1	0	0	0.0%	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
10.5	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
14.35		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
20.4		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
27.15		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
38.15		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
52.35		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
73.9		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

CETIS Summary Report

Report Date: 18 Jan-17 16:14 (p 2 of 2)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

6d 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
0	① Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
10.5	① Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
14.35		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
20.4		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
27.15		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
38.15		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
52.35		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
73.9		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

① Lab water = 20% Perrier (lab control)
 Negative Control = site water (dilution water) GH-FRI with hardness adjusted in house to ~ 700 mg/L CaCO₃

CETIS Summary Report

Report Date: 18 Jan-17 16:14 (p 1 of 1)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Batch ID: 20-1135-3637	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Point Estimate Summary

Analysis ID	Endpoint	Level	mg/L	95% LCL	95% UCL	TU	Method
04-4663-5436	Reproduction	IC5	18.74	17.2	39.35		Linear Interpolation (ICPIN)
		IC10	40.39	38.46	53.09		
		IC15	43.91	40.66	54.68		
		IC20	47.73	42.9	56.31		
		IC25	51.88	44.78	58.1		
		IC40	59.97	50.79	64.66		
		IC50	65.87	58.18	72.33		

Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	18	22	0.4069	1.287	6.47%	0.0%
10.5	Negative Control	10	19.8	19.06	20.54	19	22	0.3266	1.033	5.22%	0.5%
14.35		10	22.1	21.12	23.08	21	24	0.4333	1.37	6.2%	-11.06%
20.4		10	18.7	17.58	19.82	16	20	0.4955	1.567	8.38%	6.03%
27.15		10	19.7	18.53	20.87	17	23	0.5175	1.636	8.31%	1.01%
38.15		10	20.3	18.95	21.65	16	23	0.5972	1.889	9.3%	-2.01%
52.35		10	15.6	11.41	19.79	7	22	1.851	5.854	37.52%	21.61%
73.9		10	7.9	5.435	10.37	3	15	1.09	3.446	43.63%	60.3%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
10.5	Negative Control	20	19	21	19	22	19	20	19	19	20
14.35		21	21	22	24	24	21	21	24	21	22
20.4		16	19	20	19	20	19	20	18	16	20
27.15		20	20	21	19	18	17	19	23	20	20
38.15		22	23	21	21	20	20	19	20	16	21
52.35		11	7	9	9	22	20	20	18	19	21
73.9		15	6	7	5	6	11	3	7	9	10

CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 1 of 3)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 08-7043-6435	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:11	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 20-1135-3637	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1572136	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	>73.9	N/A	N/A
EC10	>73.9	N/A	N/A
EC15	>73.9	N/A	N/A
EC20	>73.9	N/A	N/A
EC25	>73.9	N/A	N/A
EC40	>73.9	N/A	N/A
EC50	>73.9	N/A	N/A

6d Survival Rate Summary

Calculated Variate(A/B)

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
10.5	Negative Control	30	1	1	1	0	0	0.0%	0.0%	30	30
14.35		30	1	1	1	0	0	0.0%	0.0%	30	30
20.4		30	1	1	1	0	0	0.0%	0.0%	30	30
27.15		30	1	1	1	0	0	0.0%	0.0%	30	30
38.15		30	1	1	1	0	0	0.0%	0.0%	30	30
52.35		30	1	1	1	0	0	0.0%	0.0%	30	30
73.9		30	1	1	1	0	0	0.0%	0.0%	30	30

CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 2 of 3)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 08-7043-6435 Endpoint: 6d Survival Rate CETIS Version: CETISv1.8.7
 Analyzed: 18 Jan-17 16:11 Analysis: Linear Interpolation (ICPIN) Official Results: Yes

6d 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
10.5	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
14.35		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
20.4		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
27.15		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
38.15		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
52.35		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
73.9		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
10.5	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
14.35		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
20.4		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
27.15		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
38.15		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
52.35		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
73.9		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 3 of 3)
Test Code: 161182 NO3-Ne | 09-9375-9326

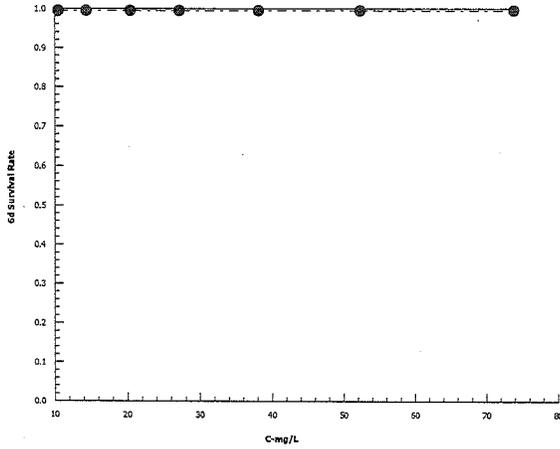
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 08-7043-6435 Endpoint: 6d Survival Rate
Analyzed: 18 Jan-17 16:11 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 1 of 2)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 04-4663-5436	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:12	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 20-1135-3637	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	226379	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	18.74	17.2	39.35
IC10	40.39	38.46	53.09
IC15	43.91	40.66	54.68
IC20	47.73	42.9	56.31
IC25	51.88	44.78	58.1
IC40	59.97	50.79	64.66
IC50	65.87	58.18	72.33

Reproduction Summary

Calculated Variate

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
10.5	Negative Control	10	19.8	19	22	0.3266	1.033	5.22%	0.0%
14.35		10	22.1	21	24	0.4333	1.37	6.2%	-11.62%
20.4		10	18.7	16	20	0.4955	1.567	8.38%	5.56%
27.15		10	19.7	17	23	0.5175	1.636	8.31%	0.51%
38.15		10	20.3	16	23	0.5972	1.889	9.3%	-2.53%
52.35		10	15.6	7	22	1.851	5.854	37.52%	21.21%
73.9		10	7.9	3	15	1.09	3.446	43.63%	60.1%

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
10.5	Negative Control	20	19	21	19	22	19	20	19	19	20
14.35		21	21	22	24	24	21	21	24	21	22
20.4		16	19	20	19	20	19	20	18	16	20
27.15		20	20	21	19	18	17	19	23	20	20
38.15		22	23	21	21	20	20	19	20	16	21
52.35		11	7	9	9	22	20	20	18	19	21
73.9		15	6	7	5	6	11	3	7	9	10

CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 2 of 2)
Test Code: 161182 NO3-Ne | 09-9375-9326

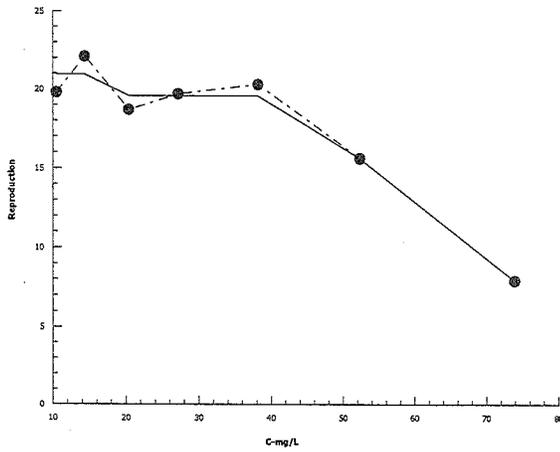
Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 04-4663-5436 Endpoint: Reproduction
Analyzed: 18 Jan-17 16:12 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 1 of 2)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 02-3302-9450	Endpoint: 6d Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:11	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 20-1135-3637	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes 6d survival rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Lab Water		10.5	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Lab Water	30	0	30	1	0	0.0%
10.5	Negative Contr	30	0	30	1	0	0.0%

6d 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
0	Lab Water	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
10.5	Negative Control	1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1
		1	1	1	1	1	1	1	1	1	1

6d 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
0	Lab Water	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
10.5	Negative Control	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1

CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 2 of 2)

Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 02-3302-9450

Endpoint: 6d Survival Rate

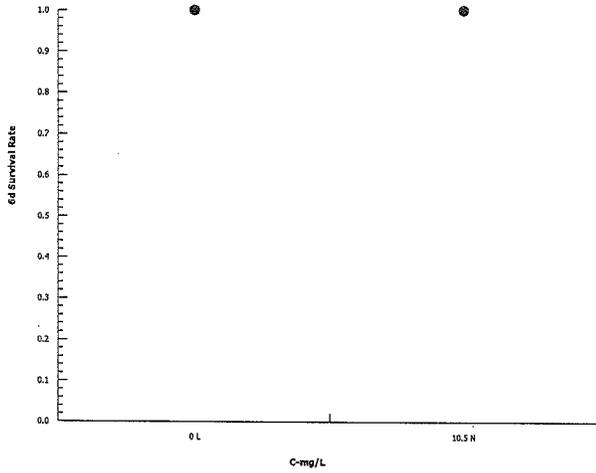
CETIS Version: CETISv1.8.7

Analyzed: 18 Jan-17 16:11

Analysis: Single 2x2 Contingency Table

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 18 Jan-17 16:14 (p 1 of 1)
 Test Code: 161182 NO3-Ne | 09-9375-9326

Ceriodaphnia 7-d Survival and Reproduction Test

Nautilus Environmental

Analysis ID: 12-1629-9952	Endpoint: Reproduction	CETIS Version: CETISv1.8.7
Analyzed: 18 Jan-17 16:13	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 20-1135-3637	Test Type: Reproduction-Survival (7d)	Analyst: Mimi Tran
Start Date: 01 Nov-16 14:00	Protocol: EC/EPS 1/RM/21	Diluent: Site Water
Ending Date: 07 Nov-16 19:30	Species: Ceriodaphnia dubia	Brine:
Duration: 6d 5h	Source: In-House Culture	Age: <24h
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 4h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	4.55%	Passes reproduction

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Lab Water	10.5	0.1917	1.734	0.905	18	0.4251	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.05	0.05	1	0.03673	0.8502	Non-Significant Effect
Error	24.5	1.361111	18			
Total	24.55		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	1.552	6.541	0.5229	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8933	0.866	0.0310	Normal Distribution

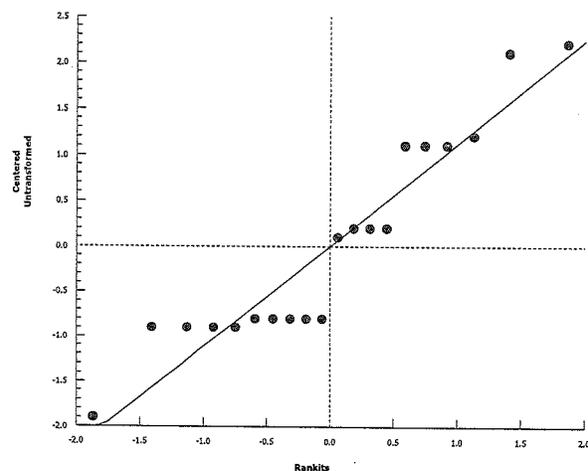
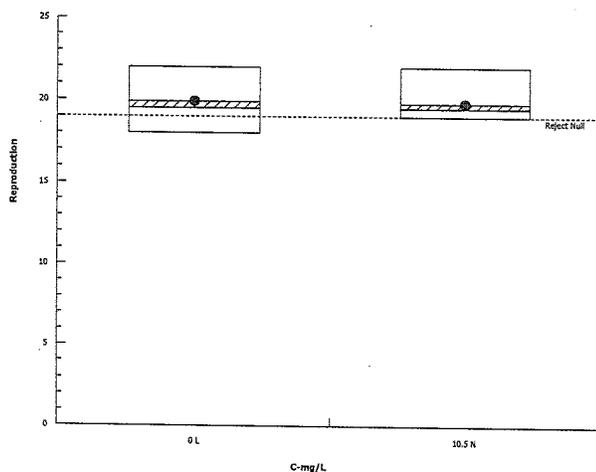
Reproduction Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Lab Water	10	19.9	18.98	20.82	19.5	18	22	0.4069	6.47%	0.0%
10.5	Negative Control	10	19.8	19.06	20.54	19.5	19	22	0.3266	5.22%	0.5%

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
0	Lab Water	19	20	19	22	21	21	18	19	21	19
10.5	Negative Control	20	19	21	19	22	19	20	19	19	20

Graphics



APPENDIX B – *Pimephales promelas* Toxicity Test Data

Method FMD 32 Day ELS Client NAU104 Sample: CTL_0317, 0318 unt, 0319 unt

Control hatching success must be >66% (≥ 10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

replicate	CTL- tap		CTL- Cu		0317- unt		0317- Cu		0318- unt		0319- unt	
	Day 1		Day 1		Day 1		Day 1		Day 1		Day 1	
	Alive Embryos	Dead Embryos										
a	15	0	15	0	14	1	14	1	15	0	15	0
b	15	0	15	0	13	2	15	0	14	1	15	0
c	15	0	15	0	15	0	14	1	14	1	14	1
d	14	1	14	1	15	0	14	1	15	0	15	0
e	28	2	30	0	30	0	30	0	30	0	30	0
f	30	0	29	1	30	0	27	3	30	0	28	2

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

replicate	CTL- tap			CTL- Cu			0317- unt			0317- Cu		
	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15	15	0	15	14	0	15	13	1	15
b	15	0	15	15	0	15	12	1	15	15	0	15
c	15	0	15	15	0	15	13	2	15	13	1	15
d	13	1	15	13	1	15	14	1	15	14	0	15
e	27	1		29	1		30	0		30	0	
f	30	0		30	0		30	0		27	0	

29

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2.

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample CTL 0317, 0318 unt, 0319 unt

Number of Alive Embryos and Hatched Organisms

replicate	CTL- tap		CTL- Cu		0317- unt		0317- Cu		0318- unt		0319- unt	
	Day 3		Day 3		Day 3		Day 3		Day 3		Day 3	
	Alive Embryos	Alive Hatched										
a	11	4	13	2	12	3	12	3	11	4	7	6
b	15	0	11	4	13	2	13	2	8	6*	2	9/12
c	11	4	14	1	12	3	12	3	11	4	7	8
d	13	2	10	15	11	4	14	1	7	8	7	7/8

CHCu

	Emb	Hatched
A	12	3
B	13	2
C	12	3
A	14	1

Comments/Observations:

0318 UNTB - 1 dead hatched
0319A - 2 dead hatched (fuffy)
B - 1 dead (fuffy) (hatched)

replicate	CTL- tap		CTL- Cu		0317- unt		0317- Cu		0318- unt		0319- unt	
	Day 4		Day 4		Day 4		Day 4		Day 4		Day 4	
	Alive Embryos	Alive Hatched										
a	1	14	1	15	1	14	4	11	0	13	-	9
b	-	15	1	13	2	13	1	14	2	11	-	14
c	-	15	-	15	1	13	3	12	0	15	-	15
d	-	15	1	15	1	14	3	12	0	14	-	14

1 dead embryo, 3 dead hatched
hatched
1 dead embryo ML

Comments/Observations:

one dead hatched
0317A - 1 dead hatched
0318 UNTA - 1 dead hatched
0318 UNTB - 1 dead hatched
0318 UNTC - 1 dead embryo
0319A - 1 dead hatched
0319B - 1 dead hatched
0319C - 1 dead hatched
0319D - 1 dead embryo
0319E - 1 dead embryo
0319F - 1 dead embryo
0319G - 1 dead embryo
0319H - 1 dead embryo
0319I - 1 dead embryo
0319J - 1 dead embryo
0319K - 1 dead embryo
0319L - 1 dead embryo
0319M - 1 dead embryo
0319N - 1 dead embryo
0319O - 1 dead embryo
0319P - 1 dead embryo
0319Q - 1 dead embryo
0319R - 1 dead embryo
0319S - 1 dead embryo
0319T - 1 dead embryo
0319U - 1 dead embryo
0319V - 1 dead embryo
0319W - 1 dead embryo
0319X - 1 dead embryo
0319Y - 1 dead embryo
0319Z - 1 dead embryo

replicate	CTL- tap		CTL- Cu		0317- unt		0317- Cu		0318- unt		0319- unt	
	Day 5		Day 5		Day 5		Day 5		Day 5		Day 5	
	Alive Embryos	Alive Hatched										
a	14	15	15	15	14	14	14	14	12	12	9	9
b	15	15	14	15	15	15	15	15	11	11	14	14
c	15	15	15	15	15	15	15	15	15	15	15	15
d	15	15	15	15	15	15	15	15	14	14	14	14

0318 UNTA - 1 dead embryo
0317A - 1 dead embryo (UNT)
0317(CU)A - 1 dead embryo
0318 UNTB - 2 dead embryo
0319A - 1 dead embryo
0319B - 1 dead embryo
0319C - 1 dead embryo
0319D - 1 dead embryo
0319E - 1 dead embryo
0319F - 1 dead embryo
0319G - 1 dead embryo
0319H - 1 dead embryo
0319I - 1 dead embryo
0319J - 1 dead embryo
0319K - 1 dead embryo
0319L - 1 dead embryo
0319M - 1 dead embryo
0319N - 1 dead embryo
0319O - 1 dead embryo
0319P - 1 dead embryo
0319Q - 1 dead embryo
0319R - 1 dead embryo
0319S - 1 dead embryo
0319T - 1 dead embryo
0319U - 1 dead embryo
0319V - 1 dead embryo
0319W - 1 dead embryo
0319X - 1 dead embryo
0319Y - 1 dead embryo
0319Z - 1 dead embryo

Comments/Observations:

1 dead embryo - CTL tap A - ML

replicate	CTL- tap		CTL- Cu		0317- unt		0317- Cu		0318- unt		0319- unt	
	Day 6		Day 6		Day 6		Day 6		Day 6		Day 6	
	Alive Embryos	Alive Hatched										
a	12	12	15	15	14	14	14	14	11	11	7	7
b	13	13	14	14	15	15	15	15	9	9	13	13
c	15	15	15	15	14(1)	14	15	15	15	15	15	15
d	15	15	15	15	13	13	15	15	13	13	9	9

Comments/Observations:

Jar fell over and lost 2-

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

Number of Alive Embryos and Hatched Organisms

replicate	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 7	Day 7	Day 7	Day 7	Day 7	Day 7
a	12	15	18	14	8	7
b	13	14	15	15	7	8(1)
c	14	15	15	15	14	10
d	15	15	8	14	10	7

Comments/Observations: 0319 - Death = fluffy

replicate	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 8	Day 8	Day 8	Day 8	Day 8	Day 8
a	12	15	1	14	7	6
b	13	13	9	15	2	5
c	14	15	3	15	14	6
d	15	15(1)	3	14	9	5

Comments/Observations:

replicate	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 9	Day 9	Day 9	Day 9	Day 9	Day 9
a	12	15	0	14	7	6
b	13	13	8	15	3	3
c	14	15	1	15	14	6
d	15	15	3	14	9	4

Comments/Observations:

replicate	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 10	Day 10	Day 10	Day 10	Day 10	Day 10
a	12	14	0	14	7	5
b	13	13	7*	15	3	3
c	14	14*	0	14*	14	5
d	15(1)	15	2	14	9	4

Comments/Observations: 0319 unt B. idella w/ micron growth 0319 death = microbial fluff

0317 Cu "
CTL TAP C "
(Cu) "

Method FMD 32 Day ELS Client NAU104 Sample: CTL, 0317, 0318 unt, 0319 unt

		Number of Alive Embryos and Hatched Organisms					
		CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
		Day 11	Day 11	Day 11	Day 11	Day 11	Day 11
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	5	
b	13	13	0	15	2	3	
c	14	14	0	14	14	5	
d	15	15	2	14	8	4	

Comments/Observations:

		CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
		Day 12					
replicate		Alive Hatched					
a	12	14	0	14	7	5	
b	13	13	0	15	2	2	
c	14	14	0	14	14	4	
d	15	15(1)	2	14	8	4	

Comments/Observations: *0319-dead = microbial growth*

		CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
		Day 13					
replicate		Alive Hatched					
a	12	14	0	14	7	4	
b	13	13	7	15	2	2	
c	14	14	0	14	14	4	
d	15	14	2	14	8	4	

Comments/Observations:

		CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
		Day 14					
replicate		Alive Hatched					
a	12	14	0	14	7	4	
b	13	13	0	14	2	2	
c	13	14	0	14	14	4	
d	15	14	2	14	8	4	

Comments/Observations:

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

Number of Alive Embryos and Hatched Organisms

	CTL- tap Day 15	CTL- Cu Day 15	0317- unt Day 15	0317- Cu Day 15	0318- unt Day 15	0319- unt Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	4
b	13	13	7	14	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	4

Comments/Observations:

	CTL- tap Day 16	CTL- Cu Day 16	0317- unt Day 16	0317- Cu Day 16	0318- unt Day 16	0319- unt Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	4
b	13	13	7	14	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	4

Comments/Observations:

	CTL- tap Day 17	CTL- Cu Day 17	0317- unt Day 17	0317- Cu Day 17	0318- unt Day 17	0319- unt Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	4
b	13	13	6	14	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	4

Comments/Observations:

	CTL- tap Day 18	CTL- Cu Day 18	0317- unt Day 18	0317- Cu Day 18	0318- unt Day 18	0319- unt Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	4
b	13	13	6	14	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	4

Comments/Observations:

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap Day 19	CTL- Cu Day 19	0317- unt Day 19	0317- Cu Day 19	0318- unt Day 19	0319- unt Day 19
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	4
b	13	13	6	14	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	4

Comments/Observations:

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap Day 20	CTL- Cu Day 20	0317- unt Day 20	0317- Cu Day 20	0318- unt Day 20	0319- unt Day 20
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	4
b	13	13	6	14(1)	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	4

Comments/Observations:

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap Day 21	CTL- Cu Day 21	0317- unt Day 21	0317- Cu Day 21	0318- unt Day 21	0319- unt Day 21
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	14	7	4
b	13	13	6	14(1)	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	3

Comments/Observations:

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap Day 22	CTL- Cu Day 22	0317- unt Day 22	0317- Cu Day 22	0318- unt Day 22	0319- unt Day 22
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12 13	14	0	14	7	4
b	13	13	6	14(1)	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	3

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample CTL, 0317, 0318 unt, 0319 unt

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 23	Day 23	Day 23	Day 23	Day 23	Day 23
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	13	7	4
b	13	13	6	13	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	3

Comments/Observations:

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 24	Day 24	Day 24	Day 24	Day 24	Day 24
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	5 0	13	7	4
b	13	13	6	12	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	3

Comments/Observations:

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 25	Day 25	Day 25	Day 25	Day 25	Day 25
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	13	7	4
b	13	13	6	12	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	3

Comments/Observations:

replicate	Number of Alive Embryos and Hatched Organisms					
	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 26	Day 26	Day 26	Day 26	Day 26	Day 26
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	14	0	12*	7	4
b	13	13	6	12	2	2
c	13	14	0	14	14	4
d	15	14	2	14	8	3

Comments/Observations: * no microbitch, tail was misformed

Method FMD 32 Day ELS Client NAU104 Sample: CTL, 0317, 0318 unt, 0319 unt

Number of Alive Embryos and Hatched Organisms						
	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 27					
replicate	Alive Hatched					
a	12	13	0	12	7	4
b	13	13	6	12	2	2
c	13	14	0	14	14	4
d	15	12	2	14	8	3

Comments/Observations:

	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 28					
replicate	Alive Hatched					
a	12	13	0	12(11)	7	4
b	13	13	6	12	2	2
c	13	14	0	14	14	4
d	15	12	2	14	8	3

Comments/Observations:

	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 29					
replicate	Alive Hatched					
a	12	13	0	12(11)	7	4
b	13	13	6	12	2	2
c	13	14	0	14	14	4
d	15	12	2	14	8	3

Comments/Observations:

	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 30					
replicate	Alive Hatched					
a	12	13	0	12	7	4
b	13	13	6	12	2	2
c	13	14	0	14	14	4
d	14	12	2	14	8	3

Comments/Observations:

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

Number of Alive Embryos and Hatched Organisms						
	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	13	0	12	7	4
b	13	13 12 ^{tw}	6	12	2	2
c	13	14	0	14	14	4
d	14	12	2	14	8	3

Comments/Observations:

Number of Alive Embryos and Hatched Organisms						
	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
	Day 32					
replicate	Alive Hatched					
a	12	13	0	12	7	4
b	13	12	0	12	2	2
c	13	14	0	14	14	4
d	14	12	2	14	8	3

Comments/Observations:

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

New Solutions						
Conc. (%)	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt

Old Solutions					
CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0	8.2	8.2	8.2	8.2	8.3	8.2
1	8.2	8.1	8.1	8.1	8.2	8.2
2	8.0	8.1	8.4	8.3	8.1	8.2
3	8.0	8.0	8.4	8.4	8.1	8.2
4	8.1	8.1	8.3	8.3	8.2	8.2
5	8.3	8.1	8.2	8.2	8.2	8.1
6	8.0	8.1	8.3	8.3	8.2	8.1
7	8.3	8.2	8.3	8.2	8.2	8.1
8	8.1	8.1	8.3	8.3	8.2	8.1

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0						
1	7.8	8.0	8.1	8.1	8.2	8.2
2	7.8	7.9	8.1	8.1	8.1	8.1
3	8.1	8.1	8.2	8.2	8.1	8.1
4	8.1	8.1	8.2	8.2	8.0	8.0
5	8.2	8.1	8.3	8.3	8.1	8.1
6	8.1	7.9	8.1	8.2	8.0	8.0
7	8.3	8.0	8.0	8.1	7.9	8.0
8	8.2	8.0	8.0	8.1	8.0	8.1

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0	391	400	396	397	452	762
1	394	384	311	307	456	722
2	353	365	312	302	415	689
3	369	348	305	302	380	666
4	343	355	290	301	376	667
5	436	361	294	306	318	667
6	375	383	292	319	409	701
7	447	375	303	318	402	747
8	369	405	291	317	399	724

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0						
1	314	381	311	317	456	755
2	433	388	325	311	455	720
3	357	376	311	307	411	705
4	364	370	305	307	391	690
5	357	362	306	311	384	658
6	423	373	315	326	402	711
7	505	389	312	318	299	704
8	452	381	308	309	411	735

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0	7.3	7.3	7.3	7.3	7.3	7.2
1	7.3	7.3	7.3	7.3	7.3	7.3
2	7.3	7.3	7.3	7.3	7.3	7.2
3	7.2	7.2	7.3	7.3	7.3	7.2
4	7.3	7.3	7.3	7.3	7.3	7.3
5	7.3	7.3	7.3	7.3	7.2	7.2
6	7.1	7.1	7.3	7.2	7.2	7.2
7	7.1	7.2	7.3	7.3	7.3	7.3
8	7.0	7.2	7.3	7.3	7.3	7.3

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0						
1	7.0	7.0	7.1	7.2	7.2	7.2
2	7.2	7.2	7.2	7.2	7.2	7.2
3	6.9	7.0	7.0	7.1	7.3	7.2
4	7.2	7.2	7.2	7.2	7.2	7.2
5	7.1	7.1	7.1	7.0	7.1	7.1
6	7.0	7.2	7.0	6.9	6.9	6.8
7	7.1	7.1	6.9	6.5	6.5	6.3
8	7.0	6.8	7.0	6.9	7.2	7.0

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0	24.1	24.8	23.5	23.6	23.5	23.5
1	25.3	25.2	23.5	23.5	24.0	23.9
2	24.4	24.4	24.2	23.9	24.5	23.9
3	25.2	24.9	23.9	23.9	23.9	23.4
4	23.8	24.1	23.5	23.5	23.5	23.5
5	24.0	24.1	24.2	24.3	25.0	24.6
6	25.5	25.7	24.2	24.7	24.9	24.7
7	23.9	24.9	24.2	24.0	24.0	24.0
8	25.4	25.0	23.5	23.5	23.5	23.5

Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
0						
1	25					
2	25					
3	25					
4	25					
5	25					
6	25					
7	25					
8	25					

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

L-tap, CTL-Cu
0317 unt
x 7.2

M

M

Method FMD 32 Day ELS

Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

New Solutions

Conc. (%)	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
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Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
9	8.1	8.1	8.3	8.3	8.2	8.2
10	7.9	8.0	8.2	8.3	8.2	8.2
11	8.2	8.2	8.0	8.2	8.0	8.0
12	8.1	8.1	8.2	8.2	8.2	8.2
13	8.1	8.0	8.3	8.3	8.2	8.2
14	7.9	8.1	8.3	8.3	8.3	8.2
15	7.9	8.0	8.2	8.2	8.0	8.0
16	7.9	7.9	7.9	7.9	7.9	8.0
17	7.9	7.9	8.0	8.1	8.0	8.0

8.2

Conductance (µS/cm)

9	359	359	349	327	399	704
10	340	351	399	315	391	695
11	352	364	277	312	374	662
12	329	322	279	283	367	709
13	321	370	265	283	390	692
14	423	376	294	320	478	730
15	358	352	287	310	405	720
16	323	383	284	318	431	696
17	377	378	254	270	372	666

LC
x 296 356

Dissolved Oxygen (mg/L) (40-100% saturation)

9	7.3	7.2	7.2	7.2	7.2	7.2
10	7.2	7.2	7.3	7.3	7.3	7.3
11	7.3	7.3	7.3	7.3	7.3	7.3
12	7.2	7.2	7.3	7.3	7.3	7.2
13	7.2	7.2	7.3	7.3	7.3	7.2
14	7.3	7.3	7.1	7.2	7.2	7.3
15	7.2	7.3	7.3	7.2	7.3	7.3
16	7.2	7.3	7.2	7.3	7.3	7.2
17	7.3	7.3	7.2	7.3	7.2	7.2

ML
7.1

Temperature (°C)

9	24.4	24.9	25.1	25.4	25.0	25.1
10	24.5	25.7	23.6	23.7	23.8	24.5
11	24.4	23.5	23.5	23.5	23.5	23.5
12	25.0	25.3	24.0	24.3	24.1	25.0
13	24.9	24.5	24.4	24.1	24.4	25.3
14	23.9	24.2	23.5	24.7	25.1	23.5
15	24.0	24.1	24.5	25.4	24.1	24.7
16	24.6	24.0	25.4	24.3	24.1	23.9
17	24.2	24.0	25.4	24.1	25.0	25.0

Old Solutions

CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
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Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
9	8.1	8.0	8.1	8.1	8.1	8.1
10	7.9	7.9	8.0	8.0	8.0	8.0
11	8.0	8.0	8.2	8.2	7.9	8.0
12	7.9	8.1	8.1	8.2	7.9	8.0
13	7.9	7.9	8.0	8.0	7.9	7.9
14	8.1	8.1	8.1	8.2	8.0	8.1
15	8.0	7.9	8.0	8.0	8.0	8.0
16	7.9	7.9	7.9	7.9	7.9	8.0
17	7.7	7.8	7.8	7.8	7.8	7.9

7.6

Conductance (µS/cm)

9	424	379	313	327	406	698
10	373	371	308	324	405	708
11	379	369	295	322	400	695
12	368	381	284	322	398	684
13	343	349	282	313	391	690
14	400	358	281	302	391	653
15	405	389	289	310	415	723
16	394	397	294	318	431	696
17	394	385	282	306	418	693

Dissolved Oxygen (mg/L) (40-100% saturation)

9	6.8	6.8	6.8	6.8	6.8	6.7
10	6.7	6.8	6.7	7.2	7.0	6.6
11	7.0	6.9	6.9	7.0	7.1	7.8
12	6.9	6.9	6.9	6.9	7.0	7.1
13	6.8	6.9	7.0	6.9	6.7	6.8
14	7.0	7.0	6.9	6.9	6.9	6.9
15	7.0	6.9	6.9	6.9	7.2	7.2
16	6.7	6.7	6.4	6.3	6.2	6.0
17	6.5	6.5	6.4	6.4	6.5	6.5

Temperature (°C)

9	25					
10	25					
11	25					
12	25					
13	25					
14	25					
15	25					
16	25					
17	25					

DO Levels (60-100% saturation) -

4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104

Sample: CTL 0317, 0318 unt, 0319 unt

New Solutions

Conc. (%)	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
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Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
18	8.2	8.2	8.1	8.2	8.2	8.1
19	8.1	8.1	8.1	8.2	8.2	8.2
20	8.0	8.0	8.0	8.0	8.0	8.0
21	8.1	8.2	8.3	8.3	8.2	8.1
22	7.9	8.0	8.3	8.3	8.0	8.1
23	7.9	8.1	8.2	8.2	8.3	8.2
24	8.1	8.2	8.3	8.3	8.2	8.2
25	8.0	8.1	8.3	8.3	8.1	8.2
26	7.8	7.9	8.1	8.1	8.1	8.0

Conductance (µS/cm)

18	369	374	251	269	383	678
19	385	368	254	260	405	700
20	322	330	283	280	336	614
21	360	370	286	283	346	672
22	310	323	306	281	379	638
23	337	351	256	276	419	662
24	290	294	245	248	349	626
25	296	286	265	243	341	634
26	302	290	240	239	347	612

Dissolved Oxygen (mg/L) (40-100% saturation)

18	7.2	7.2	7.3	7.3	7.3	7.3
19	7.2	7.2	7.2	7.2	7.2	7.2
20	7.2	7.2	7.0	7.0	7.2	7.1
21	7.3	7.3	7.3	7.3	7.3	7.3
22	7.3	7.2	7.3	7.3	7.3	7.3
23	7.3	7.3	7.3	7.3	7.3	7.3
24	7.2	7.2	7.1	7.2	7.2	7.1
25	7.2	7.2	7.3	7.3	7.2	7.3
26	7.3	7.3	7.3	7.2	7.3	7.3

Temperature (°C)

18	24.9	24.9	23.8	24.0	24.0	24.0
19	25.1	25.0	25.2	25.2	24.9	24.6
20	25.0	24.9	25.4	25.1	24.7	25.9
21	23.5	23.5	23.5	24.2	23.5	23.7
22	24.1	25.0	23.9	23.9	24.0	24.2
23	23.6	23.9	24.0	23.9	24.1	24.0
24	24.0	24.0	25.6	24.6	24.6	25.5
25	24.8	25.2	24.3	24.2	24.6	23.9
26	24.0	24.1	23.8	24.9	24.3	24.2

DO Levels (60-100% saturation) -

4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Old Solutions

CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
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Day	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
18	7.9	7.9	8.0	8.0	7.9	8.0
19	8.0	7.9	8.0	8.0	7.9	8.0
20	7.8	7.7	7.9	7.7	7.7	7.8
21	7.8	7.7	7.9	7.8	7.9	7.9
22	7.8	7.7	8.0	7.9	7.9	7.9
23	7.7	7.7	8.0	7.9	7.9	7.9
24	7.7	7.7	8.0	7.9	7.9	8.0
25	7.7	7.7	7.9	7.8	7.8	7.9
26	7.7	7.7	7.9	7.8	7.8	7.8

Conductance (µS/cm)

18	396	380	272	290	384	665
19	400	385	256	291	387	696
20	341	335	235	244	333	604
21	347	337	233	241	353	608
22	390	231	276	271	379	635
23	315	324	275	280	346	628
24	334	338	265	278	378	640
25	324	313	253	262	358	619
26	295	245	251	255	351	609

Dissolved Oxygen (mg/L) (40-100% saturation)

18	5.8	5.9	6.1	6.4	6.4	6.7
19	7.0	6.9	7.2	7.2	7.2	7.2
20	6.6	6.2	6.5	6.3	6.2	6.5
21	6.0	5.8	5.7	6.0	6.4	6.0
22	6.2	6.1	6.1	6.0	6.0	6.1
23	6.0	6.2	6.0	6.0	6.3	6.0
24	6.0	6.0	6.0	6.0	6.1	6.2
25	6.3	6.3	6.3	6.3	6.3	6.6
26	6.0	6.1	6.3	6.4	6.7	6.4

Temperature (°C)

18	25					
19	25					
20	25					
21	25					
22	25					
23	25					
24	25					
25	25					
26	25					

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

New Solutions						
Conc. (%)	CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt
Day	pH (units)					
27	8.2	8.2	8.3	8.2	8.1	8.1
28	8.1	8.1	8.4	8.3	8.2	8.2
29	8.1	8.1	8.2	8.2	8.1	8.1
30	8.1	8.0	8.2	8.2	8.1	8.1
31	8.2	8.2	8.2	8.2	8.1	8.1
32						

Old Solutions						
CTL- tap	CTL- Cu	0317- unt	0317- Cu	0318- unt	0319- unt	
pH (units)						
27	7.5	7.6	7.7	7.7	7.7	7.7
28	7.7	7.7	7.8	7.7	7.8	7.9
29	7.5	7.5	7.8	7.8	7.9	8.0
30	7.8	7.8	8.0	8.0	8.0	8.1
31	7.8	7.7	8.0	7.9	7.9	8.0
32	8.0	7.9	8.1	8.0	8.0	8.1

Conductance (µS/cm)						
27	330	342	271	263	389	686
28	334	333	315	309	430	747
29	385	332	310	291	435	733
30	385	316	270	266	395	690
31	375	372	260	254	389	687
32						

Conductance (µS/cm)						
27	333	332	276	280	402	692
28	343	336	275	276	401	697
29	343	341	315	309	427	741
30	381	334	302	298	424	725
31	385	360	286	286	418	713
32	403	367	277	275	402	719

Dissolved Oxygen (mg/L) (40-100% saturation)						
27	7.0	7.3	7.2	7.2	7.2	7.2
28	7.3	7.3	7.2	7.2	7.2	7.2
29	7.3	7.3	7.3	7.3	7.3	7.3
30	7.2	7.2	7.3	7.2	7.3	7.3
31	7.3	7.3	7.2	7.2	7.3	7.3
32						

Dissolved Oxygen (mg/L) (40-100% saturation)						
27	6.4	6.5	6.0	6.1	6.3	6.4
28	5.5	5.4	6.1	6.1	6.0	6.4
29	6.3	6.1	6.1	6.3	6.4	6.4
30	6.0	6.0	6.1	6.3	6.4	6.5
31	5.8	6.1	6.2	6.2	6.3	6.6
32	6.7	6.8	6.8	6.8	7.0	7.0

Temperature (°C)						
27	25.2	24.4	24.8	25.3	25.1	24.8
28	24.2	24.0	24.6	24.7	24.5	24.8
29	24.0	24.2	23.9	23.9	24.0	24.0
30	24.0	24.3	24.0	24.0	24.0	24.2
31	24.0	24.4	24.8	25.1	23.5	23.6
32						

Temperature (°C)						
27	25					
28	25					
29	25					
30	26					
31	26					
32	25					

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104

Sample: CTL 0317, 0318 unt, 0319 unt

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: **H=**head, **O=**oral, **E=**eyes, **G=**gills, **F=** fins, **S=**spine

Conc.

CTL- tap	Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
	Fish	Length (mm)	Normal/Abnormal									
	1	10	N	1	9	N	1	8	N	1	9	N
	2	9		2	10		2	8		2	9	
	3	10		3	10		3	8		3	9	
	4	10		4	10		4	8		4	9	
	5	10		5	10		5	8		5	9	
	6	10		6	10		6	8		6	9	
	7	10		7	10		7	8		7	9	
	8	10		8	10		8	8		8	9	
	9	10		9	10		9	8		9	9	
	10	12		10	10		10	8		10	9	
	11	10		11	10		11	8		11	9	
	12	10		12	10		12	8		12	9	
	13	11		13	10		13	8		13	9	
	14	11		14	10		14	8		14	9	
	15	11		15	10		15	8		15	9	

Comments

CTL- Cu	Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
	Fish	Length (mm)	Normal/Abnormal									
	1	10	N	1	9	N	1	10	N	1	9	N
	2	9		2	10		2	10		2	9	
	3	10		3	10		3	10		3	9	
	4	10		4	10		4	10		4	9	
	5	10		5	10		5	10		5	9	
	6	10		6	10		6	10		6	9	
	7	10		7	10		7	10		7	9	
	8	9		8	10		8	10		8	9	
	9	10		9	10		9	10		9	9	
	10	10		10	10		10	10		10	9	
	11	12		11	10		11	10		11	9	
	12	10		12	10		12	10		12	9	
	13	10		13	10		13	10		13	9	
	14	11		14	10		14	10		14	9	
	15	11		15	10		15	10		15	9	

Comments

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

Test Termination

for normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: **H=head, O=oral, E=eyes, G=gills, F=fins, S=spine**

Conc.
0317-unt

Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal		
A	1			B	1		N	C	1			D	1		N		
	2				2					2					2		N
	3				3					3					3		
	4				4					4					4		
	5				5					5					5		
	6				6					6					6		
	7				7					7					7		
	8				8					8					8		
	9				9					9					9		
	10				10					10					10		
	11				11					11					11		
	12				12					12					12		
	13				13					13					13		
	14				14					14					14		
	15				15					15					15		

Comments

Conc.
0317-Cu

Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal		
A	1		N	B	1		N	C	1			D	1		N		
	2				2					2					2		
	3				3					3					3		
	4				4					4					4		
	5				5					5					5		
	6				6					6					6		
	7				7					7					7		
	8				8					8					8		
	9				9					9					9		
	10				10					10					10		
	11				11					11					11		
	12				12					12					12		
	13				13					13					13		
	14				14					14					14		
	15				15					15					15		

Comments

Method FMD 32 Day ELS Client NAU104

Sample: CTL, 0317, 0318 unt, 0319 unt

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: **H=head, O=oral, E=eyes, G=gills, F=fins, S=spine**

Conc. 0318-unt

Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal
A	1	10	N	B	1	10	N	C	1	9	N	D	1	8	N
	2	10			2	11			2	9			2	8	
	3	10			3	11			3	9			3	8	
	4	10			4	11			4	9			4	8	
	5	10			5	11			5	9			5	8	
	6	10			6	11			6	9			6	8	
	7	10			7	11			7	9			7	8	
	8	10			8	11			8	9			8	8	
	9	10			9	11			9	9			9	8	
	10	10			10	11			10	9			10	8	
	11	10			11	11			11	9			11	8	
	12	10			12	11			12	9			12	8	
	13	10			13	11			13	9			13	8	
	14	10			14	11			14	9			14	8	
	15	10			15	11			15	9			15	8	

Comments

Conc. 0319-unt

Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal
A	1	9	N	B	1	11		C	1	10		D	1	9	N
	2	10			2	11			2	10			2	10	
	3	11			3	11			3	10			3	8	
	4	10			4	11			4	10			4	8	
	5	10			5	11			5	10			5	8	
	6	10			6	11			6	10			6	8	
	7	10			7	11			7	10			7	8	
	8	10			8	11			8	10			8	8	
	9	10			9	11			9	10			9	8	
	10	10			10	11			10	10			10	8	
	11	10			11	11			11	10			11	8	
	12	10			12	11			12	10			12	8	
	13	10			13	11			13	10			13	8	
	14	10			14	11			14	10			14	8	
	15	10			15	11			15	10			15	8	

Comments

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

Control hatching success must be >66% (≥ 10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

replicate	0318- Cu only		0318- 400 mg/L		0318- 480 mg/L		0318- 576 mg/L		0318- 691 mg/L		0318- 829 mg/L		0318- 995 mg/L	
	Day 1		Day 1		Day 1		Day 1		Day 1		Day 1		Day 1	
	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	15	0	15	0	14	1	15	0	14	1	15	0	18	0
b	13	2	13	2	15	0	14	1	15	0	15	0	15	0
c	15	0	15	0	14	1	15	0	15	0	15	0	14	1
d	13	2	13	2	15	0	15	0	15	0	13	2	15	0
e	27	3	29	1	29	1	26	4	29	1	28	3	30	0
f	26	4	26	4	29	1	30	0	30	0	27	3	21	1

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

replicate	0318- Cu only			0318- 400 mg/L			0318- 480 mg/L			0318- 576 mg/L		
	Day 2			Day 2			Day 2			Day 2		
	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	15	0	15	14	1	15	14	0	15	15	0	15
b	14	0	15	13	0	15	14	1	15	14	0	15
c	15	0	15	15	0	15	13	1	15	15	0	15
d	14	0	15	13	0	15	13	2	15	15	0	15
e	27	0		29	0		28	1		26	0	
f	26	0		26	0		27	2		30	0	

replicate	0318- 691 mg/L			0318- 829 mg/L			0318- 995 mg/L		
	Day 2			Day 2			Day 2		
	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	13	1	15	14	1	15	15	0	15
b	14	1	15	14	1	15	13	2	15
c	15	0	15	13	2	15	14	1	15
d	15	0	15	13	0	15	15	0	15
e	28	1		23	2		28	2	
f	30	0		24	3		28	1	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2.

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

Number of Alive Embryos and Hatched Organisms

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 7	Day 7	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15(1)	14	13	15	15	13	14	
b	14	14	15	12(1)	12	14	13	
c	15	15	14	15	15	15	10	
d	15	14	15	13	15	14	11	

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 8	Day 8	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15(1)	14	13	15	14	12	14	
b	14	14	15	12(1)	12	14	13	
c	15	15	14	15	15	15	10	
d	14	14	15	13	15	14	11	

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 9	Day 9	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	13	15	14	13	14	
b	14	14	15	12	12	14	13	
c	15	15	14	15	15	15	10	
d	14	14	15	13	15	14	11	

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 10	Day 10	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15(1)	14	13	15(1)	14	13	14	
b	14(1)	14	15	12(1)	12(1)	14	13	
c	15	15	14	15	15	15	10	
d	14	14	15	13	15	14	11	

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

Number of Alive Embryos and Hatched Organisms

replicate	0318- Cu only		0318- 400 mg/L		0318- 480 mg/L		0318- 576 mg/L		0318- 691 mg/L		0318- 829 mg/L		0318- 995 mg/L	
	Day 3		Day 3		Day 3		Day 3		Day 3		Day 3		Day 3	
	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	8	2	8	7	10	4*	9	6	9	6	11	4	15	0
b	14	1	10	5	12	3	4	11	12	3	15	0	13	2
c	15	0	4	11	12	3	8	7	14	1	13	2	13	0
d	14	1	10	5	13	2	12	3	13	2	7	8	15	0

Comments/Observations: 0318-480mg/L A 1 dead embryo
0318-995 C-2 dead embryo

replicate	0318- Cu only		0318- 400 mg/L		0318- 480 mg/L		0318- 576 mg/L		0318- 691 mg/L		0318- 829 mg/L		0318- 995 mg/L	
	Day 4		Day 4		Day 4		Day 4		Day 4		Day 4		Day 4	
	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	1	14	0	15	1	13	0	15	0	15	3	12	8	6
b	2	12	0	15	0	15	1	14	1	14	7	8	5	12
c	-	15	0	15	2	13	0	15	1	14	4	11	2	11
d	2	13	1	14	0	15	1	14	0	15	1	14	7	8

all dead eggs in 0318-995 mg/L were hatched

Comments/Observations: 0318-480 B-1 dead embryo
0318-691 A 1 dead embryo (691A)

replicate	0318- Cu only		0318- 400 mg/L		0318- 480 mg/L		0318- 576 mg/L		0318- 691 mg/L		0318- 829 mg/L		0318- 995 mg/L	
	Day 5		Day 5		Day 5		Day 5		Day 5		Day 5		Day 5	
	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched
a	15	14	14	13	13	15	15	15	13	13	13	14	14	14
b	14	15	15	15	15	14	14	12	14	14	14	13	13	13
c	15	15	15	14	14	15	15	15	15	15	15	11	11	11
d	14	15	15	15	15	14	14	15	15	14	14	14	14	14

829A 2
B 1 dead embryo
D 1
995B - 1 dead emb
C - 2 dead emb.
D - 2 dead emb.

Comments/Observations: 0318 400A - 1 dead embryo
480A - 1 dead embryo
480C - 1 dead embryo
576B - 1 dead embryo
691B - 1 dead embryo

replicate	0318- Cu only		0318- 400 mg/L		0318- 480 mg/L		0318- 576 mg/L		0318- 691 mg/L		0318- 829 mg/L		0318- 995 mg/L	
	Day 6		Day 6		Day 6		Day 6		Day 6		Day 6		Day 6	
	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched	Alive	Hatched
a	15	(1)	14	13	13	15	15	15	13	13	13	14	14	14
b	14	15	15	15	15	14	14	12	14	14	14	13	13	13
c	15	15	15	14	14	15	15	15	15	15	15	11	11	11
d	14	15	15	15	15	14	14	15	15	14	14	14	14	14

Comments/Observations: 0318 400D - 1 still partially unhatched.

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

Number of Alive Embryos and Hatched Organisms

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 11	Day 11	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15	14	13	14	14	13	14
b	12	14(1)	13	14	12(1)	14	11
c	15	15	14	14	15	15	10
d	15	14	15	15	15	14	11

Comments/Observations: all 14

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 12	Day 12	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15(1)	14	13	14	14	13	14
b	12	13	15	12	10	14	11
c	15	15	14	14	15	14	10
d	13	15	15	13	15	14	11

Comments/Observations: 0318(4) Cu - 2 ghosts

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 13	Day 13	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	15(1)	14	12	13	14	13	14(1)
b	12	13(2)	15	12	16	14	11
c	15	14	14	14	15	14	10
d	13	14	15	13	15	14	11

Comments/Observations:

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 14	Day 14	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13/14	14(1)	12	13	14	13	14(1)
b	12	13(2)	15	12	10	14	11
c	15	15	14	14	15	14	10
d	13	13	15	13	15	14	11

Comments/Observations: 2 have bent tails

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

Number of Alive Embryos and Hatched Organisms

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 15	Day 15	Day 15	Day 15	Day 15	Day 15	Day 15
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14(1)	14(1)	14(1)	12	13	14	13	13
b	12(0)	12(0)	13(2)	15	10	10	14	11
c	15	15	15	14	14	15	14	10
d	13	13	13	15	13	15	13	11

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 16	Day 16	Day 16	Day 16	Day 16	Day 16	Day 16
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	14	12	12	13	14	13	13
b	12	12	12(1)	15	12	10	14	11
c	15	15	15	14	14	15	13	10
d	13	13	13	15	13	15	13	11

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 17	Day 17	Day 17	Day 17	Day 17	Day 17	Day 17
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
13	a	14	12	11	13	14	13	13
12	b	12(1)	12(1)	15	12	10	14	11
14	c	15	15	14	14	15(1)	13	10
13	d	13	12	15	13(1)	15	13	11

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 18	Day 18	Day 18	Day 18	Day 18	Day 18	Day 18
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	13	11	11	13	14	13	13
b	12	12	12	15	12	10	13	11
c	14	14	15	14	14	15	13	10
d	13	13	12	15	12	15	13	11

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

		Number of Alive Embryos and Hatched Organisms						
		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 19	Day 19	Day 19	Day 19	Day 19	Day 19	Day 19
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	13	
b	12	12	15	12	10	13	11	
c	14	15	14	14	15	13	10	
d	13	12	15 HP	12	15	13	11	

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 20	Day 20	Day 20	Day 20	Day 20	Day 20	Day 20
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12 [*]	
b	12	12(1)	15	12	10	13	11	
c	13	15	14	14	14	12 [*]	10	
d	13	12	15	12	14	13	11	

Comments/Observations: 829D - one FM dead - dried along jar rim
995A - one dead w/ fuzzy growth

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 21	Day 21	Day 21	Day 21	Day 21	Day 21	Day 21
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12	
b	12	12(1)	15	12	10	12	11	
c	13	15	14	14	14	12	10	
d	13	12	15	12	14	13	11	

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 22	Day 22	Day 22	Day 22	Day 22	Day 22	Day 22
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12	
b	12	12(1)	15	12	10	12	11	
c	13	15	14	14	14	12	10	
d	13	12	15	12	14	13	11	

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

Number of Alive Embryos and Hatched Organisms

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 23	Day 23	Day 23	Day 23	Day 23	Day 23	Day 23
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12
b	12	12(1)	15	12	10	12	11
c	13	15	14	14	14	12	10
d	13	12	15	12	14	13	11

Comments/Observations:

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 24	Day 24	Day 24	Day 24	Day 24	Day 24	Day 24
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12
b	12	12	15	12	10	12	11
c	13	14	14	14	14	12	10
d	—	12	15	12	14	13	11

Comments/Observations: *Dropped + smashed 0318d) Cu Jar*

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 25	Day 25	Day 25	Day 25	Day 25	Day 25	Day 25
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12
b	12	12	15	12	10	12	11
c	13	14	14	14	14	12	10
d	—	12	15	12	14	13	11

Comments/Observations:

	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	Day 26	Day 26	Day 26	Day 26	Day 26	Day 26	Day 26
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12
b	12	12	15	12	10	12	11
c	13	14	14	14	14	12	10
d	—	12	15	12	14	13	11

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

		Number of Alive Embryos and Hatched Organisms						
		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 27	Day 27	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	14	13	12	
b	12	11	15	12	10	12	11	
c	13	14	14	14	14	12	10	
d	-	12	15	12	14	13	11	

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 28	Day 28	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	13	13	12	
b	12	11	15	12	10	12	11	
c	13	14	14	14	14	12	10	
d	-	12	15	12	14	13	11	

Comments/Observations:

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 29	Day 29	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	13	13	12	
b	12	11(1)	15	12	10	11	11	
c	13	14	14	14	14(1)	12	10	
d	-	12	15	12	14	13	11	

Comments/Observations:
400B: ONE fish grey-coloured + bloated

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 30	Day 30	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	11	11	13	13	13	12	
b	12	11(1)	15	12	10	11	11	
c	13	14	14	14	13	12	10	
d	-	12	15	12	14	13	11	

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

		Number of Alive Embryos and Hatched Organisms						
		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 31	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a		13	11	11	13	13	13	12
b		12	11(1)	15	12	10	11	11
c		13	14	14	14	13	12	10
d		-	12	15	12	14	13	11

Comments/Observations:
400B - bloated fatty - still grey, has red in stomach now

		0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
		Day 32	Day 32	Day 32	Day 32	Day 32	Day 32	Day 32
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a		13	11	11	13	13	13	12
b		12	11	15	12	10	11	11
c		13	14	14	14	13	12	10
d		-	12	15	12	14	13	11

Comments/Observations:

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0318

New Solutions							
Conc. (%)	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
0	8.3	8.7	8.2	8.3	8.2	8.2	8.2
1	8.2	8.2	8.2	8.2	8.2	8.2	8.2
2	8.2	8.1	8.1	8.1	8.2	8.2	8.2
3	8.2	8.1	8.1	8.1	8.1	8.2	8.2
4	8.1	8.1	8.1	8.1	8.1	8.1	8.1
5	8.2	8.0	8.0	8.0	8.1	8.1	8.1
6	8.2	8.1	8.1	8.1	8.1	8.1	8.1
7	8.2	8.2	8.2	8.2	8.2	8.2	8.2
8	8.2	8.1	8.1	8.1	8.1	8.1	8.2

Old Solutions						
0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
0	8.3	8.2	8.2	8.2	8.2	8.2
1	8.3	8.2	8.2	8.2	8.2	8.2
2	8.3	8.2	8.2	8.1	8.1	8.1
3	8.1	8.1	8.1	8.1	8.1	8.1
4	8.0	8.0	8.0	8.0	8.0	8.0
5	8.2	8.0	8.0	8.0	8.0	8.0
6	7.8	7.8	7.8	7.8	7.9	7.9
7	7.9	7.9	7.7	7.8	7.9	7.9
8	8.0	8.0	8.0	8.0	8.0	8.1

Conductance (µS/cm)							
0	451	1118	1261	1435	1627	1819	2110
1	406	1089	1262	1420	1612	1810	2090
2	386	1088	1253	1420	1652	1843	2021
3	355	1064	1244	1420	1656	1864	2200
4	359	1099	1256	1431	1674	1898	2230
5	362	1076	1245	1431	1655	1897	2210
6	380	1120	1326	1501	1749	2080	2360
7	425	1143	1316	1508	1759	1980	2260
8	399	1141	1326	1524	1746	1879	2260

Conductance (µS/cm)							
0	466	1052	1260	1414	1643	1834	2110
1	430	1083	1272	1457	1642	1890	2190
2	400	1078	1256	1426	1646	1842	2200
3	385	1089	1275	1435	1610	1912	2240
4	365	1017	1254	1419	1668	1917	2250
5	374	1133	1333	1510	1774	2120	2380
6	406	1137	1343	1528	1786	2120	2410
7	429	1141	1341	1571	1748	1970	2360
8	429	1141	1341	1571	1748	1970	2360

Dissolved Oxygen (mg/L) (40-100% saturation)							
0	7.3	7.3	7.3	7.3	7.3	7.3	7.3
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3
2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
3	7.2	7.2	7.2	7.2	7.2	7.3	7.3
4	7.3	7.2	7.3	7.3	7.3	7.3	7.3
5	7.2	7.2	7.2	7.2	7.2	7.0	7.3
6	7.2	7.2	7.2	7.2	7.1	7.2	7.2
7	7.3	7.3	7.3	7.3	7.3	7.3	7.3
8	7.2	7.2	7.3	7.2	7.3	7.3	7.3

Dissolved Oxygen (mg/L) (40-100% saturation)							
0	7.2	7.2	7.2	7.2	7.2	7.2	7.2
1	7.2	7.2	7.2	7.2	7.2	7.2	7.2
2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
3	7.2	7.0	7.0	7.0	7.0	7.0	7.0
4	7.2	7.0	7.0	7.0	7.0	7.0	7.0
5	7.0	7.0	7.0	7.0	7.0	7.0	7.0
6	7.1	6.9	6.9	6.9	6.8	6.8	6.8
7	6.9	6.9	6.9	6.9	6.9	6.9	6.9
8	6.7	6.7	6.7	6.7	6.6	6.6	6.7

Temperature (°C)							
0	23.5	23.5	23.5	23.5	23.5	23.5	23.5
1	24.0	23.9	23.9	23.5	23.5	23.5	23.5
2	25.0	25.1	24.8	24.6	24.6	24.6	24.8
3	25.1	25.0	24.5	24.8	24.8	23.9	23.5
4	24.4	24.5	24.3	24.3	24.4	23.5	23.5
5	25.1	25.0	25.0	25.0	25.2	25.0	24.4
6	25.2	25.1	25.2	25.3	25.5	25.4	25.2
7	24.1	24.1	24.1	24.0	24.1	24.1	24.1
8	24.9	24.9	24.4	24.8	24.9	23.5	23.5

Temperature (°C)							
0	25						
1	25						
2	25						
3	25						
4	25						
5	25						
6	25						
7	25						
8	25						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

MU
#1912

M
*24.4

M
7.2

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0318

Conc. (%) Day	New Solutions						
	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	pH (units)						
9	8.2	8.1	8.1	8.1	8.1	8.1	8.1
10	8.2	8.1	8.1	8.1	8.1	8.1	8.2
11	8.2	8.1	8.1	8.1	8.1	8.1	8.1
12	7.7	7.8	8.0	8.0	8.0	8.0	8.0
13	8.2	8.1	8.1	8.2	8.2	8.2	8.2
14	8.1	8.1	8.1	8.1	8.1	8.1	8.1
15	8.0	8.0	8.0	8.0	8.0	8.0	8.0
16	8.1	8.1	8.1	8.1	8.1	8.1	8.2
17	8.0	8.0	8.0	8.0	8.0	8.0	8.0

Conc. (%) Day	Old Solutions						
	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
	pH (units)						
9	8.0	8.0	7.9	8.0	7.9	8.0	8.0
10	7.9	8.0	7.9	8.0	8.0	8.0	8.0
11	7.8	7.8	7.9	7.9	7.9	8.0	8.0
12	7.9	7.9	7.9	7.9	7.9	7.9	8.0
13	7.9	7.9	8.0	8.0	7.9	8.0	8.0
14	7.9	7.9	7.9	7.9	7.9	8.0	8.0
15	7.9	7.9	7.8	7.9	7.9	7.9	7.9
16	7.9	7.9	7.9	7.9	7.9	7.9	7.9
17	7.7	7.8	7.7	7.7	7.7	7.8	7.9

Conc. (%) Day	Conductance (µS/cm)						
	9	394	1140	1324	1533	1761	1913
10	379	1156	1332	1529	1790	1938	2270
11	377	1135	1325	1538	1808	1945	2310
12	369	1133	1334	1549	1809	1981	2350
13	382	1165	1346	1550	1829	2070	2380
14	410	1110	1320	1492	1675	1892	2190
15	356	1130	1313	1468	1699	1895	2210
16	350	1127	1304	1471	1731	1915	2250
17	358	1115	1325	1494	1704	1930	2280

Conc. (%) Day	Conductance (µS/cm)						
	9	440	1182	1344	1525	1764	1970
10	387	1090	1304	1529	1748	1947	2310
11	392	1128	1332	1536	1803	2050	2370
12	392	1129	1331	1538	1811	2070	2360
13	382	1149	1342	1549	1803	2020	2390
14	419	1167	1364	1566	1836	2080	2410
15	393	1143	1324	1492	1732	1965	2300
16	392	1145	1341	1515	1735	1977	2290
17	373	1101	1314	1485	1729	1971	2250

Conc. (%) Day	Dissolved Oxygen (mg/L) (40-100% saturation)						
	9	7.2	7.3	7.3	7.3	7.2	7.3
10	7.2	7.2	7.3	7.3	7.2	7.3	7.3
11	7.2	7.3	7.3	7.3	7.3	7.2	7.3
12	7.3	7.3	7.2	7.2	7.2	7.2	7.2
13	7.3	7.3	7.3	7.2	7.2	7.2	7.2
14	7.2	7.2	7.2	7.2	7.3	7.3	7.2
15	7.2	7.2	7.2	7.2	7.2	7.2	7.2
16	7.2	7.2	7.3	7.2	7.3	7.2	7.2
17	7.2	7.2	7.2	7.2	7.3	7.3	7.2

Conc. (%) Day	Dissolved Oxygen (mg/L) (40-100% saturation)						
	9	6.7	6.7	6.7	6.6	6.8	6.8
10	6.3	6.2	6.4	6.5	6.5	6.6	6.6
11	7.2	6.8	6.8	6.7	6.7	6.7	6.8
12	6.7	6.6	6.7	6.8	6.9	7.0	7.0
13	6.6	6.6	6.6	6.6	6.6	6.6	6.8
14	6.7	6.7	6.8	6.8	6.8	6.7	6.8
15	6.8	6.6	6.7	6.7	6.7	6.6	6.6
16	5.9	6.0	6.0	6.1	6.1	6.0	5.9
17	6.0	6.4	6.2	6.2	6.2	6.3	6.4

Conc. (%) Day	Temperature (°C)						
	9	25.0	24.4	24.3	24.2	24.1	24.4
10	25.1	25.4	24.4	24.4	24.6	23.7	23.8
11	23.9	23.8	23.7	23.8	23.6	23.5	23.8
12	24.5	24.4	24.8	25.2	24.9	24.8	24.7
13	24.4	24.1	24.4	25.4	25.2	25.2	25.0
14	24.2	24.4	24.1	24.3	24.4	24.2	23.9
15	24.7	24.8	24.8	24.8	24.8	24.6	24.6
16	24.5	25.3	24.4	25.0	24.0	25.1	25.2
17	24.9	24.9	24.6	24.7	24.6	24.4	24.6

Conc. (%) Day	Temperature (°C)					
	9	25				
10	25					7
11	25					7
12	25					7
13	25					7
14	25					7
15	25					7
16	25					7
17	25					7

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0318

New Solutions							
Conc. (%)	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L

Old Solutions							
0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L	

pH (units)							
18	8.0	8.0	8.0	8.0	8.0	8.0	8.1
19	8.1	8.0	8.0	8.0	8.0	8.0	8.0
20	8.1	8.0	8.0	8.0	8.0	8.0	8.1
21	8.1	8.0	8.1	8.2	8.2	8.2	8.2
22	8.1	8.0	8.1	8.1	8.1	8.1	8.1
23	8.1	8.0	8.1	8.1	8.1	8.1	8.1
24	8.2	8.1	8.1	8.1	8.1	8.1	8.1
25	8.1	8.0	8.0	8.0	8.0	8.0	8.0
26	8.0	7.9	8.0	8.0	8.0	8.0	8.0

pH (units)							
18	7.9	7.9	7.9	7.8	7.8	7.8	8.0
19	7.8	7.8	7.8	7.8	7.7	7.8	7.8
20	7.8	7.7	7.7	7.7	7.7	7.7	7.8
21	7.7	7.7	7.6	7.6	7.6	7.6	7.6
22	7.6	7.7	7.7	7.7	7.7	7.7	7.7
23	7.8	7.8	7.9	7.9	7.9	7.9	7.9
24	7.8	7.8	7.8	7.8	7.8	7.8	7.8
25	7.9	7.8	7.8	7.8	7.8	7.8	7.8
26	7.7	7.7	7.7	7.7	7.7	7.7	7.7

*LC
7.7, 8.1, 8.2

*LC
2190

Conductance (µS/cm)							
18	372	1138	1345	1499	1773	1968	2320
19	774	1116	135	1579	1789	2060	2370
20	357	1058	1207	1376	1602	1802	2120
21	387	1019	1179	1321	1514	1830	2190
22	363	1003	1157	1317	1522	1758	1936
23	349	965	1154	1317	1543	1689	1980
24	351	1035	1189	1340	1570	1700	1999
25	345	1011	1173	1337	1583	1713	2120
26	342	1015	1182	1339	1603	1721	2110

Conductance (µS/cm)							
18	381	1005	1315	1475	1736	1974	2300
19	385	1147	1357	1520	176	2060	2350
20	333	992	1188	1345	1572	1795	2080
21	337	999	1263	1364	1583	1776	2130
22	410	1058	1183	1344	1540	1731	2070
23	386	1056	1183	1330	1537	1733	2090
24	378	1044	1171	1336	1562	1711	2070
25	364	1088	1165	1328	1563	1712	2040
26	353	1012	1179	1353	1605	1755	2140

Dissolved Oxygen (mg/L) (40-100% saturation)							
18	7.2	7.1	7.2	7.3	7.3	7.3	7.3
19	7.2	7.2	7.2	7.2	7.2	7.2	7.2
20	7.2	7.2	7.2	7.2	7.2	7.2	7.2
21	7.2	7.2	7.3	7.3	7.3	7.3	7.3
22	7.2	7.3	7.3	7.3	7.3	7.2	7.2
23	7.3	7.3	7.3	7.3	7.3	7.3	7.3
24	7.2	7.2	7.2	7.2	7.2	7.2	7.2
25	7.3	7.3	7.3	7.3	7.3	7.2	7.2
26	7.2	7.3	7.3	7.2	7.3	7.2	7.2

Dissolved Oxygen (mg/L) (40-100% saturation)							
18	5.9	6.0	6.0	6.2	6.2	6.1	6.1
19	7.0	7.0	6.9	6.9	6.8	6.8	6.7
20	6.3	6.3	6.2	5.9	6.0	5.7	5.9
21	6.5	6.5	5.5	5.5	5.4	5.6	5.5
22	6.0	5.9	5.9	5.9	5.9	5.9	5.9
23	6.8	6.5	6.4	6.2	6.2	6.2	6.2
24	6.2	6.0	6.0	5.9	5.8	5.8	5.8
25	6.0	6.0	6.0	6.0	6.0	6.0	6.0
26	6.6	6.4	6.2	6.3	6.3	6.0	6.0

*LC
7.2

Temperature (°C)							
18	25.3	24.9	24.7	24.2	24.2	24.0	24.0
19	24.9	25.1	25.1	25.1	25.4	25.4	25.1
20	24.6	25.1	25.2	25.3	25.3	25.4	25.3
21	24.6	24.7	24.2	24.5	24.2	23.9	23.5
22	24.3	24.1	24.1	24.3	24.3	24.2	24.3
23	24.3	24.1	24.3	24.3	24.2	24.3	24.2
24	24.8	24.8	24.8	24.6	24.6	24.6	24.6
25	24.0	23.9	24.0	23.9	23.9	24.2	24.7
26	24.8	24.3	24.2	24.8	24.4	24.6	24.7

Temperature (°C)							
18	25						
19	25						
20	25						
21	25						
22	25						
23	25						
24	25						
25	25						
26	25						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0318

New Solutions							
Conc. (%)	0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L
Day							
	pH (units)						
27	8.2	8.1	8.0	8.0	8.1	8.1	8.1
28	8.3	8.2	8.2	8.2	8.2	8.2	8.1
29	8.1	8.1	8.1	8.1	8.1	8.1	8.0
30	7.9	8.0	8.0	8.1	8.1	8.1	8.0
31	8.1	8.1	8.1	8.1	8.1	8.1	7.9
32							

Old Solutions							
0318- Cu only	0318- 400 mg/L	0318- 480 mg/L	0318- 576 mg/L	0318- 691 mg/L	0318- 829 mg/L	0318- 995 mg/L	
	pH (units)						
27	7.7	7.6	7.6	7.6	7.6	7.7	7.7
28	7.6	7.6	7.6	7.6	7.8	7.7	7.7
29	7.7	7.7	7.7	7.8	7.8	7.9	7.8
30	7.7	7.7	7.8	7.8	7.8	7.8	7.8
31	7.6	7.6	7.7	7.7	7.8	7.8	7.7
32	7.6	7.6	7.8	7.8	7.8	7.9	7.8

Conductance (µS/cm)							
27	413	1175	1345	1536	1804	2060	2470
28	404	1125	1318	1479	1728	1859	1715
29	395	1126	1329	1479	1369	1879	1874
30	371	1003	1316	1473	1777	1899	188
31	378	1135	1330	1494	1816	1933	1925
32							

Conductance (µS/cm)							
27	446	1147	1325	1515	1801	1980	2410
28	400	1171	1334	1521	1826	1983	2410
29	405	1107	1313	1471	1743	1894	1878
30	381	1093	1307	1474	1756	1916	1970
31	387	1034	1302	1479	1781	1934	1906
32	380	1128	1316	1504	1816	2050	1998

Dissolved Oxygen (mg/L) (40-100% saturation)							
27	7.3	7.2	7.3	7.3	7.2	7.3	7.2
28	7.2	7.2	7.2	7.2	7.2	7.2	7.2
29	7.3	7.3	7.3	7.3	7.2	7.2	7.3
30	7.3	7.2	7.3	7.2	7.2	7.2	7.3
31	7.3	7.2	7.1	7.3	7.2	7.1	7.2
32							

Dissolved Oxygen (mg/L) (40-100% saturation)							
27	5.8	5.8	5.7	5.9	5.9	5.9	6.0
28	5.9	5.8	5.8	5.7	5.6	5.6	5.6
29	5.8	5.8	5.8	5.8	6.0	6.0	6.0
30	5.8	5.9	5.9	5.9	6.0	6.0	6.0
31	6.1	6.2	6.1	6.1	6.1	6.0	6.0
32	6.5	6.5	6.5	6.4	6.4	6.6	6.6

Temperature (°C)							
27	24.4	24.6	24.2	24.3	25.0	24.2	24.8
28	24.9	24.7	24.0	24.7	24.7	24.8	24.3
29	24.2	24.2	24.3	24.3	24.3	24.3	24.1
30	24.4	24.0	24.4	25.1	25.0	24.8	24.1
31	24.1	25.2	25.1	24.4	24.9	24.5	23.5
32							

Temperature (°C)							
27	25						
28	25						
29	25						
30	26						
31	26						
32	25						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0318

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: **H=head, O=oral, E=eyes, G=gills, F=fins, S=spine**

Conc. 0318- Cu only

Replicate #	Fish	Length (mm)	Normal/Abnormal
Replicate # <u>A</u>			
1	6		N
2	FT		
3	FT		
4	FT		
5	6		
6	6		
7	6		
8	FT		
9	FT		
10	6		
11	6		
12	FT		
13	FT		
14			
15			
Replicate # <u>B</u>			
1			N
2	FT		
3	FT		
4	FT		
5	FT		
6	FT		
7	FT		
8	FT		
9	FT		
10	FT		
11	FT		
12	FT		
13	FT		
14			
15			
Replicate # <u>C</u>			
1			N
2	6		
3	6		
4	FT		
5	FT		
6	FT		
7	6		
8	6		
9	6		
10	6		
11	6		
12	6		
13	6		
14			
15			
Replicate # <u>D</u>			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Comments

Conc. 0318- 400 mg/L

Replicate #	Fish	Length (mm)	Normal/Abnormal
Replicate # <u>A</u>			
1	6		N
2	FT		
3	FT		
4	FT		
5	6		
6	6		
7	6		
8	6		
9	6		
10	6		
11	6		
12			
13			
14			
15			
Replicate # <u>B</u>			
1			N
2	FT		
3	FT		
4	FT		
5	FT		
6	FT		
7	FT		
8	FT		
9	FT		
10	FT		A
11	FT		N
12			
13			
14			
15			
Replicate # <u>C</u>			
1			N
2	6		
3	6		
4	6		
5	6		
6	6		
7	6		
8	6		
9	6		
10	6		
11	6		
12	6		
13	6		
14	6		
15			
Replicate # <u>D</u>			
1			N
2	FT		
3	FT		
4	FT		
5	FT		
6	FT		AS
7	FT		
8	FT		
9	FT		
10	FT		
11	FT		
12	FT		
13	FT		
14	FT		
15	FT		

Comments
* swollen belly

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0318

Test Termination

for normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: **H=head, O=oral, E=eyes, G=gills, F=fins, S=spine**

Conc. **0318-480** mg/L

Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal
A	1	50	N	B	1	45	N	C	1	45	N	D	1	45	N
A	2	50	N	B	2	45	N	C	2	45	N	D	2	45	N
A	3	50	N	B	3	45	N	C	3	45	N	D	3	45	N
A	4	50	N	B	4	45	N	C	4	45	N	D	4	45	N
A	5	50	N	B	5	45	N	C	5	45	N	D	5	45	N
A	6	50	N	B	6	45	N	C	6	45	N	D	6	45	N
A	7	50	N	B	7	45	N	C	7	45	N	D	7	45	N
A	8	50	N	B	8	45	N	C	8	45	N	D	8	45	N
A	9	50	N	B	9	45	N	C	9	45	N	D	9	45	N
A	10	50	N	B	10	45	N	C	10	45	N	D	10	45	N
A	11	50	N	B	11	45	N	C	11	45	N	D	11	45	N
A	12	50	N	B	12	45	N	C	12	45	N	D	12	45	N
A	13	50	N	B	13	45	N	C	13	45	N	D	13	45	N
A	14	50	N	B	14	45	N	C	14	45	N	D	14	45	N
A	15	50	N	B	15	45	N	C	15	45	N	D	15	45	N

Comments

Conc. **0318-576** mg/L

Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal	Replicate #	Fish	Length (mm)	Normal/Abnormal
A	1	50	N	B	1	45	N	C	1	45	N	D	1	45	N
A	2	50	N	B	2	45	N	C	2	45	N	D	2	45	N
A	3	50	N	B	3	45	N	C	3	45	N	D	3	45	N
A	4	50	N	B	4	45	N	C	4	45	N	D	4	45	N
A	5	50	N	B	5	45	N	C	5	45	N	D	5	45	N
A	6	50	N	B	6	45	N	C	6	45	N	D	6	45	N
A	7	50	N	B	7	45	N	C	7	45	N	D	7	45	N
A	8	50	N	B	8	45	N	C	8	45	N	D	8	45	N
A	9	50	N	B	9	45	N	C	9	45	N	D	9	45	N
A	10	50	N	B	10	45	N	C	10	45	N	D	10	45	N
A	11	50	N	B	11	45	N	C	11	45	N	D	11	45	N
A	12	50	N	B	12	45	N	C	12	45	N	D	12	45	N
A	13	50	N	B	13	45	N	C	13	45	N	D	13	45	N
A	14	50	N	B	14	45	N	C	14	45	N	D	14	45	N
A	15	50	N	B	15	45	N	C	15	45	N	D	15	45	N

Comments

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0318

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.
0318-691
mg/L

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/Abnormal									
1	50	N	1	45	O	1	45	N	1	50	N
2	50	N	2	45	O	2	45	N	2	50	N
3	50	N	3	45	O	3	45	N	3	50	N
4	50	N	4	45	O	4	45	N	4	50	N
5	50	N	5	45	O	5	45	N	5	50	N
6	50	N	6	45	O	6	45	N	6	50	N
7	50	N	7	45	O	7	45	N	7	50	N
8	50	N	8	45	O	8	45	N	8	50	N
9	50	N	9	45	O	9	45	N	9	50	N
10	50	N	10	45	O	10	45	N	10	50	N
11	50	N	11	45	O	11	45	N	11	50	N
12	50	N	12	45	O	12	45	N	12	50	N
13	50	N	13	45	O	13	45	N	13	50	N
14	50	N	14	45	O	14	45	N	14	50	N
15	50	N	15	45	O	15	45	N	15	50	N

Comments

Conc.
0318-829
mg/L

Replicate # A			Replicate # B			Replicate # C			Replicate # D		
Fish	Length (mm)	Normal/Abnormal									
1	50	N	1	45	O	1	45	N	1	50	N
2	50	N	2	45	O	2	45	N	2	50	N
3	50	N	3	45	O	3	45	N	3	50	N
4	50	N	4	45	O	4	45	N	4	50	N
5	50	N	5	45	O	5	45	N	5	50	N
6	50	N	6	45	O	6	45	N	6	50	N
7	50	N	7	45	O	7	45	N	7	50	N
8	50	N	8	45	O	8	45	N	8	50	N
9	50	N	9	45	O	9	45	N	9	50	N
10	50	N	10	45	O	10	45	N	10	50	N
11	50	N	11	45	O	11	45	N	11	50	N
12	50	N	12	45	O	12	45	N	12	50	N
13	50	N	13	45	O	13	45	N	13	50	N
14	50	N	14	45	O	14	45	N	14	50	N
15	50	N	15	45	O	15	45	N	15	50	N

Comments

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0318

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: **H=head, O=oral, E=eyes, G=gills, F=fins, S=spine**

Conc. 0318- 995 mg/L	Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
	Fish	Length (mm)	Normal/Abnormal									
	1	48	N	1	50	N	1	48	N	1	50	N
	2	48	N	2	50	N	2	48	N	2	50	N
	3	48	N	3	50	N	3	48	N	3	50	N
	4	48	N	4	50	N	4	48	N	4	50	N
	5	48	N	5	50	N	5	48	N	5	50	N
	6	48	N	6	50	N	6	48	N	6	50	N
	7	48	N	7	50	N	7	48	N	7	50	N
	8	48	N	8	50	N	8	48	N	8	50	N
	9	48	N	9	50	N	9	48	N	9	50	N
	10	48	N	10	50	N	10	48	N	10	50	N
	11	48	N	11	50	N	11	48	N	11	50	N
	12	48	N	12	50	N	12	48	N	12	50	N
	13	48	N	13	50	N	13	48	N	13	50	N
	14	48	N	14	50	N	14	48	N	14	50	N
	15	48	N	15	50	N	15	48	N	15	50	N

Comments

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Control hatching success must be >66% (≥10 per replicate). Post hatch survival must be >70%.

Number of Alive Embryos and Hatched Organisms

replicate	0319- Cu only		0319- 400 mg/L		0319- 480 mg/L		0319- 576 mg/L		0319- 691 mg/L		0319- 829 mg/L		0319- 995 mg/L	
	Day 1		Day 1		Day 1		Day 1		Day 1		Day 1		Day 1	
	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos	Alive Embryos	Dead Embryos
a	13	2	15	0	13	2	15	0	15	0	15	0	15	0
b	14	1	14	1	15	0	14	1	15	0	15	0	15	0
c	15	0	14	1	14	1	14	1	15	0	15	0	13	2
d	14	1	13	2	14	1	15	0	15	0	15	0	12	3
e	28	2	30	0	30	0	30	0	30	0	27	3	27	1
f	29	1	28	2	28	2	28	2	28	2	27	3	28	2

Comments/Observations:

Number of Alive Embryos and Hatched Organisms

replicate	0319- Cu only			0319- 400 mg/L			0319- 480 mg/L			0319- 576 mg/L		
	Day 2			Day 2			Day 2			Day 2		
	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	12	1	15	15	0	15	13	0	15	13	2	15
b	14	0	15	13	1	15	13	2	15	11	3	15
c	15	0	15	14	0	15	13	1	15	14	0	15
d	14	0	15	13	0	15	14	0	15	14	1	15
e	27	1		29	1		30	0		29	1	
f	28	1		27	1		28	0		27	1	

replicate	0319- 691 mg/L			0319- 829 mg/L			0319- 995 mg/L		
	Day 2			Day 2			Day 2		
	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15	Alive Embryos	Dead Embryos	Cull to 15
a	14	1	15	15	0	15	13	2	15
b	14	1	15	14	1	15	12	3	15
c	14	1	15	14	1	15	12	1	15
d	15	0	15	12	0	15	11	1	15
e	28	2		26	1		29	1	
f	27	1		27	0		27	1	

Day 2 - Poor looking and dead embryos in replicates a, b, c and d are replaced with healthy embryos from replicates e and f. Replicates e and f are discarded after day 2

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Number of Alive Embryos and Hatched Organisms

replicate	0319- Cu only		0319- 400 mg/L		0319- 480 mg/L		0319- 576 mg/L		0319- 691 mg/L		0319- 829 mg/L		0319- 995 mg/L	
	Day 3		Day 3		Day 3		Day 3		Day 3		Day 3		Day 3	
	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	13	2	13	2	12	3	12	3	10	5	12	3	12	3
b	11	4	12	3	14	1	12	3	8	7	15	0	15	0
c	14	1	13	2	14	1	14	0	13	2	14	1	11	4
d	10	5	14	1	12	2	12	3	13	1	12	3	14	1

480D > 1 dead embryo
576C
691D

Comments/Observations:

all 691 mg/L + 995 mg/L - All embryos covered in debris
829 mg/L + 995 mg/L - All embryos covered in debris

replicate	0319- Cu only		0319- 400 mg/L		0319- 480 mg/L		0319- 576 mg/L		0319- 691 mg/L		0319- 829 mg/L		0319- 995 mg/L	
	Day 4		Day 4		Day 4		Day 4		Day 4		Day 4		Day 4	
	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched	Alive Embryos	Alive Hatched
a	1	15	1	15	1	15	1	15	1	15	1	15	1	15
b	1	14	1	14	1	15	2	12	1	14	5	10	3	12
c	1	15	1	15	1	15	1	14	1	15	3	12	1	14
d	1	15	1	15	1	13	1	14	1	13	2	13	1	14

Comments/Observations:

480D - 1 dead hatched, 1 dead embryo
576B - 1 dead embryo
691 mg/L + 995 mg/L - All embryos covered in debris

replicate	0319- Cu only		0319- 400 mg/L		0319- 480 mg/L		0319- 576 mg/L		0319- 691 mg/L		0319- 829 mg/L		0319- 995 mg/L	
	Day 5		Day 5		Day 5		Day 5		Day 5		Day 5		Day 5	
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	14	15	15	15	15	15	15	15	15	15	15	15	15	15
b	14	14	15	15	15	13	15	15	15	15	13	15	15	15
c	15	15	15	15	15	14	15	15	15	15	15	15	15	15
d	15	15	13	15	15	15	15	15	15	15	15	15	15	15

Comments/Observations:

400B - 1 dead embryo
576B - 1 dead embryo
691D - 1 dead embryo
829B - 2 dead embryo

replicate	0319- Cu only		0319- 400 mg/L		0319- 480 mg/L		0319- 576 mg/L		0319- 691 mg/L		0319- 829 mg/L		0319- 995 mg/L	
	Day 6		Day 6		Day 6		Day 6		Day 6		Day 6		Day 6	
	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	15	14	15	15	15	15	15	15	15	15	15	15	15
b	14	14	15	15	15	11	15	15	14	15	13	15	15	15
c	15	15	14	15	15	14	15	15	15	15	15	15	15	15
d	14	9	13	15	15	14	15	15	13	15	15	15	15	15

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Number of Alive Embryos and Hatched Organisms

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 7	Day 7	Day 7	Day 7	Day 7	Day 7	Day 7
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	10	14	13/14	13	13/15	13
b	14	14	15	12/11	13	14/13	13
c	15	15	14	14/14	15(1)	15/15	13
d	13(1)	5	13	14/14	13	14/15	15

Comments/Observations: MC

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 8	Day 8	Day 8	Day 8	Day 8	Day 8	Day 8
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	10	14	13/14	13	15	13
b	14	14	15	12/11	13	13	12
c	15	15	14	13(1)	15(1)	15	14
d	13(1)	5	13	14/14	13	15	15(1)

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 9	Day 9	Day 9	Day 9	Day 9	Day 9	Day 9
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	9	14	14	13	15	13
b	14	14	15	11	13	13	12
c	15	15	14	13	15	15	14
d	13	4	12	14	13	15	15

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 10	Day 10	Day 10	Day 10	Day 10	Day 10	Day 10
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	14	13/14	12/13	15	13
b	14	13	15	11(1)	12	13	12
c	15	15	14	13(1)	15/14	15	14
d	11	4	12	14	13	14	15(1)

Comments/Observations: 400mg/L - small amount microbial growth

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

		Number of Alive Embryos and Hatched Organisms						
		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 11	Day 11	Day 11	Day 11	Day 11	Day 11	Day 11
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	14	13	13	15	13	
b	14	12	14	11	12	13	12	
c	15	15	13	13(1)	14	15	14	
d	11	3	12	14	13	14	15(1)	

Comments/Observations:

		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 12	Day 12	Day 12	Day 12	Day 12	Day 12	Day 12
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	12	13	13	15	13	
b	14	12	14	11	12	13	12	
c	15	14	13	13(2)	14	15	14	
d	11	3	12	14	13	13	15(1)	

Comments/Observations: *Dead - stuck in fluffy food*

		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 13	Day 13	Day 13	Day 13	Day 13	Day 13	Day 13
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	12	13	13	15(1)	13	
b	14	12	14	11	12	13	12	
c	15	13	13	14	14	15	14	
d	11	3	12	13	13	13	15(1)	

Comments/Observations:

		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 14	Day 14	Day 14	Day 14	Day 14	Day 14	Day 14
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	12	13	13	14	13	
b	14	11	14	11	12	13	12	
c	15	13	13	11	14	14	14	
d	11	3	12	13	13	13	15	

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Number of Alive Embryos and Hatched Organisms

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 15	Day 15	Day 15	Day 15	Day 15	Day 15	Day 15
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	12	13	13	14	13
b	14	11	14	11	12	13	12
c	14	13	13	11	14	13	14
d	11	2	12	13	13	13	15

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 16	Day 16	Day 16	Day 16	Day 16	Day 16	Day 16
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	12	13	13	14	13
b	13	11	14	11	12	13	12
c	14	13	13	11	14	13	14
d	11	2	12	13	13	13	15

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 17	Day 17	Day 17	Day 17	Day 17	Day 17	Day 17
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	13	8	12	13	13	13	13
b	13	11	14	11	12	12	12
c	14	13	13	11	14	13	14
d	11	2	12(1)	12(1)	13	13	14

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 18	Day 18	Day 18	Day 18	Day 18	Day 18	Day 18
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	7	12	13	13	12	13
b	13	11	14	11	12	12	12
c	14	13	13	11	14	13	14
d	11	2	11	11	13	12	14

Comments/Observations: * 576 - little microgrowth on dead FM

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0319

		Number of Alive Embryos and Hatched Organisms						
		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 19	Day 19	Day 19	Day 19	Day 19	Day 19	Day 19
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a		12	7	12	13	13	12	13
b		13	11	14	11	12	12	11*
c		14	13	13	11	14	13	14
d		11	2	11	11	13	12	14

Comments/Observations: xmicrobial growth on dead FM

		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 20	Day 20	Day 20	Day 20	Day 20	Day 20	Day 20
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a		12	7	12	13	13	12	13
b		13	10(u)	14	11	12	12	11
c		14	13	13	11	14	13	14(u)
d		11	2	11	11	13	12	13

Comments/Observations:

		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 21	Day 21	Day 21	Day 21	Day 21	Day 21	Day 21
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a		12	7	12	13	13	12	13
b		13	9	14	11	8*	12	11
c		14	13	13	11	14	13	13
d		11	2	11	11	13	12	12*

Comments/Observations: 691B- 4 dead all w/ fuzzy growth
995 D- 1 dead - fuzzy growth

		0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
		Day 22	Day 22	Day 22	Day 22	Day 22	Day 22	Day 22
replicate		Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a		12	7	12	13	13	12	13
b		13	9	14	11	8	12	11
c		14	13	13	11	14	13	13
d		11	2	11	11	13	12	12

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Number of Alive Embryos and Hatched Organisms

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 23						
replicate	Alive Hatched						
a	12	7	12	13	13	12	13
b	13	9	14	11	8	12	11
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 24						
replicate	Alive Hatched						
a	12	7	12	13	15	12	13
b	13	9	14	11	8	13	11
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 25						
replicate	Alive Hatched						
a	12	7	12	13	13	12	13
b	13	9	14	11	8	12	11
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 26						
replicate	Alive Hatched						
a	12	7	12	13	13	12	13
b	13	9	14	11 Hatched	8	12	11
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Number of Alive Embryos and Hatched Organisms

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 27	Day 27	Day 27	Day 27	Day 27	Day 27	Day 27
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	7	12	13	12	12	13
b	13	9	14	11	8	12	11
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 28	Day 28	Day 28	Day 28	Day 28	Day 28	Day 28
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	7	12	13	12	12	13
b	13	9	14	11	8	12	11
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 29	Day 29	Day 29	Day 29	Day 29	Day 29	Day 29
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	7	12	13	12	12	13
b	13	9	14	11	8	12	11
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 30	Day 30	Day 30	Day 30	Day 30	Day 30	Day 30
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	7	12	13	12	12	13
b	13	9	14	11	8	12	10
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations: 995(b) - no microbial

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Number of Alive Embryos and Hatched Organisms

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31	Day 31
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	7	12	13	12	12	13
b	13	9	14	11	10	12	10
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
	Day 32	Day 32	Day 32	Day 32	Day 32	Day 32	Day 32
replicate	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched	Alive Hatched
a	12	7	12	13	12	12	13
b	13	9	14	11	8	12	10
c	14	13	13	11	14	13	13
d	11	2	11	11	13	12	12

Comments/Observations:

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0319

New Solutions							
Conc. (%)	0319- Cu	0319- 400	0319- 480	0319- 576	0319- 691	0319- 829	0319- 995
Day	only	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L

Old Solutions							
0319- Cu	0319- 400	0319- 480	0319- 576	0319- 691	0319- 829	0319- 995	
only	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	

x6.0

pH (units)							
0	8.2	8.2	8.2	8.2	8.1	8.2	8.2
1	8.2	8.2	8.2	8.2	8.2	8.2	8.2
2	8.2	8.7	8.7	8.2	8.2	8.2	8.2
3	8.1	8.1	8.1	8.1	8.1	8.1	8.1
4	8.0	8.1	8.1	8.1	8.1	8.1	8.1
5	8.1	8.1	8.1	8.0	8.1	8.1	8.1
6	8.1	8.1	8.1	8.1	8.1	8.1	8.1
7	8.1	8.1	8.1	8.1	8.1	8.1	8.1
8	8.2	8.2	8.2	8.2	8.1	8.1	8.1

pH (units)							
0	8.2	8.2	8.1	8.1	8.1	8.1	8.1
1	8.1	8.1	8.1	8.1	8.1	8.1	8.1
2	8.2	8.2	8.1	8.1	8.1	8.1	8.1
3	8.1	8.1	8.1	8.1	8.1	8.1	8.1
4	8.1	8.0	8.0	8.0	8.0	8.0	8.0
5	8.0	8.0	8.0	8.0	8.0	8.0	8.0
6	8.0	7.9	7.9	7.9	7.9	7.9	7.9
7	7.8	7.8	7.8	7.8	7.8	7.8	7.8
8	8.1	8.1	8.0	8.1	8.1	8.1	8.1

M
R-710

Conductance (µS/cm)							
0	710	1112	1258	1426	1624	1817	2110
1	710	1090	1221	1401	1605	1789	2090
2	690	1034	1187	1377	1605	1764	2070
3	694	1028	1175	1363	1595	1788	2080
4	688	1033	1187	1376	1610	1800	2090
5	655	1027	1171	1365	1594	1801	2010
6	692	1075	1246	1437	1695	1916	2230
7	731	1123	1294	1480	1678	1842	2180
8	724	1105	1279	1460	1662	1831	2190

Conductance (µS/cm)							
0	737	1096	1241	1423	1628	1815	2110
1	716	1087	1238	1407	1649	1844	2140
2	694	1045	1209	1392	1613	1821	2100
3	665	1039	1194	1385	1601	1819	2140
4	685	1031	1193	1375	1619	1818	2120
5	670	1069	1245	1428	1690	1930	2260
6	694	1087	1261	1448	1654	1932	2250
7	716	1111	1280	1483	1688	1873	2240
8	716	1111	1280	1483	1688	1873	2240

576 691 829 995
7.1, 7.1, 7.1, 7.1

Dissolved Oxygen (mg/L) (40-100% saturation)							
0	7.3	7.3	7.3	7.3	7.3	7.3	7.3
1	7.3	7.3	7.3	7.3	7.3	7.3	7.3
2	7.3	7.3	7.3	7.3	7.3	7.3	7.3
3	7.2	7.2	7.2	7.2	7.1	7.1	7.3
4	7.3	7.3	7.3	7.2	7.2	7.2	7.3
5	7.2	7.2	7.1	7.2	7.2	7.2	7.2
6	7.2	7.2	7.2	7.2	7.2	7.2	7.2
7	7.3	7.3	7.3	7.3	7.3	7.3	7.3
8	7.3	7.2	7.2	7.2	7.2	7.2	7.2

Dissolved Oxygen (mg/L) (40-100% saturation)							
0	7.2	7.2	7.2	7.2	7.2	7.2	7.2
1	7.2	7.2	7.2	7.2	7.2	7.2	7.2
2	7.2	7.2	7.2	7.2	7.2	7.2	7.2
3	7.1	7.0	7.0	7.0	7.0	7.0	7.0
4	7.2	7.2	7.2	7.1	7.1	7.0	7.1
5	7.0	7.0	7.0	7.0	7.0	7.0	7.0
6	6.9	6.8	6.8	6.7	6.7	6.8	7.1
7	6.6	6.6	6.6	6.6	6.5	6.5	6.1
8	6.6	6.6	6.7	6.7	6.6	6.6	6.7

Temperature (°C)							
0	23.5	23.5	23.5	23.5	23.5	23.5	23.5
1	24.0	24.0	24.0	24.1	24.0	23.7	23.6
2	24.8	25.0	25.1	25.0	25.3	24.8	24.5
3	25.2	25.1	25.2	25.3	25.8	24.7	23.7
4	24.3	24.1	24.4	24.6	24.9	24.6	24.2
5	25.2	25.3	25.6	25.7	25.5	25.5	25.7
6	25.4	25.3	25.4	25.3	25.4	25.4	25.4
7	24.1	24.2	24.1	24.1	24.1	24.1	24.0
8	24.3	25.0	25.2	25.2	25.4	24.8	24.9

Temperature (°C)							
0	25						
1	25						
2	25						
3	25						
4	25						
5	25						
6	25						
7	25						
8	25						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0319

Conc. (%) Day	New Solutions						
	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L

pH (units)							
9	8.1	8.1	8.1	8.1	8.1	8.1	8.1
10	8.1	8.1	8.1	8.1	8.1	8.1	8.1
11	8.1	8.1	8.1	8.1	8.1	8.1	8.1
12	8.1	8.0	8.1	8.0	8.0	8.0	8.0
13	8.2	8.2	8.2	8.2	8.2	8.2	8.2
14	8.2	8.2	8.2	8.2	8.2	8.2	8.2
15	8.1	8.0	8.0	8.0	8.0	8.0	8.0
16	8.2	8.2	8.2	8.2	8.2	8.2	8.2
17	7.9	8.0	8.0	8.0	8.0	8.0	8.0

Conductance (µS/cm)							
9	705	1080	1239	1421	1671	1852	2200
10	689	1039	1251	1426	1673	1867	2230
11	693	1066	1249	1427	1674	1857	2210
12	721	1074	1245	1418	1654	1894	2240
13	699	1080	1246	1419	1681	1906	2260
14	737	1114	1275	1466	1650	1836	2180
15	721	1085	1258	1452	1648	1859	2200
16	694	1079	1248	1441	1651	1825	2190
17	694	1091	1244	1449	1645	1879	2210

x1086

Dissolved Oxygen (mg/L) (40-100% saturation)							
9	7.2	7.3	7.2	7.2	7.2	7.2	7.2
10	7.2	7.2	7.2	7.2	7.2	7.2	7.2
11	7.3	7.2	7.2	7.2	7.2	7.2	7.3
12	7.2	7.2	7.2	7.2	7.2	7.2	7.2
13	7.2	7.1	7.1	7.2	7.2	7.2	7.2
14	7.3	7.3	7.2	7.2	7.2	7.3	7.3
15	7.2	7.2	7.2	7.2	7.2	7.2	7.2
16	7.1	7.2	7.2	7.2	7.2	7.1	7.3
17	7.2	7.2	7.2	7.2	7.2	7.1	7.1

Temperature (°C)							
9	25.0	24.4	25.1	25.1	25.3	25.1	24.5
10	25.1	25.3	25.0	25.1	25.3	25.1	24.5
11	24.4	24.6	24.6	24.6	24.7	24.7	23.7
12	25.4	25.4	25.2	25.4	25.3	25.3	25.1
13	25.4	25.6	25.5	25.4	25.8	25.4	25.4
14	24.3	24.4	24.5	24.9	25.0	24.2	24.1
15	24.5	24.9	25.0	25.0	25.2	24.8	25.4
16	25.6	25.3	25.0	25.1	25.3	25.9	23.8
17	24.9	25.2	25.2	25.2	25.4	25.6	25.6

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Old Solutions						
0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L

pH (units)						
9	7.8	7.9	7.9	7.9	8.0	8.0
10	8.0	8.0	8.0	8.0	8.0	8.0
11	8.0	8.0	8.0	8.0	8.0	8.0
12	7.9	7.9	7.9	7.9	7.9	7.9
13	8.0	8.0	8.0	8.0	8.0	8.0
14	7.9	8.0	8.0	8.0	8.0	8.0
15	8.0	7.9	7.9	7.9	7.9	7.9
16	8.0	8.1	8.0	8.0	8.0	8.0
17	7.9	7.8	7.9	7.8	7.8	7.8

Conductance (µS/cm)						
9	744	1114	1301	1461	1686	1899
10	681	1083	1266	1432	1674	1886
11	680	1073	1262	1426	1672	1897
12	699	1096	1252	1429	1678	1902
13	697	1066	1240	1435	1699	1910
14	704	1048	1246	1428	1677	1901
15	729	1110	1288	1480	1673	1920
16	801	1088	1242	1430	1641	1896
17	703	1088	1238	1443	1644	1899

Dissolved Oxygen (mg/L) (40-100% saturation)						
9	6.5	6.5	6.5	6.6	6.6	6.5
10	6.9	6.8	6.6	6.5	6.6	6.5
11	7.1	7.0	6.9	6.8	6.7	6.6
12	6.7	6.7	6.9	6.8	6.7	6.8
13	6.7	6.6	6.6	6.8	6.6	6.5
14	6.7	6.7	6.8	6.7	6.7	6.6
15	6.7	6.7	6.7	6.6	6.7	6.7
16	6.0	6.1	6.1	6.2	6.2	6.1
17	6.2	6.3	6.3	6.3	6.1	6.2

Temperature (°C)						
9	25					
10	25					
11	25					
12	25					
13	25					
14	25					
15	25					
16	25					
17	25					

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0319

New Solutions							
Conc. (%)	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	8.1	8.1	8.1	8.1	8.1	8.1	8.1
19	8.1	8.2	8.1	8.0	8.0	8.0	8.1
20	8.0	8.0	8.0	8.0	8.0	8.1	8.1
21	8.1	8.1	8.1	8.1	8.1	8.1	8.1
22	8.2	8.1	8.1	8.1	8.1	8.1	8.1
23	8.1	8.1	8.1	8.1	8.1	8.1	8.1
24	8.2	8.1	8.1	8.1	8.1	8.1	8.1
25	8.1	8.1	8.1	8.1	8.1	8.0	8.0
26	8.1	8.1	8.1	8.0	8.0	8.0	8.0

Old Solutions						
0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	7.9	8.0	7.9	7.9	7.9	8.0	8.0
19	7.9	7.9	7.8	7.8	7.8	7.9	7.9
20	8.0	7.9	7.8	7.8	7.8	7.8	7.8
21	7.7	7.7	7.7	7.6	7.7	7.8	7.7
22	7.9	7.8	7.8	7.8	7.8	7.8	7.8
23	8.0	8.0	8.0	8.0	8.0	8.0	8.0
24	7.9	7.9	8.0	7.9	7.9	7.9	7.9
25	7.9	7.9	7.9	7.9	8.0	8.0	7.9
26	7.8	7.8	7.8	7.8	7.8	7.8	7.8

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	695	1087	1250	1454	1653	1893	2230
19	502	1105	1250	1455	1650	1928	2250
20	618	975	1111	1308	1480	1721	1971
21	1062	999	1152	1302	1500	1631	1821
22	1029	967	1111	1266	1465	1604	1819
23	609	948	1105	1268	1471	1622	1833
24	627	956	1100	1265	1477	1628	1836
25	602	932	1091	1257	1480	1633	1845
26	644	937	1091	1247	1489	1664	1871

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	688	1068	1230	1442	1633	1904	2250
19	709	1091	1255	1460	1659	1931	2250
20	617	972	1105	1296	1467	1710	1946
21	610	965	1107	1324	1487	1723	1975
22	690	997	1141	1326	1479	1675	1872
23	637	960	1117	1275	1472	1671	1920
24	655	984	1138	1283	1482	1669	1887
25	618	971	1098	1263	1455	1658	1874
26	622	939	1101	1257	1508	1671	1873

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	7.2	7.2	7.2	7.2	7.1	7.3	7.3
19	7.2	7.2	7.2	7.2	7.2	7.2	7.2
20	7.1	7.1	7.1	7.2	7.2	7.2	7.1
21	7.2	7.3	7.2	7.2	7.2	7.2	7.2
22	7.3	7.2	7.2	7.2	7.2	7.1	7.2
23	7.3	7.3	7.2	7.2	7.1	7.3	7.2
24	7.1	7.2	7.2	7.2	7.2	7.2	7.2
25	7.3	7.3	7.2	7.2	7.2	7.2	7.3
26	7.2	7.2	7.2	7.2	7.3	7.2	7.2

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	6.1	6.2	6.4	6.3	6.3	6.3	6.5
19	6.9	6.9	6.9	6.8	6.8	6.7	6.7
20	6.3	6.3	6.2	6.2	6.1	6.2	6.2
21	6.1	6.0	5.9	6.0	5.8	5.8	5.8
22	6.0	6.0	6.0	5.9	5.9	5.9	5.9
23	6.4	6.5	6.4	6.3	6.2	6.3	6.2
24	6.0	5.9	5.9	6.0	6.0	6.0	5.9
25	6.0	6.0	6.2	6.2	6.2	6.2	6.2
26	6.0	6.1	6.0	6.0	6.1	6.2	6.3

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	25.2	25.2	25.0	25.0	25.9	24.2	24.1
19	24.7	25.3	25.0	25.1	25.1	25.3	25.1
20	25.9	26.1	26.3	25.3	25.1	25.3	25.1
21	25.2	24.4	24.4	24.8	25.1	25.9	23.5
22	24.4	25.1	25.1	25.1	25.1	25.1	24.4
23	24.3	24.3	24.2	25.1	25.3	24.4	25.1
24	25.5	24.8	25.1	25.2	25.2	24.8	24.9
25	24.1	24.7	24.3	25.0	25.1	25.2	24.7
26	24.7	24.7	24.7	24.7	24.4	25.0	25.2

Day	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
18	25						
19	25						
20	25						
21	25						
22	25						
23	25						
24	25						
25	25						
26	25						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS

Client NAU104

Sample: 1617-0319

New Solutions							
Conc. (%)	0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L
Day	pH (units)						
27	8.0	8.0	8.0	8.0	8.0	8.0	8.0
28	8.3	8.3	8.2	8.3	8.3	8.3	8.3
29	8.1	8.1	8.1	8.1	8.1	8.1	8.1
30	8.1	8.1	8.1	8.1	8.1	8.1	8.1
31	8.0	8.0	8.0	8.0	8.0	8.0	8.0
32							

Old Solutions							
0319- Cu only	0319- 400 mg/L	0319- 480 mg/L	0319- 576 mg/L	0319- 691 mg/L	0319- 829 mg/L	0319- 995 mg/L	
pH (units)							
27	7.5	7.6	7.6	7.6	7.6	7.6	7.6
28	7.6	7.7	7.8	7.8	7.7	7.7	7.7
29	7.9	8.0	7.9	7.9	7.9	7.9	7.9
30	7.8	7.7	7.8	7.8	7.9	7.8	7.9
31	7.8	7.8	7.8	7.9	7.9	7.8	7.9
32	8.0	8.0	7.9	8.0	7.9	7.9	7.9

Conductance (µS/cm)							
27	699	1088	1255	1414	166	1890	2190
28	705	1120	1285	1465	1675	1849	2190
29	732	1095	1262	1459	1667	1858	2210
30	682	1067	1244	1448	1682	185	2200
31	674	1066	1232	1437	1684	1856	2210
32							

Conductance (µS/cm)							
27	684	1069	1262	1415	1685	1871	2150
28	720	1082	1248	1442	1640	1873	2190
29	755	1104	1250	1452	1677	1871	2190
30	732	1077	1220	1457	1673	1882	2210
31	715	1080	1255	1457	1700	1887	2230
32	766	1070	1261	1447	1732	1898	2270

Dissolved Oxygen (mg/L) (40-100% saturation)							
27	7.2	7.3	7.3	7.3	7.3	7.2	7.2
28	7.2	7.2	7.2	7.2	7.2	7.2	7.2
29	7.3	7.3	7.3	7.3	7.3	7.3	7.3
30	7.3	7.2	7.2	7.2	7.2	7.1	7.3
31	7.3	7.1	7.2	7.2	7.2	7.1	7.1
32							

Dissolved Oxygen (mg/L) (40-100% saturation)							
27	6.2	6.2	6.1	6.1	6.0	6.0	5.9
28	5.7	5.6	5.6	5.7	5.6	5.6	5.6
29	6.2	6.3	6.1	5.9	5.9	6.0	5.9
30	6.1	6.1	6.0	5.9	6.0	6.0	5.9
31	6.5	6.4	6.4	6.4	6.3	6.2	6.1
32	6.7	6.7	6.7	6.6	6.7	6.7	6.7

Temperature (°C)							
27	24.5	24.1	24.2	24.3	24.4	25.1	24.0
28	24.5	24.6	24.5	24.7	24.7	24.5	24.6
29	24.1	24.1	24.1	24.0	24.0	24.0	24.0
30	24.0	25.1	25.1	25.4	24.9	24.8	23.9
31	24.4	25.5	25.4	25.4	25.4	25.1	25.1
32							

Temperature (°C)							
27	25						
28	25						
29	25						
30	25						
31	26						
32	25						

DO Levels (60-100% saturation) -
4.4 to 7.3 mg/L at 24°C
4.5 to 7.2 mg/L at 25°C
4.3 to 7.1 mg/L at 26°C

Comments:

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.		Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
0319- Cu only		Fish	Length (mm)	Normal/Abnormal									
		1	13	N	1	10	N	1	10	N	1	10	N
		2	10		2	9		2	11		2	11	
		3	10		3	9		3	10		3	10	
		4	10		4	11		4	12		4	11	
		5	9		5	8		5	11		5	10	
		6	10		6	9		6	11		6	11	
		7	10		7	10		7	10		7	11	
		8	12		8	12		8	10		8	11	
		9	10		9	9		9	10		9	12	
		10	10		10	9		10	9		10	10	
		11	10		11	10		11	9		11	10	
		12	10		12	10		12	9		12	11	
		13	-	-	13	11		13	10		13	11	
		14	-	-	14	11		14	10		14	11	
		15	-	-	15	11		15	11		15	11	
Comments													
0319- 400 mg/L		Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
		Fish	Length (mm)	Normal/Abnormal									
		1	11	N	1	10	N	1	10	N	1	13	N
		2	10		2	10		2	10		2	14	
		3	10		3	10		3	10		3	11	
		4	10		4	10		4	10		4	11	
		5	10		5	10		5	10		5	11	
		6	10		6	10		6	10		6	11	
		7	10		7	10		7	10		7	11	
		8	11		8	12		8	10		8	11	
		9	11		9	10		9	10		9	11	
		10	11		10	11		10	10		10	11	
		11	11		11	11		11	10		11	11	
		12	11		12	11		12	10		12	11	
		13	11		13	11		13	10		13	11	
		14	11		14	11		14	11		14	11	
		15	11		15	11		15	11		15	11	
Comments													

Method FMD 32 Day ELS Client NAU104

Sample: 1617-0319

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc.
0319-
480
mg/L

Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
Fish	Length (mm)	Normal/Abnormal									
1	10	N	1	9	N	1	10	N	1	10	N
2	11	↓	2	8	↓	2	12	↓	2	11	↓
3	10	↓	3	10	↓	3	11	↓	3	12	↓
4	12	↓	4	11	↓	4	11	↓	4	10	↓
5	8	↓	5	12	↓	5	9	↓	5	10	↓
6	9	↓	6	10	↓	6	9	↓	6	11	↓
7	11	↓	7	8	↓	7	8	↓	7	11	↓
8	12	↓	8	8	↓	8	12	↓	8	12	↓
9	8	↓	9	10	↓	9	10	↓	9	9	↓
10	11	↓	10	10	↓	10	9	↓	10	10	↓
11	8	↓	11	11	↓	11	9	↓	11	9	↓
12	11	↓	12	12	↓	12	8	↓	12	-	-
13	-	-	13	10	↓	13	10	↓	13	-	-
14	-	-	14	10	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

0319-
576
mg/L

Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
Fish	Length (mm)	Normal/Abnormal									
1	10	N									
2	11	↓	2	10	↓	2	9	↓	2	9	↓
3	10	↓	3	10	↓	3	10	↓	3	9	↓
4	10	↓	4	10	↓	4	11	↓	4	12	↓
5	9	↓	5	11	↓	5	11	↓	5	9	↓
6	10	↓	6	12	↓	6	11	↓	6	10	↓
7	8	↓	7	9	↓	7	9	↓	7	10	↓
8	12	↓	8	10	↓	8	12	↓	8	13	↓
9	10	↓	9	9	↓	9	13	↓	9	10	↓
10	10	↓	10	10	↓	10	11	↓	10	10	↓
11	11	↓	11	10	↓	11	10	↓	11	10	↓
12	12	↓	12	-	-	12	-	-	12	-	-
13	10	↓	13	-	-	13	-	-	13	-	-
14	-	-	14	-	-	14	-	-	14	-	-
15	-	-	15	-	-	15	-	-	15	-	-

Comments

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. 0319-691 mg/L	Replicate # A			Replicate # B			Replicate # C			Replicate # D		
	Fish	Length (mm)	Normal/Abnormal									
	1	50	N	1	48	N	1	52	N	1	50	N
	2	50	N									
	3	50	N									
	4	50	N									
	5	50	N									
	6	50	N									
	7	50	N									
	8	50	N									
	9	50	N									
	10	50	N									
	11	50	N									
	12	50	N									
	13	50	N									
	14	50	N									
15	50	N	15	50	N	15	50	N	15	50	N	
Comments												
0319-829 mg/L	Replicate # A			Replicate # B			Replicate # C			Replicate # D		
	Fish	Length (mm)	Normal/Abnormal									
	1	50	N									
	2	50	N									
	3	50	N									
	4	50	N									
	5	50	N									
	6	50	N									
	7	50	N									
	8	50	N									
	9	50	N									
	10	50	N									
	11	50	N									
	12	50	N									
	13	50	N									
	14	50	N									
15	50	N	15	50	N	15	50	N	15	50	N	
Comments												

Method FMD 32 Day ELS Client NAU104 Sample: 1617-0319

Test Termination

For normal/abnormal column, use the following notation:

N=Normal, A= Abnormal And note location: H=head, O=oral, E=eyes, G=gills, F=fins, S=spine

Conc. 0319- 995 mg/L	Replicate # <u>A</u>			Replicate # <u>B</u>			Replicate # <u>C</u>			Replicate # <u>D</u>		
	Fish	Length (mm)	Normal/Abnormal									
	1	9	N	1	10	N	1	8	N	1	9	N
	2	9		2	9		2	8		2	9	
	3	9		3	9		3	9		3	9	
	4	9		4	9		4	9		4	9	
	5	9		5	9		5	9		5	9	
	6	9		6	9		6	9		6	9	
	7	9		7	9		7	9		7	9	
	8	9		8	9		8	9		8	9	
	9	9		9	9		9	9		9	9	
	10	9		10	9		10	9		10	9	
	11	9		11	9		11	9		11	9	
	12	9		12	9		12	9		12	9	
	13	9		13	9		13	9		13	9	
	14	9		14	9		14	9		14	9	
	15	9		15	9		15	9		15	9	
Comments												

CETIS Summary Report

Report Date: 06 Feb-17 14:57 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
11-8736-1026	Hatched Rate	73.1	>73.1	NA	NA	1.368	Fisher Exact Test
14-7763-9651	Hatched Rate	23.42	>23.42	NA	NA	4.27	Fisher Exact Test

Hatched Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	① Unamended Sa	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
0.1	② Upstream Contr	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
23.42	③ Negative Control	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
73.1	④ Lab Water	4	1	1	1	1	1	0	0	0.0%	-1.7%

Hatched Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9333	1	1	1
0.1	Upstream Contr	0.9333	1	1	1
23.42	Negative Control	0.9333	1	1	1
73.1	Lab Water	1	1	1	1

Hatched Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	14/15	15/15	15/15	15/15
0.1	Upstream Contr	14/15	15/15	15/15	15/15
23.42	Negative Control	14/15	15/15	15/15	15/15
73.1	Lab Water	15/15	15/15	15/15	15/15

- ① lab control w/o Cu
- ② site GH ER2 w/o Cu
- ③ GH ER2 w/ Cu
- ④ lab control w/ Cu

CETIS Summary Report

Report Date: 06 Feb-17 14:57 (p 1 of 2)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
09-4763-2943	Length-mm	73.1	>73.1	NA	13.5%	1.368	Equal Variance t Two-Sample Test
20-7574-6838	Length-mm	23.42	>23.42	NA	17.0%	4.27	Equal Variance t Two-Sample Test
16-4607-5441	Mean Dry Biomass-mg	23.42	>23.42	NA	118.0%	4.27	Equal Variance t Two-Sample Test
17-1375-6734	Mean Dry Biomass-mg	73.1	>73.1	NA	8.93%	1.368	Equal Variance t Two-Sample Test
00-2227-8925	Proportion Normal	73.1	>73.1	NA	NA	1.368	Fisher Exact Test
10-0685-5072	Proportion Normal	23.42	>23.42	NA	NA	4.27	Fisher Exact Test
07-6411-6854	Survival Rate	23.42	>23.42	NA	NA	4.27	Fisher Exact Test
08-8240-5510	Survival Rate	73.1	>73.1	NA	NA	1.368	Fisher Exact Test

Length-mm Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	9.25	8.454	10.05	9	10	0.25	0.5	5.41%	0.0%
0.1	Upstream Contr	2	9	-3.706	21.71	8	10	1	1.414	15.71%	2.7%
23.42	Negative Control	4	7.75	6.954	8.546	7	8	0.25	0.5	6.45%	16.22%
73.1	Lab Water	4	9.25	7.727	10.77	8	10	0.4787	0.9574	10.35%	0.0%

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.9005	0.7163	1.085	0.7933	1.054	0.05787	0.1157	12.85%	0.0%
0.1	Upstream Contr	4	0.198	-0.1697	0.5657	0	0.4373	0.1156	0.2311	116.7%	78.01%
23.42	Negative Control	4	0.8473	0.7458	0.9488	0.7553	0.8927	0.0319	0.06379	7.53%	5.9%
73.1	Lab Water	4	0.9493	0.8783	1.02	0.908	1.012	0.02231	0.04461	4.7%	-5.43%

Proportion Normal Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	1	1	1	1	1	0	0	0.0%	0.0%
0.1	Upstream Contr	2	1	1	1	1	1	0	0	0.0%	0.0%
23.42	Negative Control	4	1	1	1	1	1	0	0	0.0%	0.0%
73.1	Lab Water	4	1	1	1	1	1	0	0	0.0%	0.0%

Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.8974 ✓	0.8405	0.9544	0.8667	0.9333	0.01789	0.03578	3.99%	0.0%
0.1	Upstream Contr	4	0.1333	0	0.4334	0	0.4	0.09428	0.1886	141.4%	85.14%
23.42	Negative Control	4	0.8667	0.7442	0.9892	0.8	0.9333	0.03849	0.07698	8.88%	3.43%
73.1	Lab Water	4	0.85	0.7484	0.9516	0.8	0.9333	0.03191	0.06383	7.51%	5.29%

CETIS Summary Report

Report Date: 06 Feb-17 14:57 (p 2 of 2)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Length-mm Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	10	9	9	9
0.1	Upstream Contr	8	10		
23.42	Negative Control	7	8	8	8
73.1	Lab Water	10	9	8	10

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1.054	0.7933	0.832	0.9227
0.1	Upstream Contr	0.4373	0.3547	0	0
23.42	Negative Control	0.7553	0.8533	0.888	0.8927
73.1	Lab Water	0.946	0.9313	1.012	0.908

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1	1	1	1
0.1	Upstream Contr	1	1		
23.42	Negative Control	1	1	1	1
73.1	Lab Water	1	1	1	1

Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9231	0.8667	0.8667	0.9333
0.1	Upstream Contr	0.4	0.1333	0	0
23.42	Negative Control	0.8	0.8	0.9333	0.9333
73.1	Lab Water	0.8667	0.8	0.9333	0.8

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/12	13/13	13/13	14/14
0.1	Upstream Contr	6/6	2/2		
23.42	Negative Control	12/12	12/12	14/14	14/14
73.1	Lab Water	13/13	12/12	14/14	12/12

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/13	13/15	13/15	14/15
0.1	Upstream Contr	6/15	2/15	0/15	0/15
23.42	Negative Control	12/15	12/15	14/15	14/15
73.1	Lab Water	13/15	12/15	14/15	12/15

CETIS Analytical Report

Report Date: 03 Feb-17 11:39 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 11-8736-1026	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 11:38	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes hatched rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
23.42		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
23.42	Negative Contr	59	1	60	0.9833	0.01667	0.0%
73.1	Lab Water	60	0	60	1	0	-1.7%

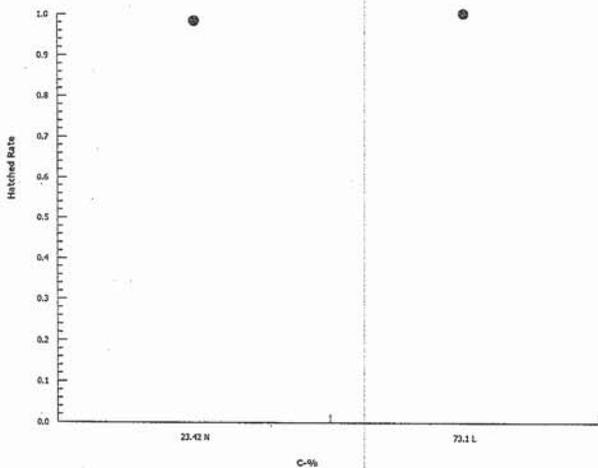
Hatched Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
23.42	Negative Control	0.9333	1	1	1
73.1	Lab Water	1	1	1	1

Hatched Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
23.42	Negative Control	14/15	15/15	15/15	15/15
73.1	Lab Water	15/15	15/15	15/15	15/15

Graphics



Negative control = site water control with Cu
 Lab water = Lab control with Cu.

CETIS Analytical Report

Report Date: 25 Jan-17 16:08 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 08-8240-5510	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 13:30	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes survival rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
23.42		73.1	0.5	0.5000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
23.42	Negative Contr	52	8	60	0.8667	0.1333	0.0%
73.1	Lab Water	51	9	60	0.85	0.15	1.92%

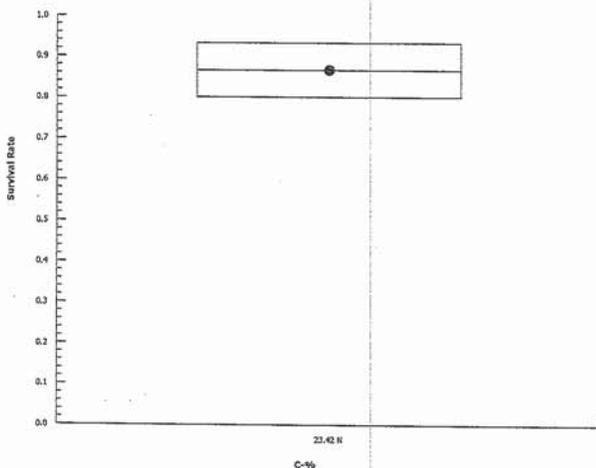
Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
23.42	Negative Control	0.8	0.8	0.9333	0.9333
73.1	Lab Water	0.8667	0.8	0.9333	0.8

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
23.42	Negative Control	12/15	12/15	14/15	14/15
73.1	Lab Water	13/15	12/15	14/15	12/15

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:08 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 17-1375-6734	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 13:30	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	8.93%	Passes mean dry biomass-mg

Equal Variance t Two-Sample Test									
Control	vs	Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
23.42		73.1	-2.621	1.943	0.076	6	0.9802	CDF	Non-Significant Effect

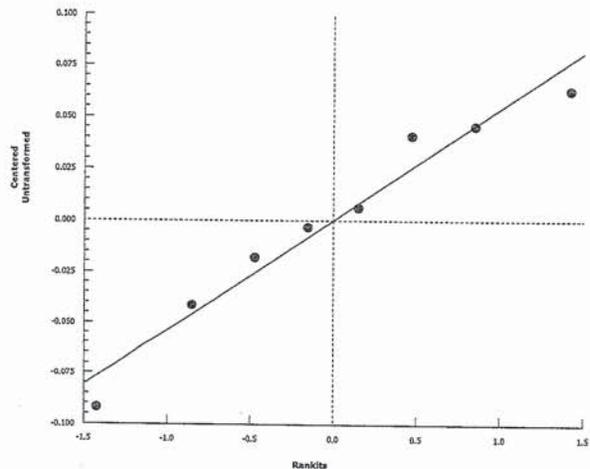
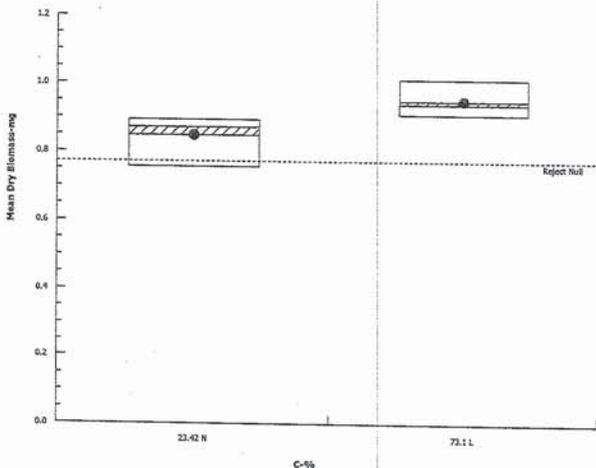
ANOVA Table						
Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02080796	0.02080796	1	6.868	0.0396	Significant Effect
Error	0.01817931	0.003029885	6			
Total	0.03898727		7			

Distributional Tests						
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)	
Variances	Variance Ratio F	2.045	47.47	0.5718	Equal Variances	
Distribution	Shapiro-Wilk W Normality	0.9555	0.6451	0.7660	Normal Distribution	

Mean Dry Biomass-mg Summary											
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
23.42	Negative Control	4	0.8473	0.7458	0.9488	0.8707	0.7553	0.8927	0.0319	7.53%	0.0%
73.1	Lab Water	4	0.9493	0.8783	1.02	0.9387	0.908	1.012	0.02231	4.7%	-12.04%

Mean Dry Biomass-mg Detail						
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	
23.42	Negative Control	0.7553	0.8533	0.888	0.8927	
73.1	Lab Water	0.946	0.9313	1.012	0.908	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:08 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 09-4763-2943	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 13:31	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	13.5%	Passes length-mm

Equal Variance t Two-Sample Test									
Control	vs	Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
23.42		73.1	-2.777	1.943	1.049	6	0.9839	CDF	Non-Significant Effect

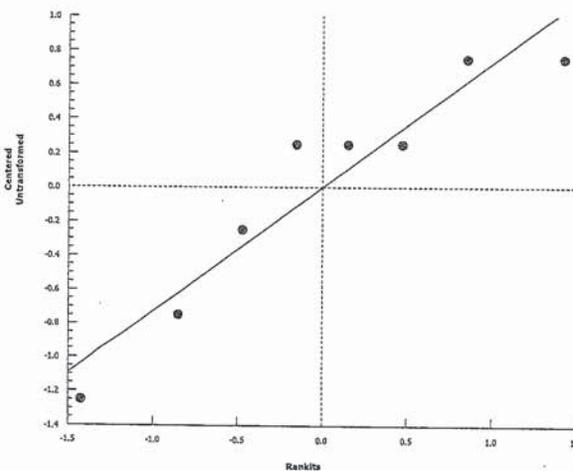
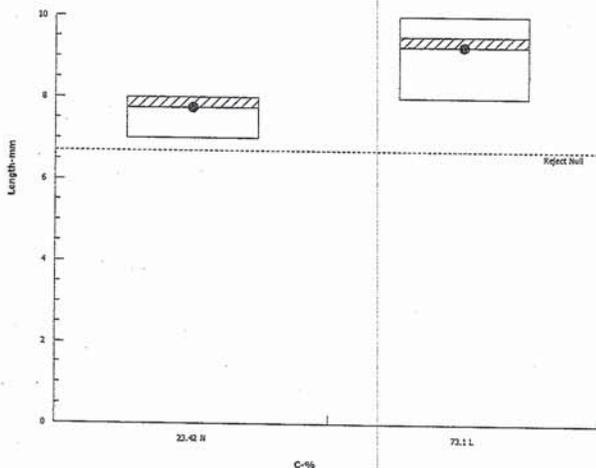
ANOVA Table						
Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	4.5	4.5	1	7.714	0.0321	Significant Effect
Error	3.5	0.5833333	6			
Total	8		7			

Distributional Tests						
Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)	
Variances	Variance Ratio F	3.667	47.47	0.3142	Equal Variances	
Distribution	Shapiro-Wilk W Normality	0.8973	0.6451	0.2730	Normal Distribution	

Length-mm Summary											
C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
23.42	Negative Control	4	7.75	6.954	8.546	8	7	8	0.25	6.45%	0.0%
73.1	Lab Water	4	9.25	7.727	10.77	9.5	8	10	0.4787	10.35%	-19.35%

Length-mm Detail						
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	
23.42	Negative Control	7	8	8	8	
73.1	Lab Water	10	9	8	10	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:08 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 00-2227-8925	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 13:31	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
23.42		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
23.42	Negative Contr	52	0	52	1	0	0.0%
73.1	Lab Water	51	0	51	1	0	0.0%

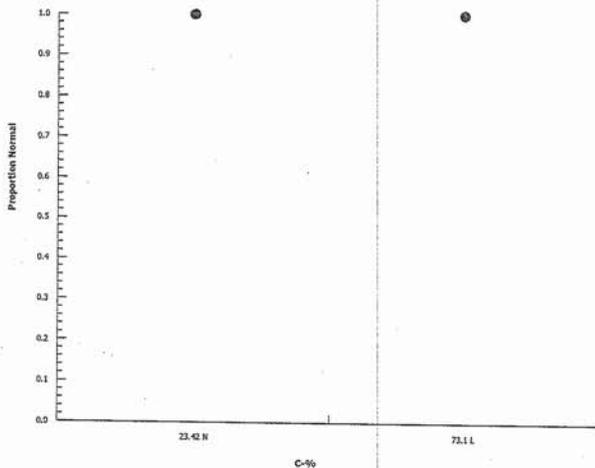
Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
23.42	Negative Control	1	1	1	1
73.1	Lab Water	1	1	1	1

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
23.42	Negative Control	12/12	12/12	14/14	14/14
73.1	Lab Water	13/13	12/12	14/14	12/12

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 11:40 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test				Nautilus Environmental
Analysis ID: 14-7763-9651	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7		
Analyzed: 03 Feb-17 11:40	Analysis: Single 2x2 Contingency Table	Official Results: Yes		
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee		
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2		
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:		
Duration: 31d 21h	Source: Aquatox, AR	Age:		
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal		
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:		
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)			
Sample Age: 9d 2h	Station: GH_ER2			

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes hatched rate

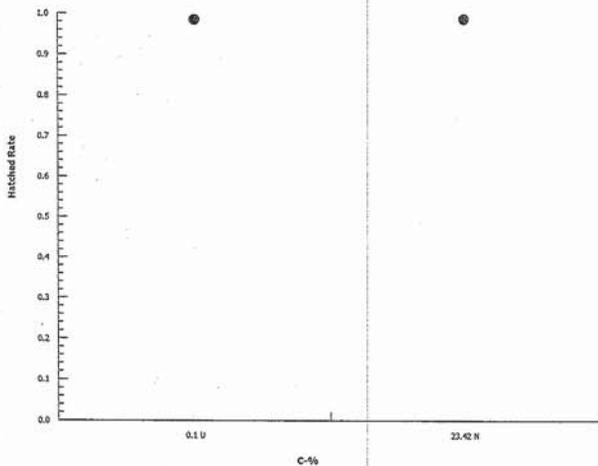
Fisher Exact Test						
Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		23.42	0.7521	0.7521	Exact	Non-Significant Effect

Data Summary							
C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	59	1	60	0.9833	0.01667	0.0%
23.42	Negative Contr	59	1	60	0.9833	0.01667	0.0%

Hatched Rate Detail						
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	
0.1	Upstream Contr	0.9333	1	1	1	
23.42	Negative Control	0.9333	1	1	1	

Hatched Rate Binomials					
C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	14/15	15/15	15/15	15/15
23.42	Negative Control	14/15	15/15	15/15	15/15

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 17:20 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 07-6411-6854	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 17:20	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes survival rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		23.42	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	8	52	60	0.1333	0.8667	0.0%
23.42	Negative Contr	52	8	60	0.8667	0.1333	-550.0%

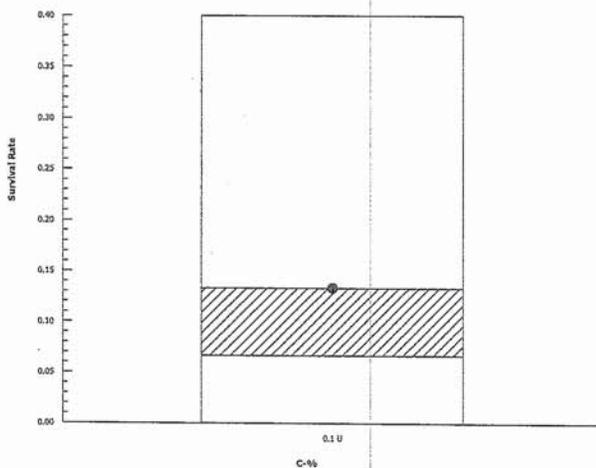
Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.4	0.1333	0	0
23.42	Negative Control	0.8	0.8	0.9333	0.9333

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	6/15	2/15	0/15	0/15
23.42	Negative Control	12/15	12/15	14/15	14/15

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 17:20 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 16-4607-5441	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 17:20	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	118.0%	Passes mean dry biomass-mg

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
0.1	23.42	-5.417	1.943	0.233	6	0.9992	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.8432685	0.8432685	1	29.34	0.0016	Significant Effect
Error	0.1724424	0.0287404	6			
Total	1.015711		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	13.12	47.47	0.0626	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9409	0.6451	0.6199	Normal Distribution

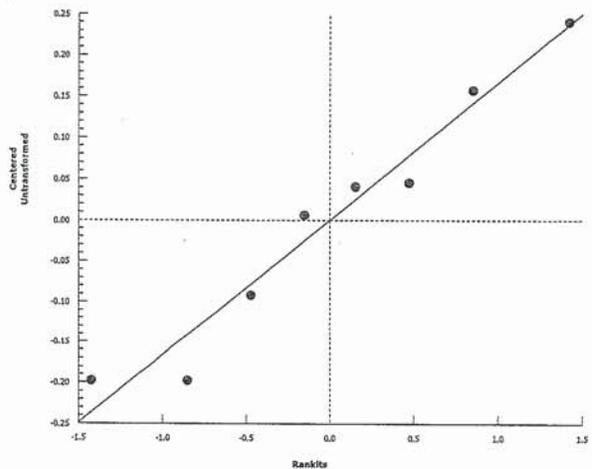
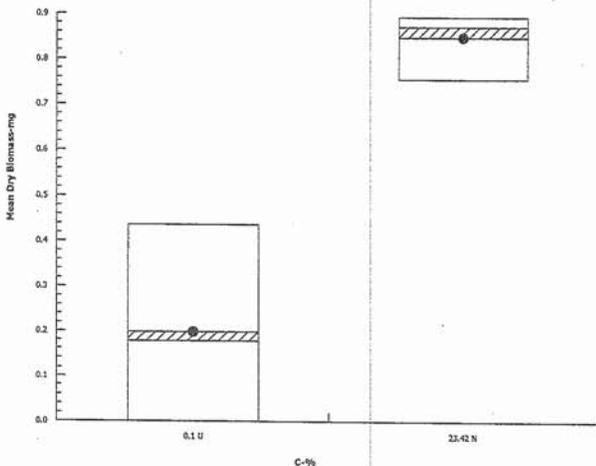
Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.1	Upstream Contr	4	0.198	-0.1697	0.5657	0.1773	0	0.4373	0.1156	116.7%	0.0%
23.42	Negative Control	4	0.8473	0.7458	0.9488	0.8707	0.7553	0.8927	0.0319	7.53%	-327.9%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.4373	0.3547	0	0
23.42	Negative Control	0.7553	0.8533	0.888	0.8927

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 17:20 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 20-7574-6838	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 17:20	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	17.0%	Passes length-mm

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
0.1	23.42	1.741	2.132	1.531	4	0.0783	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.083333	2.083333	1	3.03	0.1567	Non-Significant Effect
Error	2.75	0.6875	4			
Total	4.833333		5			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	8	55.55	0.1326	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8925	0.43	0.3316	Normal Distribution

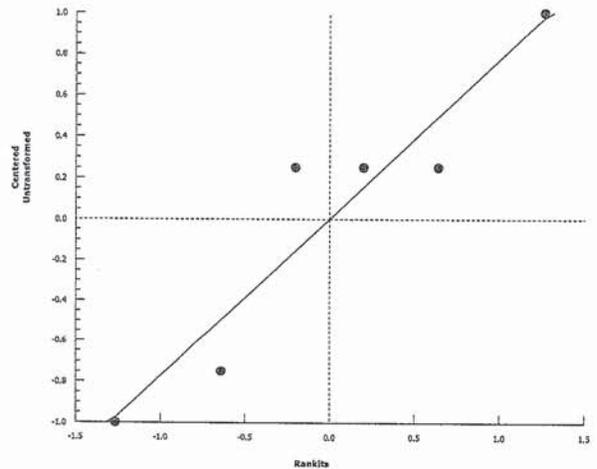
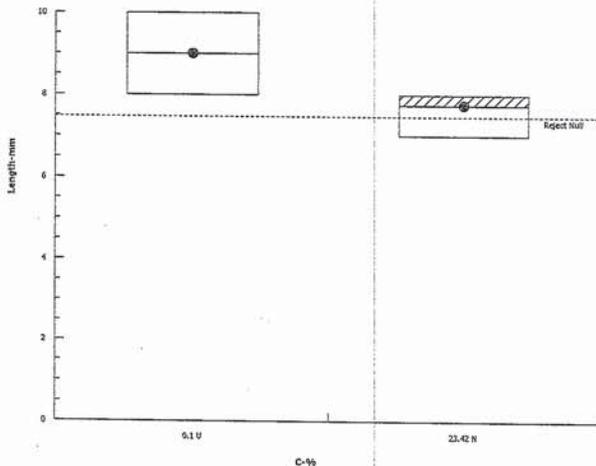
Length-mm Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.1	Upstream Contr	2	9	-3.706	21.71	9	8	10	1	15.71%	0.0%
23.42	Negative Control	4	7.75	6.954	8.546	8	7	8	0.25	6.45%	13.89%

Length-mm Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	8	10		
23.42	Negative Control	7	8	8	8

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 17:20 (p 1 of 1)
 Test Code: 161396c | 02-8360-0456

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 10-0685-5072	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 17:20	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 17-1110-4242	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: Site Water GH_ER2
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 19-0491-6270	Code: 718AB72E	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 2h	Station: GH_ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		23.42	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	8	0	8	1	0	0.0%
23.42	Negative Contr	52	0	52	1	0	0.0%

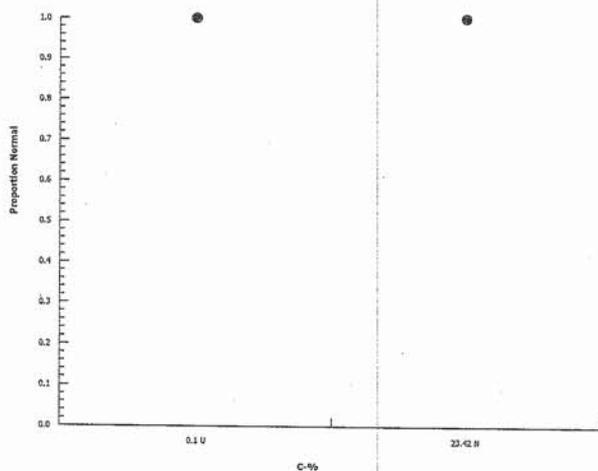
Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	1	1		
23.42	Negative Control	1	1	1	

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	6/6	2/2		
23.42	Negative Control	12/12	12/12	14/14	14/14

Graphics



CETIS Summary Report

Report Date: 06 Feb-17 14:54 (p 1 of 4)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
02-7738-0936	Length-mm	77.84	>77.84	NA	18.2%		Equal Variance t Two-Sample Test
11-4468-9775	Length-mm	73.1	>73.1	NA	11.3%		Equal Variance t Two-Sample Test
12-6282-6943	Length-mm	73.1	>73.1	NA	14.3%		Equal Variance t Two-Sample Test
04-3722-0518	Mean Dry Biomass-mg	73.1	>73.1	NA	6.69%		Equal Variance t Two-Sample Test
06-0159-7729	Mean Dry Biomass-mg	73.1	>73.1	NA	13.4%		Equal Variance t Two-Sample Test
18-6267-6218	Mean Dry Biomass-mg	77.84	>77.84	NA	28.0%		Equal Variance t Two-Sample Test
04-5594-6896	Proportion Normal	73.1	>73.1	NA	NA		Fisher Exact Test
07-6275-8971	Proportion Normal	77.84	>77.84	NA	NA		Fisher Exact Test
19-4966-5682	Proportion Normal	73.1	>73.1	NA	NA		Fisher Exact Test
02-1594-1506	Survival Rate	73.1	>73.1	NA	NA		Fisher Exact Test
11-5729-4898	Survival Rate	73.1	>73.1	NA	NA		Fisher Exact Test
15-5041-7022	Survival Rate	77.84	>77.84	NA	NA		Fisher Exact Test

CETIS Summary Report

Report Date: 06 Feb-17 14:54 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
10-0988-3257	Hatched Rate	73.1	>73.1	NA	NA		Fisher Exact Test
13-4644-6557	Hatched Rate	77.84	>77.84	NA	NA		Fisher Exact Test

Hatched Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
0.1	Upstream Contr	4	0.8833	0.7022	1	0.7333	1	0.05693	0.1139	12.89%	10.17%
73.1	Lab Water	4	1	1	1	1	1	0	0	0.0%	-1.7%
77.84	Negative Control	3	0.9778	0.8822	1	0.9333	1	0.02222	0.03849	3.94%	0.57%
528.71		4	1	1	1	1	1	0	0	0.0%	-1.7%
639.29		4	0.95	0.8484	1	0.8667	1	0.03191	0.06383	6.72%	3.39%
755.71		4	0.9667	0.9054	1	0.9333	1	0.01925	0.03849	3.98%	1.7%
951.43		4	0.95	0.7909	1	0.8	1	0.05	0.1	10.53%	3.39%
1107.14		4	0.9333	0.8467	1	0.8667	1	0.02722	0.05443	5.83%	5.09%
1248.43		4	0.8167	0.6575	0.9758	0.7333	0.9333	0.05	0.1	12.24%	16.95%

Hatched Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9333	1	1	1
0.1	Upstream Contr	0.8667	0.7333	1	0.9333
73.1	Lab Water	1	1	1	1
77.84	Negative Control	1	0.9333	1	
528.71		1	1	1	1
639.29		0.8667	1	0.9333	1
755.71		1	0.9333	1	0.9333
951.43		1	0.8	1	1
1107.14		0.8667	0.9333	1	0.9333
1248.43		0.9333	0.8667	0.7333	0.7333

Hatched Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	14/15	15/15	15/15	15/15
0.1	Upstream Contr	13/15	11/15	15/15	14/15
73.1	Lab Water	15/15	15/15	15/15	15/15
77.84	Negative Control	15/15	14/15	15/15	
528.71		15/15	15/15	15/15	15/15
639.29		13/15	15/15	14/15	15/15
755.71		15/15	14/15	15/15	14/15
951.43		15/15	12/15	15/15	15/15
1107.14		13/15	14/15	15/15	14/15
1248.43		14/15	13/15	11/15	11/15

CETIS Summary Report

Report Date: 06 Feb-17 14:54 (p 2 of 4)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Length-mm Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	9.25	8.454	10.05	9	10	0.25	0.5	5.41%	0.0%
0.1	Upstream Contr	4	8.25	6.248	10.25	7	10	0.6292	1.258	15.25%	10.81%
73.1	Lab Water	4	9.25	7.727	10.77	8	10	0.4787	0.9574	10.35%	0.0%
77.84	Negative Control	3	8	8	8	8	8	0	0	0.0%	13.51%
528.71		4	7.25	6.454	8.046	7	8	0.25	0.5	6.9%	21.62%
639.29		4	7.5	6.581	8.419	7	8	0.2887	0.5774	7.7%	18.92%
755.71		4	8	8	8	8	8	0	0	0.0%	13.51%
951.43		4	7.75	6.954	8.546	7	8	0.25	0.5	6.45%	16.22%
1107.14		4	7.75	6.954	8.546	7	8	0.25	0.5	6.45%	16.22%
1248.43		4	8	8	8	8	8	0	0	0.0%	13.51%

Mean Dry Biomass-mg Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.9005	0.7163	1.085	0.7933	1.054	0.05787	0.1157	12.85%	0.0%
0.1	Upstream Contr	4	0.552	0.347	0.757	0.4247	0.7293	0.06442	0.1288	23.34%	38.7%
73.1	Lab Water	4	0.9493	0.8783	1.02	0.908	1.012	0.02231	0.04461	4.7%	-5.43%
77.84	Negative Control	3	0.8382	0.7926	0.8839	0.8207	0.8573	0.01061	0.01838	2.19%	6.91%
528.71		4	0.6765	0.6001	0.7529	0.6047	0.7053	0.02401	0.04802	7.1%	24.87%
639.29		4	0.7695	0.7053	0.8337	0.7093	0.796	0.02019	0.04038	5.25%	14.54%
755.71		4	0.7507	0.7129	0.7884	0.7353	0.7853	0.01186	0.02372	3.16%	16.64%
951.43		4	0.7675	0.665	0.87	0.6947	0.832	0.0322	0.06439	8.39%	14.77%
1107.14		4	0.7838	0.691	0.8766	0.704	0.8327	0.02916	0.05833	7.44%	12.95%
1248.43		4	0.7643	0.5914	0.9373	0.6473	0.9073	0.05435	0.1087	14.22%	15.12%

Proportion Normal Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	1	1	1	1	1	0	0	0.0%	0.0%
0.1	Upstream Contr	4	1	1	1	1	1	0	0	0.0%	0.0%
73.1	Lab Water	4	1	1	1	1	1	0	0	0.0%	0.0%
77.84	Negative Control	3	1	1	1	1	1	0	0	0.0%	0.0%
528.71		4	0.9564	0.8763	1	0.9091	1	0.0252	0.05039	5.27%	4.36%
639.29		4	1	1	1	1	1	0	0	0.0%	0.0%
755.71		4	1	1	1	1	1	0	0	0.0%	0.0%
951.43		4	1	1	1	1	1	0	0	0.0%	0.0%
1107.14		4	1	1	1	1	1	0	0	0.0%	0.0%
1248.43		4	1	1	1	1	1	0	0	0.0%	0.0%

Survival Rate Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.8974	0.8405	0.9544	0.8667	0.9333	0.01789	0.03578	3.99%	0.0%
0.1	Upstream Contr	4	0.5167	0	1	0.1333	0.9333	0.1641	0.3283	63.54%	42.43%
73.1	Lab Water	4	0.85	0.7484	0.9516	0.8	0.9333	0.03191	0.06383	7.51%	5.29%
77.84	Negative Control	3	0.8444	0.7488	0.9401	0.8	0.8667	0.02222	0.03849	4.56%	5.91%
528.71		4	0.8	0.65	0.95	0.7333	0.9333	0.04714	0.09428	11.79%	10.86%
639.29		4	0.9167	0.7159	1	0.7333	1	0.0631	0.1262	13.77%	-2.14%
755.71		4	0.85	0.7484	0.9516	0.8	0.9333	0.03191	0.06383	7.51%	5.29%
951.43		4	0.8333	0.6496	1	0.6667	0.9333	0.05774	0.1155	13.86%	7.14%
1107.14		4	0.8167	0.7151	0.9182	0.7333	0.8667	0.03191	0.06383	7.82%	9.0%
1248.43		4	0.7333	0.6467	0.8199	0.6667	0.8	0.02722	0.05443	7.42%	18.29%

CETIS Summary Report

Report Date: 06 Feb-17 14:54 (p 3 of 4)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Length-mm Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	10	9	9	9
0.1	Upstream Contr	8	10	7	8
73.1	Lab Water	10	9	8	10
77.84	Negative Control	8	8	8	
528.71		8	7	7	7
639.29		8	7	8	7
755.71		8	8	8	8
951.43		8	8	7	8
1107.14		8	7	8	8
1248.43		8	8	8	8

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1.054	0.7933	0.832	0.9227
0.1	Upstream Contr	0.506	0.4247	0.7293	0.548
73.1	Lab Water	0.946	0.9313	1.012	0.908
77.84	Negative Control	0.8573	0.8207	0.8367	
528.71		0.6987	0.6047	0.7053	0.6973
639.29		0.7853	0.7873	0.796	0.7093
755.71		0.7467	0.7853	0.7353	0.7353
951.43		0.81	0.7333	0.6947	0.832
1107.14		0.7773	0.704	0.8327	0.8213
1248.43		0.9073	0.7293	0.6473	0.7733

Proportion Normal Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1	1	1	1
0.1	Upstream Contr	1	1	1	1
73.1	Lab Water	1	1	1	1
77.84	Negative Control	1	1	1	
528.71		1	0.9091	1	0.9167
639.29		1	1	1	1
755.71		1	1	1	1
951.43		1	1	1	1
1107.14		1	1	1	1
1248.43		1	1	1	1

Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9231	0.8667	0.8667	0.9333
0.1	Upstream Contr	0.4667	0.1333	0.9333	0.5333
73.1	Lab Water	0.8667	0.8	0.9333	0.8
77.84	Negative Control	0.8667	0.8	0.8667	
528.71		0.7333	0.7333	0.9333	0.8
639.29		0.7333	1	0.9333	1
755.71		0.8667	0.8	0.9333	0.8
951.43		0.8667	0.6667	0.8667	0.9333
1107.14		0.8667	0.7333	0.8	0.8667
1248.43		0.8	0.7333	0.6667	0.7333

CETIS Summary Report

Report Date: 06 Feb-17 14:54 (p 4 of 4)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Proportion Normal Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/12	13/13	13/13	14/14
0.1	Upstream Contr	7/7	2/2	14/14	8/8
73.1	Lab Water	13/13	12/12	14/14	12/12
77.84	Negative Control	13/13	12/12	13/13	
528.71		11/11	10/11	14/14	11/12
639.29		11/11	15/15	14/14	15/15
755.71		13/13	12/12	14/14	12/12
951.43		13/13	10/10	13/13	14/14
1107.14		13/13	11/11	12/12	13/13
1248.43		12/12	11/11	10/10	11/11

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/13	13/15	13/15	14/15
0.1	Upstream Contr	7/15	2/15	14/15	8/15
73.1	Lab Water	13/15	12/15	14/15	12/15
77.84	Negative Control	13/15	12/15	13/15	
528.71		11/15	11/15	14/15	12/15
639.29		11/15	15/15	14/15	15/15
755.71		13/15	12/15	14/15	12/15
951.43		13/15	10/15	13/15	14/15
1107.14		13/15	11/15	12/15	13/15
1248.43		12/15	11/15	10/15	11/15

CETIS Analytical Report

Report Date: 03 Feb-17 10:34 (p 1 of 2)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 01-9283-0183	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 10:30	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	341811	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	1047	375.2	1189
EC10	1158	1011	N/A
EC15	1218	1131	N/A
EC20	>1248	N/A	N/A
EC25	>1248	N/A	N/A
EC40	>1248	N/A	N/A
EC50	>1248	N/A	N/A

Hatched Rate Summary

Calculated Variate(A/B)

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
77.84	Negative Control	3	0.9778	0.9333	1	0.02222	0.03849	3.94%	0.0%	44	45
528.71		4	1	1	1	0	0	0.0%	-2.27%	60	60
639.29		4	0.95	0.8667	1	0.03191	0.06383	6.72%	2.84%	57	60
755.71		4	0.9667	0.9333	1	0.01924	0.03849	3.98%	1.14%	58	60
951.43		4	0.95	0.8	1	0.05	0.1	10.53%	2.84%	57	60
1107.14		4	0.9333	0.8667	1	0.02722	0.05443	5.83%	4.55%	56	60
1248.43		4	0.8167	0.7333	0.9333	0.05	0.1	12.24%	16.48%	49	60

Hatched Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
77.84	Negative Control	1	0.9333	1	
528.71		1	1	1	1
639.29		0.8667	1	0.9333	1
755.71		1	0.9333	1	0.9333
951.43		1	0.8	1	1
1107.14		0.8667	0.9333	1	0.9333
1248.43		0.9333	0.8667	0.7333	0.7333

Hatched Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
77.84	Negative Control	15/15	14/15	15/15	
528.71		15/15	15/15	15/15	15/15
639.29		13/15	15/15	14/15	15/15
755.71		15/15	14/15	15/15	14/15
951.43		15/15	12/15	15/15	15/15
1107.14		13/15	14/15	15/15	14/15
1248.43		14/15	13/15	11/15	11/15

CETIS Analytical Report

Report Date: 03 Feb-17 10:34 (p 2 of 2)
Test Code: 161396a | 04-0134-6493

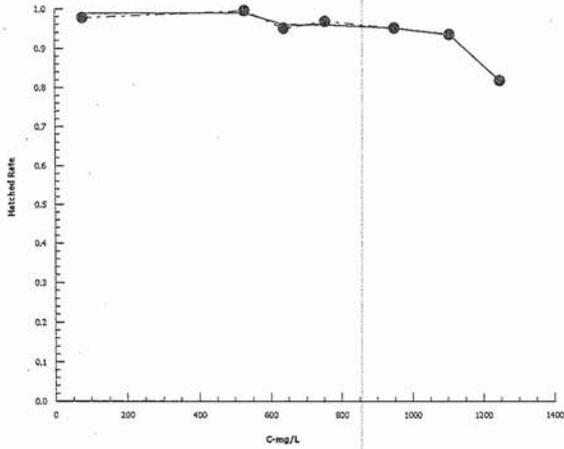
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 01-9283-0183 Endpoint: Hatched Rate
Analyzed: 03 Feb-17 10:30 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:52 (p 1 of 2)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 02-9303-4981	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:19	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16 ⁰⁵⁻³⁵ Oct 25/16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h ¹¹⁴⁵ Oct 26/16	Station: EV_ER4	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	57631	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	1116	350	1206
EC10	1187	720.1	N/A
EC15	>1248	N/A	N/A
EC20	>1248	N/A	N/A
EC25	>1248	N/A	N/A
EC40	>1248	N/A	N/A
EC50	>1248	N/A	N/A

Survival Rate Summary

C-mg/L	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
77.84	Negative Control	3	0.8444	0.8	0.8667	0.02222	0.03849	4.56%	0.0%	38	45
528.71		4	0.8	0.7333	0.9333	0.04714	0.09428	11.79%	5.26%	48	60
639.29		4	0.9167	0.7333	1	0.0631	0.1262	13.77%	-8.55%	55	60
755.71		4	0.85	0.8	0.9333	0.03191	0.06383	7.51%	-0.66%	51	60
951.43		4	0.8333	0.6667	0.9333	0.05774	0.1155	13.86%	1.32%	50	60
1107.14		4	0.8167	0.7333	0.8667	0.03191	0.06383	7.82%	3.29%	49	60
1248.43		4	0.7333	0.6667	0.8	0.02722	0.05443	7.42%	13.16%	44	60

Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
77.84	Negative Control	0.8667	0.8	0.8667	
528.71		0.7333	0.7333	0.9333	0.8
639.29		0.7333	1	0.9333	1
755.71		0.8667	0.8	0.9333	0.8
951.43		0.8667	0.6667	0.8667	0.9333
1107.14		0.8667	0.7333	0.8	0.8667
1248.43		0.8	0.7333	0.6667	0.7333

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
77.84	Negative Control	13/15	12/15	13/15	
528.71		11/15	11/15	14/15	12/15
639.29		11/15	15/15	14/15	15/15
755.71		13/15	12/15	14/15	12/15
951.43		13/15	10/15	13/15	14/15
1107.14		13/15	11/15	12/15	13/15
1248.43		12/15	11/15	10/15	11/15

CETIS Analytical Report

Report Date: 25 Jan-17 15:52 (p 2 of 2)
Test Code: 161396a | 04-0134-6493

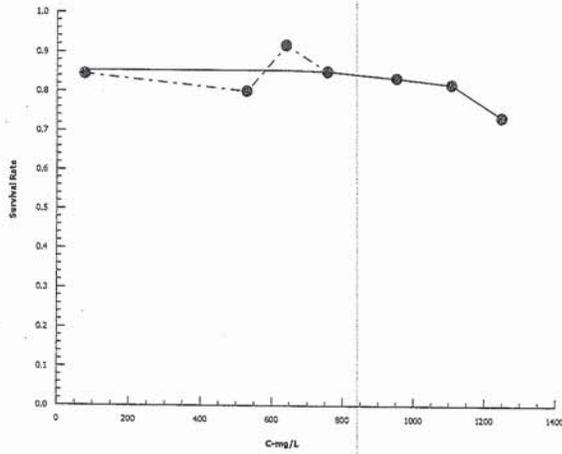
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 02-9303-4981 Endpoint: Survival Rate
Analyzed: 20 Jan-17 11:19 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 10:36 (p 1 of 2)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 19-4540-2728	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 10:35	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1109396	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	198.1	139.9	389.7
IC10	502	234.9	N/A
IC15	>1248	N/A	N/A
IC20	>1248	N/A	N/A
IC25	>1248	N/A	N/A
IC40	>1248	N/A	N/A
IC50	>1248	N/A	N/A

Mean Dry Biomass-mg Summary

Calculated Variate

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
77.84	Negative Control	3	0.8382	0.8207	0.8573	0.01061	0.01838	2.19%	0.0%
528.71		4	0.6765	0.6047	0.7053	0.02401	0.04802	7.1%	19.29%
639.29		4	0.7695	0.7093	0.796	0.02019	0.04038	5.25%	8.2%
755.71		4	0.7507	0.7353	0.7853	0.01186	0.02372	3.16%	10.45%
951.43		4	0.7675	0.6947	0.832	0.0322	0.06439	8.39%	8.44%
1107.14		4	0.7838	0.704	0.8327	0.02916	0.05833	7.44%	6.49%
1248.43		4	0.7643	0.6473	0.9073	0.05435	0.1087	14.22%	8.82%

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
77.84	Negative Control	0.8573	0.8207	0.8367	
528.71		0.6987	0.6047	0.7053	0.6973
639.29		0.7853	0.7873	0.796	0.7093
755.71		0.7467	0.7853	0.7353	0.7353
951.43		0.81	0.7333	0.6947	0.832
1107.14		0.7773	0.704	0.8327	0.8213
1248.43		0.9073	0.7293	0.6473	0.7733

CETIS Analytical Report

Report Date: 03 Feb-17 10:36 (p 2 of 2)
Test Code: 161396a | 04-0134-6493

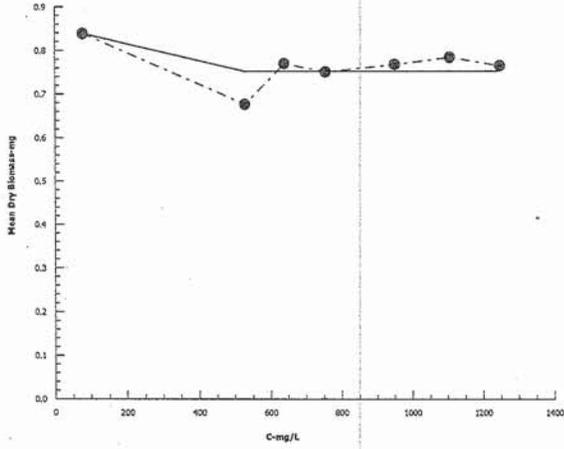
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 19-4540-2728 Endpoint: Mean Dry Biomass-mg
Analyzed: 03 Feb-17 10:35 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:46 (p 1 of 2)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test Nautilus Environmental

Analysis ID: 08-7659-5835	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:19	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
<hr/>		
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
<hr/>		
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16 ⁰⁸³⁵	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30 ^{Oct 25/16}	Source: Teck Coal (TECK COAL)	
Sample Age: 62h ^{Oct 26/16 1145}	Station: EV_ER4	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1798612	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L	95% LCL	95% UCL
IC5	>1248	N/A	N/A
IC10	>1248	N/A	N/A
IC15	>1248	N/A	N/A
IC20	>1248	N/A	N/A
IC25	>1248	N/A	N/A
IC40	>1248	N/A	N/A
IC50	>1248	N/A	N/A

Length-mm Summary			Calculated Variate						
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
77.84	Negative Control	3	8	8	8	0	0	0.0%	0.0%
528.71		4	7.25	7	8	0.25	0.5	6.9%	9.38%
639.29		4	7.5	7	8	0.2887	0.5774	7.7%	6.25%
755.71		4	8	8	8	0	0	0.0%	0.0%
951.43		4	7.75	7	8	0.25	0.5	6.45%	3.13%
1107.14		4	7.75	7	8	0.25	0.5	6.45%	3.13%
1248.43		4	8	8	8	0	0	0.0%	0.0%

Length-mm Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
77.84	Negative Control	8	8	8	
528.71		8	7	7	7
639.29		8	7	8	7
755.71		8	8	8	8
951.43		8	8	7	8
1107.14		8	7	8	8
1248.43		8	8	8	8

CETIS Analytical Report

Report Date: 25 Jan-17 15:46 (p 2 of 2)
Test Code: 161396a | 04-0134-6493

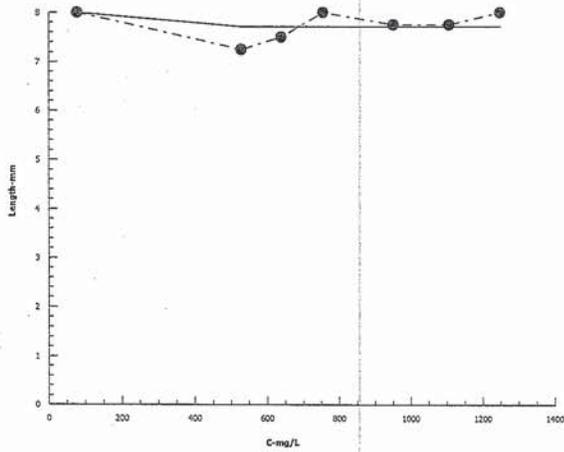
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 08-7659-5835 Endpoint: Length-mm
Analyzed: 20 Jan-17 11:19 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:46 (p 1 of 2)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test Nautilus Environmental

Analysis ID: 02-8846-1744	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:19	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16 ⁰⁸³⁵ 01 Nov-16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 ¹¹⁴⁵ 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h	Station: EV_ER4	

Linear Interpolation Options					
X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	856972	200	Yes	Two-Point Interpolation

Point Estimates			
Level	mg/L	95% LCL	95% UCL
EC5	>1248	N/A	N/A
EC10	>1248	N/A	N/A
EC15	>1248	N/A	N/A
EC20	>1248	N/A	N/A
EC25	>1248	N/A	N/A
EC40	>1248	N/A	N/A
EC50	>1248	N/A	N/A

Proportion Normal Summary			Calculated Variate(A/B)								
C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
77.84	Negative Control	3	1	1	1	0	0	0.0%	0.0%	38	38
528.71		4	0.9564	0.9091	1	0.0252	0.05039	5.27%	4.36%	46	48
639.29		4	1	1	1	0	0	0.0%	0.0%	55	55
755.71		4	1	1	1	0	0	0.0%	0.0%	51	51
951.43		4	1	1	1	0	0	0.0%	0.0%	50	50
1107.14		4	1	1	1	0	0	0.0%	0.0%	49	49
1248.43		4	1	1	1	0	0	0.0%	0.0%	44	44

Proportion Normal Detail						
C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	
77.84	Negative Control	1	1	1		
528.71		1	0.9091	1	0.9167	
639.29		1	1	1	1	
755.71		1	1	1	1	
951.43		1	1	1	1	
1107.14		1	1	1	1	
1248.43		1	1	1	1	

Proportion Normal Binomials					
C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
77.84	Negative Control	13/13	12/12	13/13	
528.71		11/11	10/11	14/14	11/12
639.29		11/11	15/15	14/14	15/15
755.71		13/13	12/12	14/14	12/12
951.43		13/13	10/10	13/13	14/14
1107.14		13/13	11/11	12/12	13/13
1248.43		12/12	11/11	10/10	11/11

CETIS Analytical Report

Report Date: 25 Jan-17 15:46 (p 2 of 2)
Test Code: 161396a | 04-0134-6493

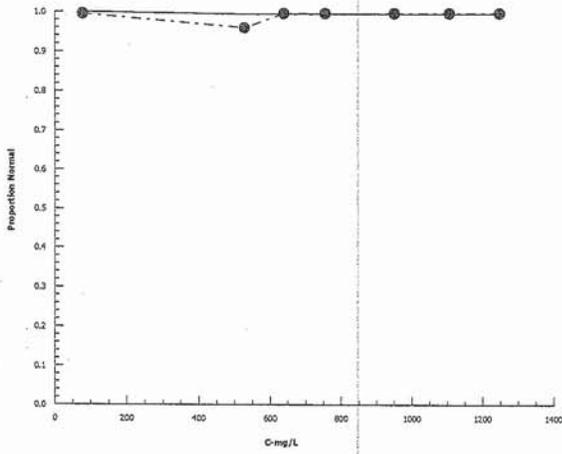
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 02-8846-1744 Endpoint: Proportion Normal
Analyzed: 20 Jan-17 11:19 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 10:42 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 10-0988-3257	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 10:42	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes hatched rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
77.84		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
73.1	Lab Water	60	0	60	1	0	-2.27%
77.84	Negative Contr	44	1	45	0.9778	0.02222	0.0%

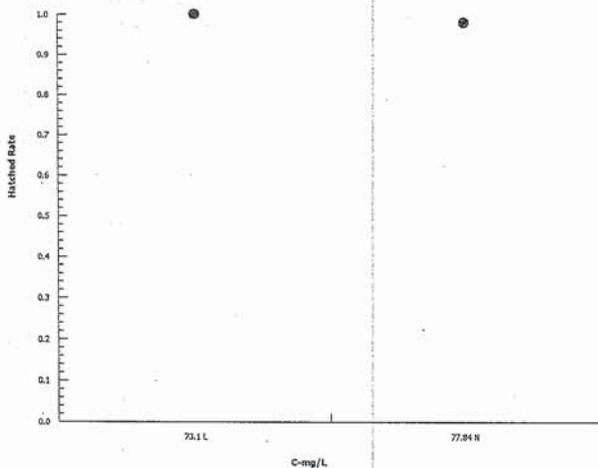
Hatched Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	1	1	1	1
77.84	Negative Control	1	0.9333	1	

Hatched Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	15/15	15/15	15/15	15/15
77.84	Negative Control	15/15	14/15	15/15	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:46 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 02-1594-1506	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:20	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes survival rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
77.84		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
73.1	Lab Water	51	9	60	0.85	0.15	-0.66%
77.84	Negative Contr	38	7	45	0.8444	0.1556	0.0%

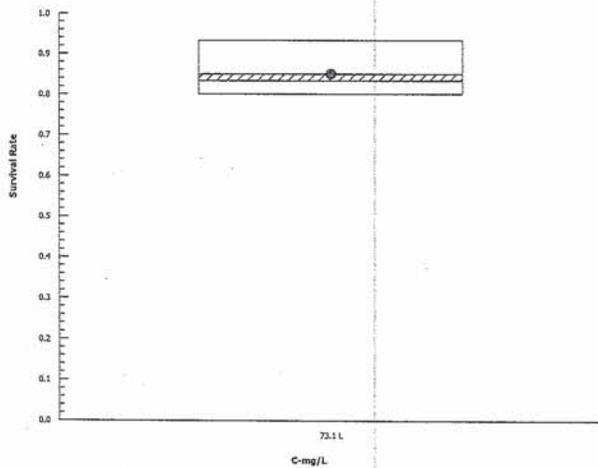
Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	0.8667	0.8	0.9333	0.8
77.84	Negative Control	0.8667	0.8	0.8667	

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	13/15	12/15	14/15	12/15
77.84	Negative Control	13/15	12/15	13/15	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:50 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 04-3722-0518	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:20	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	6.69%	Passes mean dry biomass-mg

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
77.84	73.1	-3.99	2.015	0.056	5	0.9948	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.02116389	0.02116389	1	15.92	0.0104	Significant Effect
Error	0.006646361	0.001329272	5			
Total	0.02781026		6			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	5.89	199.2	0.2972	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9226	0.5629	0.4897	Normal Distribution

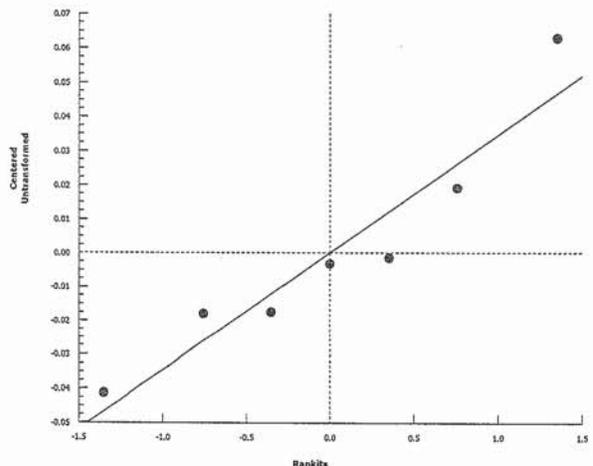
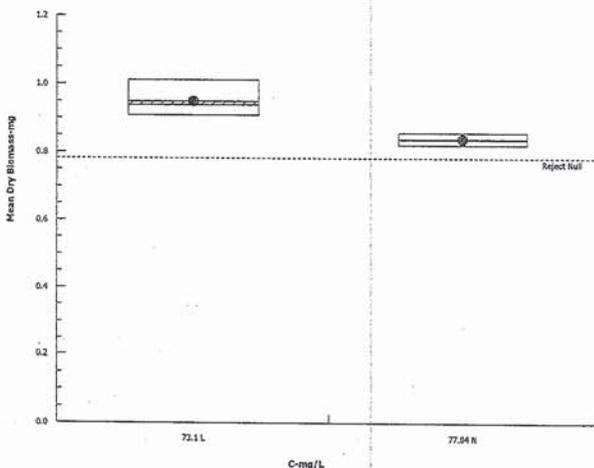
Mean Dry Biomass-mg Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
73.1	Lab Water	4	0.9493	0.8783	1.02	0.9387	0.908	1.012	0.02231	4.7%	0.0%
77.84	Negative Control	3	0.8382	0.7926	0.8839	0.8367	0.8207	0.8573	0.01061	2.19%	11.7%

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	0.946	0.9313	1.012	0.908
77.84	Negative Control	0.8573	0.8207	0.8367	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:50 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 12-6282-6943	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:20	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	14.3%	Passes length-mm

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
77.84	73.1	-2.207	2.015	1.141	5	0.9608	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	2.678571	2.678571	1	4.87	0.0784	Non-Significant Effect
Error	2.75	0.55	5			
Total	5.428572		6			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	4	21.2	0.1161	Equal Variances
Variances	Levene Equality of Variance	9.643	16.26	0.0267	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8728	0.5629	0.1963	Normal Distribution

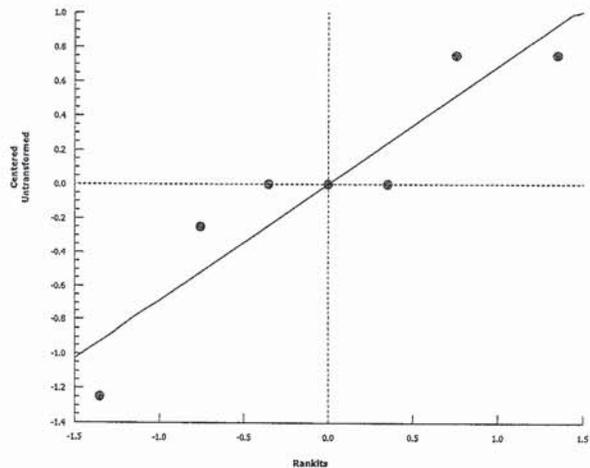
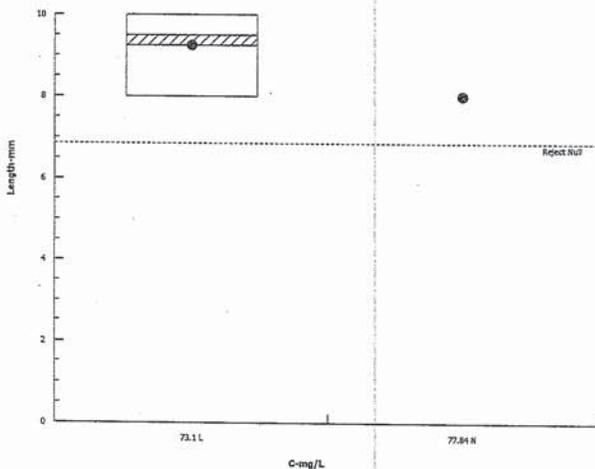
Length-mm Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
73.1	Lab Water	4	9.25	7.727	10.77	9.5	8	10	0.4787	10.35%	0.0%
77.84	Negative Control	3	8	8	8	8	8	8	0	0.0%	13.51%

Length-mm Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	10	9	8	10
77.84	Negative Control	8	8	8	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:50 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 19-4966-5682	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:20	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:

Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16 ⁰⁸³⁵	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30 ^{0825/16}	Source: Teck Coal (TECK COAL)	
Sample Age: 82h ¹¹⁴⁵	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
77.84		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
73.1	Lab Water	51	0	51	1	0	0.0%
77.84	Negative Contr	38	0	38	1	0	0.0%

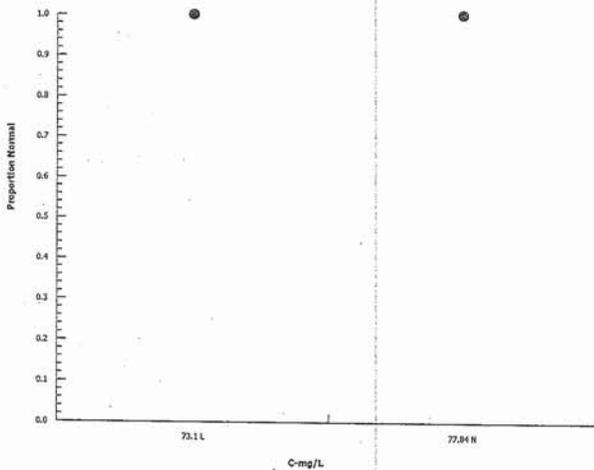
Proportion Normal Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	1	1	1	1
77.84	Negative Control	1	1	1	1

Proportion Normal Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	13/13	12/12	14/14	12/12
77.84	Negative Control	13/13	12/12	13/13	

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 10:47 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 13-4644-6557	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 10:46	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes hatched rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		77.84	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	53	7	60	0.8833	0.1167	0.0%
77.84	Negative Contr	44	1	45	0.9778	0.0222	-10.69%

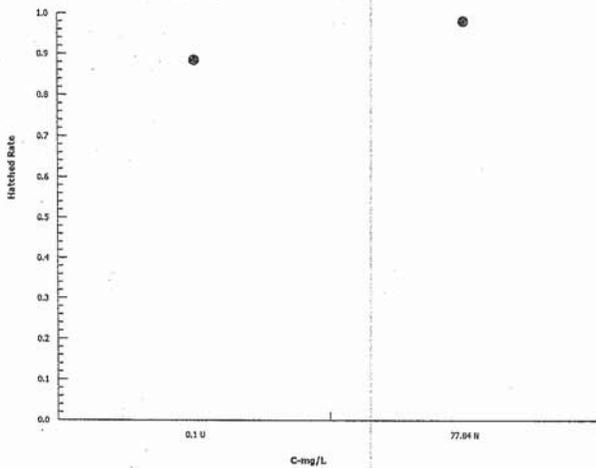
Hatched Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.8667	0.7333	1	0.9333
77.84	Negative Control	1	0.9333	1	

Hatched Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	13/15	11/15	15/15	14/15
77.84	Negative Control	15/15	14/15	15/15	

Graphics



upstream control = site water without Cu
 Negative control = site water with Cu

CETIS Analytical Report

Report Date: 25 Jan-17 16:38 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 15-5041-7022	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:37	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes survival rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		77.84	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	31	29	60	0.5167	0.4833	0.0%
77.84	Negative Contr	38	7	45	0.8444	0.1556	-63.44%

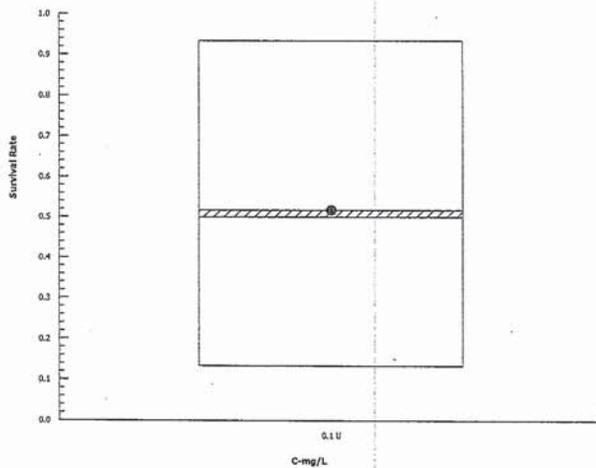
Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.4667	0.1333	0.9333	0.5333
77.84	Negative Control	0.8667	0.8	0.8667	

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	7/15	2/15	14/15	8/15
77.84	Negative Control	13/15	12/15	13/15	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:38 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 18-6267-6218	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:37	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	28.0%	Passes mean dry biomass-mg

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
0.1	77.84	-3.73	2.015	0.155	5	0.9932	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1404405	0.1404405	1	13.91	0.0136	Significant Effect
Error	0.0504687	0.01009374	5			
Total	0.1909092		6			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	49.12	199.2	0.0400	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8891	0.5629	0.2699	Normal Distribution

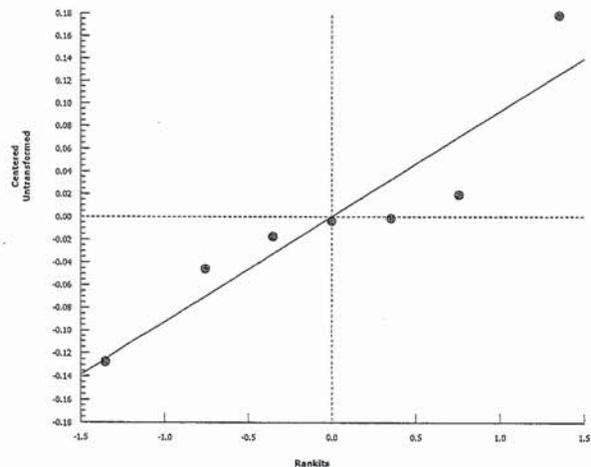
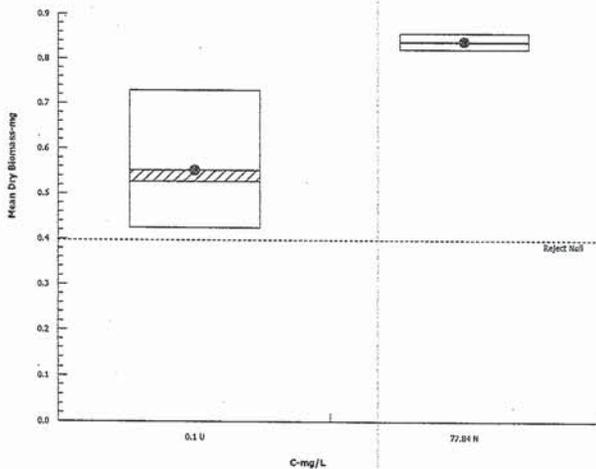
Mean Dry Biomass-mg Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.1	Upstream Contr	4	0.552	0.347	0.757	0.527	0.4247	0.7293	0.06442	23.34%	0.0%
77.84	Negative Control	3	0.8382	0.7926	0.8839	0.8367	0.8207	0.8573	0.01061	2.19%	-51.85%

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.506	0.4247	0.7293	0.548
77.84	Negative Control	0.8573	0.8207	0.8367	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:38 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 02-7738-0936	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:37	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869 <i>0535</i>	Code: 171A9C1D	Client: Teck Coal
Sample Date: <i>01 Nov-16 Oct 25/16</i>	Material: Sulphate	Project:
Receive Date: <i>02 Nov-16 10:30 Oct 26/16</i>	Source: Teck Coal (TECK COAL)	
Sample Age: <i>62h 1145</i>	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	18.2%	Passes length-mm

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
0.1	77.84	0.3358	2.015	1.5	5	0.3753	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.1071429	0.1071429	1	0.1128	0.7506	Non-Significant Effect
Error	4.75	0.95	5			
Total	4.857143		6			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	1.091	21.2	0.3552	Equal Variances
Variances	Levene Equality of Variance	3.889	16.26	0.1056	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8256	0.5629	0.0727	Normal Distribution

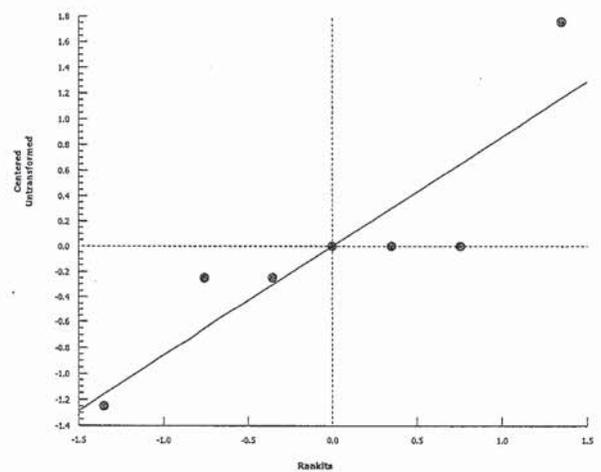
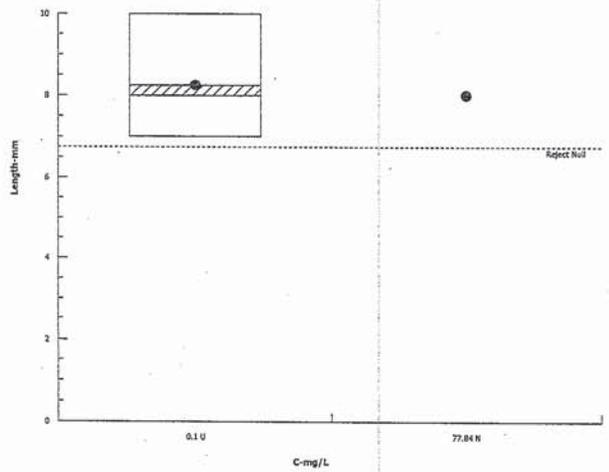
Length-mm Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.1	Upstream Contr	4	8.25	6.248	10.25	8	7	10	0.6292	15.25%	0.0%
77.84	Negative Control	3	8	8	8	8	8	8	0	0.0%	3.03%

Length-mm Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	8	10	7	8
77.84	Negative Control	8	8	8	

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:38 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 07-6275-8971	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:37	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16 <i>0835</i>	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30 <i>0-25/16</i>	Source: Teck Coal (TECK COAL)	
Sample Age: 62h <i>0-26/16</i>	Station: EV_ER4	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Sample	vs Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1	77.84	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	31	0	31	1	0	0.0%
77.84	Negative Contr	38	0	38	1	0	0.0%

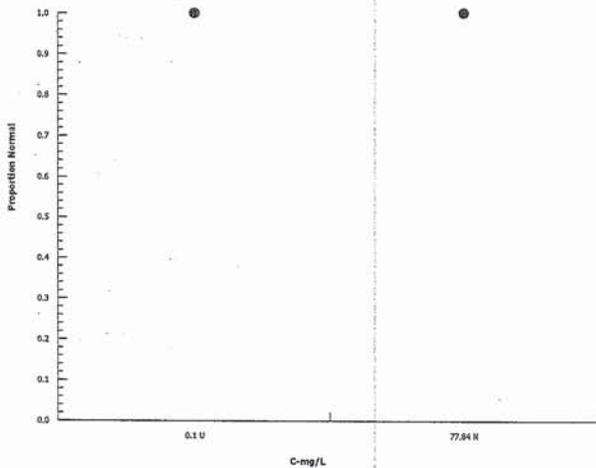
Proportion Normal Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	1	1	1	1
77.84	Negative Control	1	1		

Proportion Normal Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	7/7	2/2	14/14	8/8
77.84	Negative Control	13/13	12/12	13/13	

Graphics



CETIS Summary Report

Report Date: 06 Feb-17 14:56 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
04-2146-8640	Hatched Rate	217.14	>217.14	NA	NA	0.4605	Fisher Exact Test
12-7776-3199	Hatched Rate	73.1	>73.1	NA	NA	1.368	Fisher Exact Test

Hatched Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
0.1	Upstream Contr	4	0.9333	0.7833	1	0.8	1	0.04714	0.09428	10.1%	5.09%
73.1	Lab Water	4	1	1	1	1	1	0	0	0.0%	-1.7%
217.14	Negative Control	4	1	1	1	1	1	0	0	0.0%	-1.7%
455.86		4	0.9833	0.9303	1	0.9333	1	0.01667	0.03333	3.39%	0.0%
556.29		4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	1.7%
682.71		4	0.95	0.8484	1	0.8667	1	0.03191	0.06383	6.72%	3.39%
869.86		4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	1.7%
1024.71		4	0.9667	0.8606	1	0.8667	1	0.03333	0.06667	6.9%	1.7%
1234.29		4	1	1	1	1	1	0	0	0.0%	-1.7%

Hatched Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9333	1	1	1
0.1	Upstream Contr	0.8	0.9333	1	1
73.1	Lab Water	1	1	1	1
217.14	Negative Control	1	1	1	1
455.86		1	0.9333	1	1
556.29		1	1	1	0.8667
682.71		1	0.8667	0.9333	1
869.86		1	1	1	0.8667
1024.71		1	0.8667	1	1
1234.29		1	1	1	1

Hatched Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	14/15	15/15	15/15	15/15
0.1	Upstream Contr	12/15	14/15	15/15	15/15
73.1	Lab Water	15/15	15/15	15/15	15/15
217.14	Negative Control	15/15	15/15	15/15	15/15
455.86		15/15	14/15	15/15	15/15
556.29		15/15	15/15	15/15	13/15
682.71		15/15	13/15	14/15	15/15
869.86		15/15	15/15	15/15	13/15
1024.71		15/15	13/15	15/15	15/15
1234.29		15/15	15/15	15/15	15/15

CETIS Summary Report

Report Date: 06 Feb-17 14:56 (p 1 of 4)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Batch ID: 15-4012-3439 Test Type: Survival-Development-Growth Analyst: Karen Lee
 Start Date: 03 Nov-16 14:00 Protocol: ASTM E1241-05 (2013) Diluent: GH_FR1
 Ending Date: 05 Dec-16 11:00 Species: Pimephales promelas Brine:
 Duration: 31d 21h Source: Aquatox, AR Age:

Sample ID: 05-7317-6432 Code: 2229FA70 Client: Teck Coal
 Sample Date: 25 Oct-16 Material: Water Sample Project:
 Receive Date: 25 Oct-16 12:30 Source: Teck Coal (TECK COAL)
 Sample Age: 9d 14h Station: GH_FR1

Comparison Summary

Analysis ID	Endpoint	NOEL	LOEL	TOEL	PMSD	TU	Method
20-3694-0438	Length-mm	73.1	>73.1	NA	9.3%	1.368	Equal Variance t Two-Sample Test
04-1927-9168	Length-mm	217.14	>217.14	NA	7.93%	0.4605	Wilcoxon Rank Sum Two-Sample Test
14-5446-2347	Mean Dry Biomass-mg	217.14	>217.14	NA	93.4%	0.4605	Equal Variance t Two-Sample Test
16-3662-9229	Mean Dry Biomass-mg	73.1	>73.1	NA	40.7%	1.368	Unequal Variance t Two-Sample Test
05-8489-5926	Proportion Normal	217.14	>217.14	NA	NA	0.4605	Fisher Exact Test
18-1751-9971	Proportion Normal	73.1	>73.1	NA	NA	1.368	Fisher Exact Test
01-7138-6279	Survival Rate	73.1	>73.1	NA	NA	1.368	Fisher Exact Test
09-9015-5261	Survival Rate	217.14	>217.14	NA	NA	0.4605	Fisher Exact Test

CETIS Summary Report

Report Date: 06 Feb-17 14:56 (p 2 of 4)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Length-mm Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	9.25	8.454	10.05	9	10	0.25	0.5	5.41%	0.0%
0.1	Upstream Contr	4	10	8.701	11.3	9	11	0.4082	0.8165	8.17%	-8.11%
73.1	Lab Water	4	9.25	7.727	10.77	8	10	0.4787	0.9574	10.35%	0.0%
217.14	Negative Control	4	10	10	10	10	10	0	0	0.0%	-8.11%
455.86		4	11	7.818	14.18	10	14	1	2	18.18%	-18.92%
556.29		4	10	10	10	10	10	0	0	0.0%	-8.11%
682.71		4	10.25	9.454	11.05	10	11	0.25	0.5	4.88%	-10.81%
869.86		4	9	9	9	9	9	0	0	0.0%	2.7%
1024.71		4	9	9	9	9	9	0	0	0.0%	2.7%
1234.29		4	8.75	7.954	9.546	8	9	0.25	0.5	5.71%	5.41%

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.9005	0.7163	1.085	0.7933	1.054	0.05787	0.1157	12.85%	0.0%
0.1	Upstream Contr	4	0.368	0.2858	0.4501	0.3213	0.4147	0.02581	0.05163	14.03%	59.13%
73.1	Lab Water	4	0.9493	0.8783	1.02	0.908	1.012	0.02231	0.04461	4.7%	-5.43%
217.14	Negative Control	4	1.021	0.4635	1.577	0.772	1.539	0.175	0.35	34.3%	-13.33%
455.86		4	0.741	0.644	0.838	0.6593	0.7993	0.03047	0.06095	8.23%	17.71%
556.29		4	0.7218	0.6427	0.8009	0.6767	0.7927	0.02485	0.04971	6.89%	19.84%
682.71		4	0.6957	0.6038	0.7875	0.6407	0.774	0.02885	0.0577	8.3%	22.74%
869.86		4	0.7297	0.615	0.8443	0.652	0.8153	0.03603	0.07207	9.88%	18.97%
1024.71		4	0.7465	0.7117	0.7813	0.714	0.76	0.01093	0.02186	2.93%	17.1%
1234.29		4	0.8585	0.6341	1.083	0.6867	1.025	0.0705	0.141	16.42%	4.66%

Proportion Normal Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	1	1	1	1	1	0	0	0.0%	0.0%
0.1	Upstream Contr	4	1	1	1	1	1	0	0	0.0%	0.0%
73.1	Lab Water	4	1	1	1	1	1	0	0	0.0%	0.0%
217.14	Negative Control	4	1	1	1	1	1	0	0	0.0%	0.0%
455.86		4	1	1	1	1	1	0	0	0.0%	0.0%
556.29		4	1	1	1	1	1	0	0	0.0%	0.0%
682.71		4	1	1	1	1	1	0	0	0.0%	0.0%
869.86		4	1	1	1	1	1	0	0	0.0%	0.0%
1024.71		4	1	1	1	1	1	0	0	0.0%	0.0%
1234.29		4	1	1	1	1	1	0	0	0.0%	0.0%

Survival Rate Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	Unamended Sa	4	0.8974	0.8405	0.9544	0.8667	0.9333	0.01789	0.03578	3.99%	0.0%
0.1	Upstream Contr	4	0.2167	0.1151	0.3182	0.1333	0.2667	0.03191	0.06383	29.46%	75.86%
73.1	Lab Water	4	0.85	0.7484	0.9516	0.8	0.9333	0.03191	0.06383	7.51%	5.29%
217.14	Negative Control	4	0.8333	0.6964	0.9703	0.7333	0.9333	0.04303	0.08607	10.33%	7.14%
455.86		4	0.5167	0.03151	1	0.1333	0.8667	0.1524	0.3049	59.01%	42.43%
556.29		4	0.8333	0.6964	0.9703	0.7333	0.9333	0.04303	0.08607	10.33%	7.14%
682.71		4	0.7667	0.6606	0.8727	0.7333	0.8667	0.03333	0.06667	8.7%	14.57%
869.86		4	0.7833	0.5043	1	0.5333	0.9333	0.08767	0.1753	22.38%	12.71%
1024.71		4	0.8167	0.7636	0.8697	0.8	0.8667	0.01667	0.03333	4.08%	9.0%
1234.29		4	0.8	0.65	0.95	0.6667	0.8667	0.04714	0.09428	11.79%	10.86%

CETIS Summary Report

Report Date: 06 Feb-17 14:56 (p 3 of 4)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Length-mm Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	10	9	9	9
0.1	Upstream Contr	10	11	10	9
73.1	Lab Water	10	9	8	10
217.14	Negative Control	10	10	10	10
455.86		10	10	10	14
556.29		10	10	10	10
682.71		10	10	11	10
869.86		9	9	9	9
1024.71		9	9	9	9
1234.29		9	8	9	9

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1.054	0.7933	0.832	0.9227
0.1	Upstream Contr	0.4107	0.3213	0.4147	0.3253
73.1	Lab Water	0.946	0.9313	1.012	0.908
217.14	Negative Control	0.8793	0.8913	0.772	1.539
455.86		0.7727	0.7993	0.7327	0.6593
556.29		0.7053	0.6767	0.7127	0.7927
682.71		0.774	0.6407	0.7007	0.6673
869.86		0.6927	0.652	0.7587	0.8153
1024.71		0.7533	0.714	0.7587	0.76
1234.29		0.8947	0.6867	1.025	0.8273

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1	1	1	1
0.1	Upstream Contr	1	1	1	1
73.1	Lab Water	1	1	1	1
217.14	Negative Control	1	1	1	1
455.86		1	1	1	1
556.29		1	1	1	1
682.71		1	1	1	1
869.86		1	1	1	1
1024.71		1	1	1	1
1234.29		1	1	1	1

Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9231	0.8667	0.8667	0.9333
0.1	Upstream Contr	0.2667	0.1333	0.2667	0.2
73.1	Lab Water	0.8667	0.8	0.9333	0.8
217.14	Negative Control	0.8	0.8667	0.9333	0.7333
455.86		0.4667	0.6	0.8667	0.1333
556.29		0.8	0.9333	0.8667	0.7333
682.71		0.8667	0.7333	0.7333	0.7333
869.86		0.8	0.5333	0.9333	0.8667
1024.71		0.8	0.8	0.8667	0.8
1234.29		0.8667	0.6667	0.8667	0.8

CETIS Summary Report

Report Date: 06 Feb-17 14:56 (p 4 of 4)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/12	13/13	13/13	14/14
0.1	Upstream Contr	4/4	2/2	4/4	3/3
73.1	Lab Water	13/13	12/12	14/14	12/12
217.14	Negative Control	12/12	13/13	14/14	11/11
455.86		7/7	9/9	13/13	2/2
556.29		12/12	14/14	13/13	11/11
682.71		13/13	11/11	11/11	11/11
869.86		12/12	8/8	14/14	13/13
1024.71		12/12	12/12	13/13	12/12
1234.29		13/13	10/10	13/13	12/12

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/13	13/15	13/15	14/15
0.1	Upstream Contr	4/15	2/15	4/15	3/15
73.1	Lab Water	13/15	12/15	14/15	12/15
217.14	Negative Control	12/15	13/15	14/15	11/15
455.86		7/15	9/15	13/15	2/15
556.29		12/15	14/15	13/15	11/15
682.71		13/15	11/15	11/15	11/15
869.86		12/15	8/15	14/15	13/15
1024.71		12/15	12/15	13/15	12/15
1234.29		13/15	10/15	13/15	12/15

CETIS Analytical Report

Report Date: 03 Feb-17 11:55 (p 1 of 2)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 11-6516-5891	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 11:55	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2028611	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>1234	N/A	N/A	<0.08104	NA	NA
EC10	>1234	N/A	N/A	<0.08104	NA	NA
EC15	>1234	N/A	N/A	<0.08104	NA	NA
EC20	>1234	N/A	N/A	<0.08104	NA	NA
EC25	>1234	N/A	N/A	<0.08104	NA	NA
EC40	>1234	N/A	N/A	<0.08104	NA	NA
EC50	>1234	N/A	N/A	<0.08104	NA	NA

Hatched Rate Summary

C-%	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
217.14	Negative Control	4	1	1	1	0	0	0.0%	0.0%	60	60
455.86		4	0.9833	0.9333	1	0.01667	0.03333	3.39%	1.67%	59	60
556.29		4	0.9667	0.8667	1	0.03333	0.06667	6.9%	3.33%	58	60
682.71		4	0.95	0.8667	1	0.03191	0.06383	6.72%	5.0%	57	60
869.86		4	0.9667	0.8667	1	0.03333	0.06667	6.9%	3.33%	58	60
1024.71		4	0.9667	0.8667	1	0.03333	0.06667	6.9%	3.33%	58	60
1234.29		4	1	1	1	0	0	0.0%	0.0%	60	60

Hatched Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	1	1	1	1
455.86		1	0.9333	1	1
556.29		1	1	1	0.8667
682.71		1	0.8667	0.9333	1
869.86		1	1	1	0.8667
1024.71		1	0.8667	1	1
1234.29		1	1	1	1

Hatched Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	15/15	15/15	15/15	15/15
455.86		15/15	14/15	15/15	15/15
556.29		15/15	15/15	15/15	13/15
682.71		15/15	13/15	14/15	15/15
869.86		15/15	15/15	15/15	13/15
1024.71		15/15	13/15	15/15	15/15
1234.29		15/15	15/15	15/15	15/15

Negative control -> site control with Cu

CETIS Analytical Report

Report Date: 03 Feb-17 11:55 (p 2 of 2)
Test Code: 161396b | 14-0200-4843

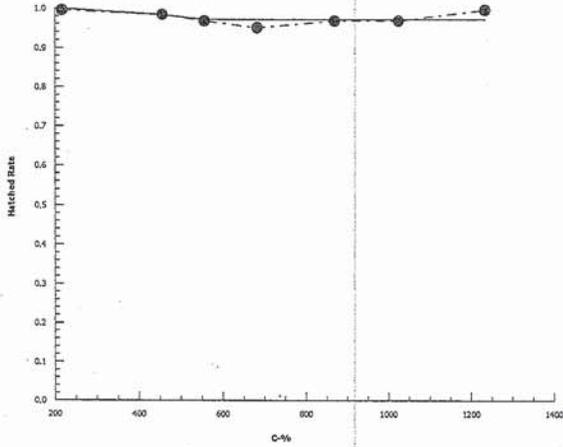
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 11-6516-5891 Endpoint: Hatched Rate
Analyzed: 03 Feb-17 11:55 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 15:59 (p 1 of 2)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 12-9296-9637	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:06	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	44259	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	318.7	228.3	N/A	0.3137	NA	0.4379
EC10	>1234	N/A	N/A	<0.08104	NA	NA
EC15	>1234	N/A	N/A	<0.08104	NA	NA
EC20	>1234	N/A	N/A	<0.08104	NA	NA
EC25	>1234	N/A	N/A	<0.08104	NA	NA
EC40	>1234	N/A	N/A	<0.08104	NA	NA
EC50	>1234	N/A	N/A	<0.08104	NA	NA

Survival Rate Summary

C-%	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
217.14	Negative Control	4	0.8333	0.7333	0.9333	0.04303	0.08607	10.33%	0.0%	50	60
455.86		4	0.5167	0.1333	0.8667	0.1524	0.3049	59.01%	38.0%	31	60
556.29		4	0.8333	0.7333	0.9333	0.04303	0.08607	10.33%	0.0%	50	60
682.71		4	0.7667	0.7333	0.8667	0.03333	0.06667	8.7%	8.0%	46	60
869.86		4	0.7833	0.5333	0.9333	0.08767	0.1753	22.38%	6.0%	47	60
1024.71		4	0.8167	0.8	0.8667	0.01667	0.03333	4.08%	2.0%	49	60
1234.29		4	0.8	0.6667	0.8667	0.04714	0.09428	11.79%	4.0%	48	60

Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	0.8	0.8667	0.9333	0.7333
455.86		0.4667	0.6	0.8667	0.1333
556.29		0.8	0.9333	0.8667	0.7333
682.71		0.8667	0.7333	0.7333	0.7333
869.86		0.8	0.5333	0.9333	0.8667
1024.71		0.8	0.8	0.8667	0.8
1234.29		0.8667	0.6667	0.8667	0.8

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	12/15	13/15	14/15	11/15
455.86		7/15	9/15	13/15	2/15
556.29		12/15	14/15	13/15	11/15
682.71		13/15	11/15	11/15	11/15
869.86		12/15	8/15	14/15	13/15
1024.71		12/15	12/15	13/15	12/15
1234.29		13/15	10/15	13/15	12/15

CETIS Analytical Report

Report Date: 25 Jan-17 15:59 (p 2 of 2)

Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

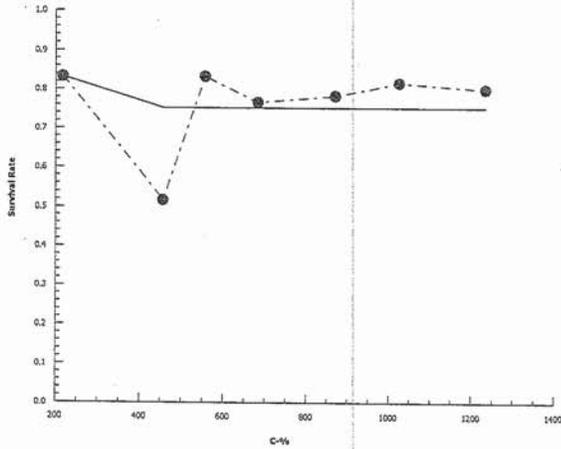
Nautilus Environmental

Analysis ID: 12-9296-9637
Analyzed: 20 Jan-17 11:06

Endpoint: Survival Rate
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 11:56 (p 1 of 2)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 04-2424-7235	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:06	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1898837	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	249.6	227.2	451.7	0.4006	0.2214	0.4402
IC10	287	236.8	N/A	0.3485	NA	0.4223
IC15	329.9	245.8	N/A	0.3032	NA	0.4068
IC20	379.2	253.9	N/A	0.2637	NA	0.3938
IC25	435.8	260.8	N/A	0.2295	NA	0.3834
IC40	>1234	N/A	N/A	<0.08104	NA	NA
IC50	>1234	N/A	N/A	<0.08104	NA	NA

Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
217.14	Negative Control	4	1.021	0.772	1.539	0.175	0.35	34.3%	0.0%
455.86		4	0.741	0.6593	0.7993	0.03047	0.06095	8.23%	27.39%
556.29		4	0.7218	0.6767	0.7927	0.02485	0.04971	6.89%	29.27%
682.71		4	0.6957	0.6407	0.774	0.02885	0.0577	8.3%	31.83%
869.86		4	0.7297	0.652	0.8153	0.03603	0.07207	9.88%	28.5%
1024.71		4	0.7465	0.714	0.76	0.01093	0.02186	2.93%	26.85%
1234.29		4	0.8585	0.6867	1.025	0.0705	0.141	16.42%	15.87%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	0.8793	0.8913	0.772	1.539
455.86		0.7727	0.7993	0.7327	0.6593
556.29		0.7053	0.6767	0.7127	0.7927
682.71		0.774	0.6407	0.7007	0.6673
869.86		0.6927	0.652	0.7587	0.8153
1024.71		0.7533	0.714	0.7587	0.76
1234.29		0.8947	0.6867	1.025	0.8273

CETIS Analytical Report

Report Date: 03 Feb-17 11:56 (p 2 of 2)
Test Code: 161396b | 14-0200-4843

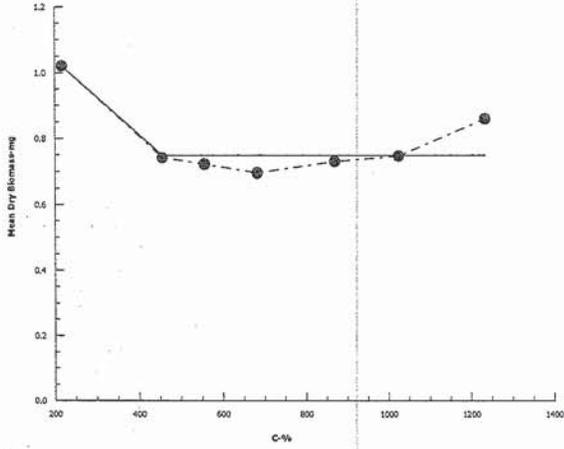
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 04-2424-7235 Endpoint: Mean Dry Biomass-mg
Analyzed: 20 Jan-17 11:06 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:03 (p 1 of 2)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 12-7070-4307	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:03	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	589598	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	705.1	390.7	809.9	0.1418	0.1235	0.2559
IC10	789.5	645.4	1501	0.1267	0.06662	0.1549
IC15	1084	628.5	N/A	0.09229	NA	0.1591
IC20	>1234	N/A	N/A	<0.08104	NA	NA
IC25	>1234	N/A	N/A	<0.08104	NA	NA
IC40	>1234	N/A	N/A	<0.08104	NA	NA
IC50	>1234	N/A	N/A	<0.08104	NA	NA

Length-mm Summary

Calculated Variate

C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
217.14	Negative Control	4	10	10	10	0	0	0.0%	0.0%
455.86		4	11	10	14	1	2	18.18%	-10.0%
556.29		4	10	10	10	0	0	0.0%	0.0%
682.71		4	10.25	10	11	0.25	0.5	4.88%	-2.5%
869.86		4	9	9	9	0	0	0.0%	10.0%
1024.71		4	9	9	9	0	0	0.0%	10.0%
1234.29		4	8.75	8	9	0.25	0.5	5.71%	12.5%

Length-mm Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	10	10	10	10
455.86		10	10	10	14
556.29		10	10	10	10
682.71		10	10	11	10
869.86		9	9	9	9
1024.71		9	9	9	9
1234.29		9	8	9	9

CETIS Analytical Report

Report Date: 25 Jan-17 16:03 (p 2 of 2)
Test Code: 161396b | 14-0200-4843

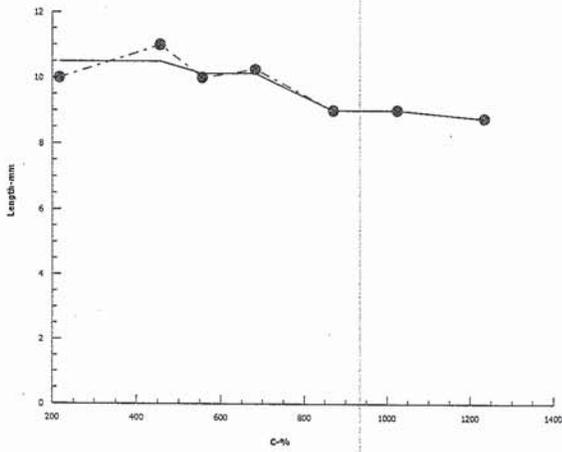
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 12-7070-4307 Endpoint: Length-mm
Analyzed: 25 Jan-17 16:03 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:00 (p 1 of 2)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test **Nautilus Environmental**

Analysis ID: 04-0347-1026	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:06	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2027745	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>1234	N/A	N/A	<0.08104	NA	NA
EC10	>1234	N/A	N/A	<0.08104	NA	NA
EC15	>1234	N/A	N/A	<0.08104	NA	NA
EC20	>1234	N/A	N/A	<0.08104	NA	NA
EC25	>1234	N/A	N/A	<0.08104	NA	NA
EC40	>1234	N/A	N/A	<0.08104	NA	NA
EC50	>1234	N/A	N/A	<0.08104	NA	NA

Proportion Normal Summary			Calculated Variate(A/B)									
C-%	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B	
217.14	Negative Control	4	1	1	1	0	0	0.0%	0.0%	50	50	
455.86		4	1	1	1	0	0	0.0%	0.0%	31	31	
556.29		4	1	1	1	0	0	0.0%	0.0%	50	50	
682.71		4	1	1	1	0	0	0.0%	0.0%	46	46	
869.86		4	1	1	1	0	0	0.0%	0.0%	47	47	
1024.71		4	1	1	1	0	0	0.0%	0.0%	49	49	
1234.29		4	1	1	1	0	0	0.0%	0.0%	48	48	

Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	1	1	1	1
455.86		1	1	1	1
556.29		1	1	1	1
682.71		1	1	1	1
869.86		1	1	1	1
1024.71		1	1	1	1
1234.29		1	1	1	1

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
217.14	Negative Control	12/12	13/13	14/14	11/11
455.86		7/7	9/9	13/13	2/2
556.29		12/12	14/14	13/13	11/11
682.71		13/13	11/11	11/11	11/11
869.86		12/12	8/8	14/14	13/13
1024.71		12/12	12/12	13/13	12/12
1234.29		13/13	10/10	13/13	12/12

CETIS Analytical Report

Report Date: 25 Jan-17 16:00 (p 2 of 2)
Test Code: 161396b | 14-0200-4843

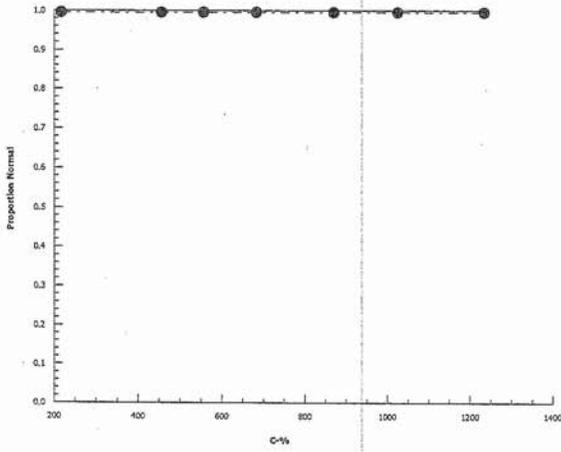
Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 04-0347-1026 Endpoint: Proportion Normal
Analyzed: 20 Jan-17 11:06 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 12:30 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 12-7776-3199	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 12:30	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes hatched rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
217.14		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
73.1	Lab Water	60	0	60	1	0	0.0%
217.14	Negative Contr	60	0	60	1	0	0.0%

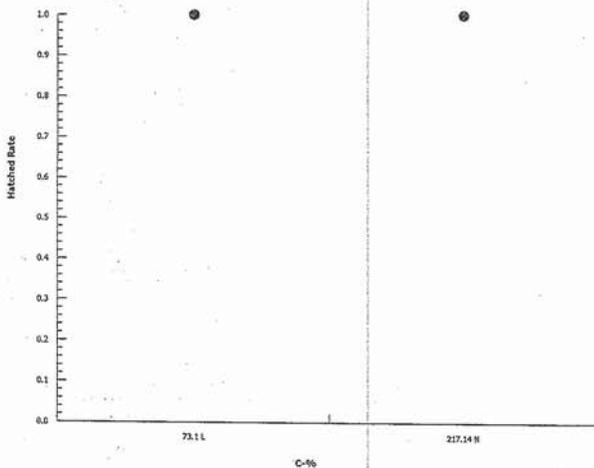
Hatched Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	1	1	1	1
217.14	Negative Control	1	1	1	1

Hatched Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	15/15	15/15	15/15	15/15
217.14	Negative Control	15/15	15/15	15/15	15/15

Graphics



Lab water = Lab control with Cu
 Negative control (= site control with Cu)

CETIS Analytical Report

Report Date: 03 Feb-17 12:44 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 16-3662-9229	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 12:44	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	40.7%	Passes mean dry biomass-mg

Unequal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
217.14	73.1	0.4034	2.353	0.415	3	0.3569	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.01012948	0.01012948	1	0.1627	0.7007	Non-Significant Effect
Error	0.3735242	0.06225404	6			
Total	0.3836537		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	61.56	47.47	0.0068	Unequal Variances
Distribution	Shapiro-Wilk W Normality	0.8161	0.6451	0.0424	Normal Distribution

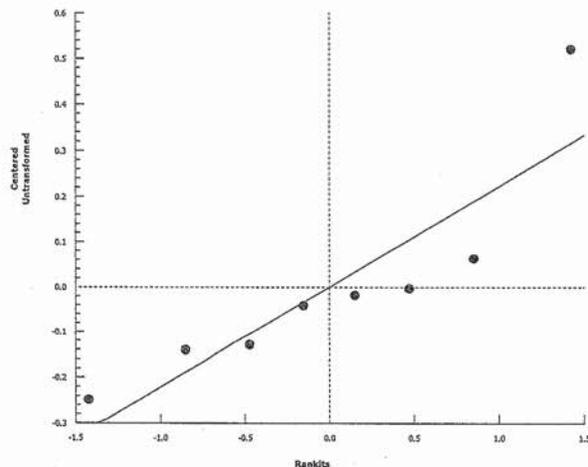
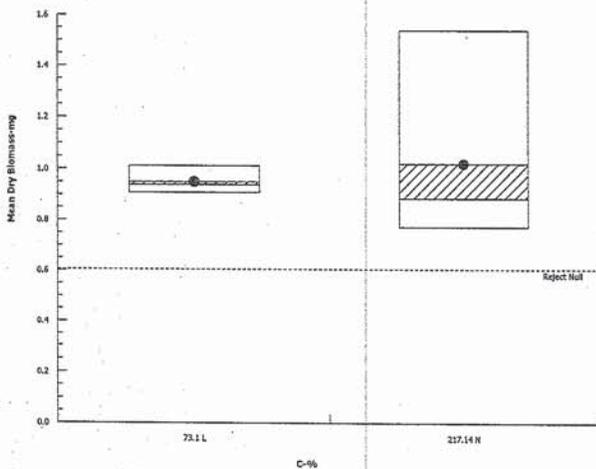
Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
73.1	Lab Water	4	0.9493	0.8783	1.02	0.9387	0.908	1.012	0.02231	4.7%	0.0%
217.14	Negative Control	4	1.021	0.4635	1.577	0.8853	0.772	1.539	0.175	34.3%	-7.5%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	0.946	0.9313	1.012	0.908
217.14	Negative Control	0.8793	0.8913	0.772	1.539

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:00 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 01-7138-6279	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:08	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes survival rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
217.14		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
73.1	Lab Water	51	9	60	0.85	0.15	-2.0%
217.14	Negative Contr	50	10	60	0.8333	0.1667	0.0%

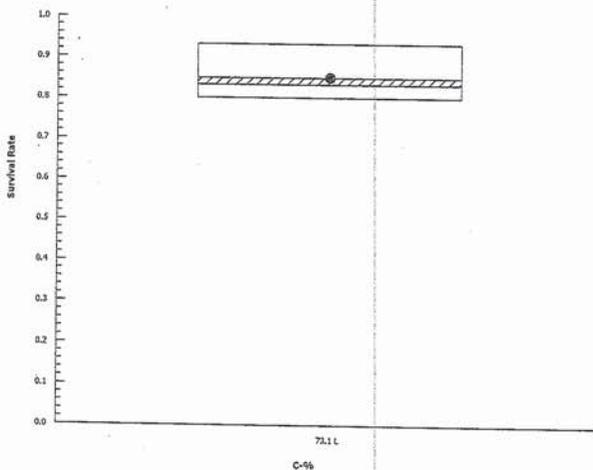
Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	0.8667	0.8	0.9333	0.8
217.14	Negative Control	0.8	0.8667	0.9333	0.7333

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	13/15	12/15	14/15	12/15
217.14	Negative Control	12/15	13/15	14/15	11/15

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:04 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 20-3694-0438	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:04	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	9.3%	Passes length-mm

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
217.14	73.1	1.567	1.943	0.930	6	0.0841	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	1.125	1.125	1	2.455	0.1682	Non-Significant Effect
Error	2.75	0.4583333	6			
Total	3.875		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	9	13.75	0.0240	Equal Variances
Variances	Levene Equality of Variance	13.5	13.75	0.0104	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8473	0.6451	0.0894	Normal Distribution

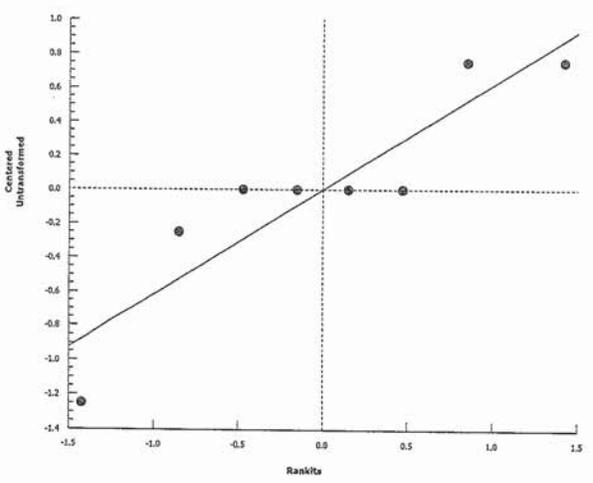
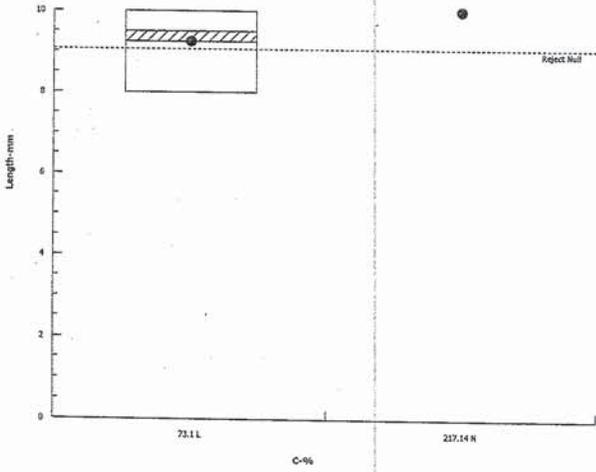
Length-mm Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
73.1	Lab Water	4	9.25	7.727	10.77	9.5	8	10	0.4787	10.35%	0.0%
217.14	Negative Control	4	10	10	10	10	10	10	0	0.0%	-8.11%

Length-mm Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	10	9	8	10
217.14	Negative Control	10	10	10	10

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:00 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 18-1751-9971	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 20 Jan-17 11:08	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
217.14		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
73.1	Lab Water	51	0	51	1	0	0.0%
217.14	Negative Contr	50	0	50	1	0	0.0%

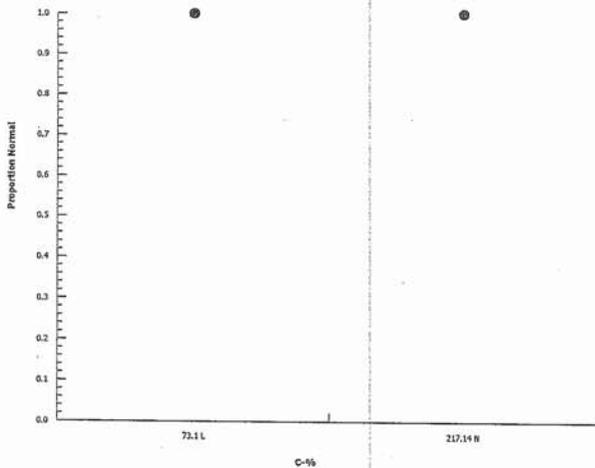
Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	1	1	1	1
217.14	Negative Control	1	1	1	1

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
73.1	Lab Water	13/13	12/12	14/14	12/12
217.14	Negative Control	12/12	13/13	14/14	11/11

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 12:01 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 04-2146-8640	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 12:01	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes hatched rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		217.14	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	56	4	60	0.9333	0.06667	0.0%
217.14	Negative Contr	60	0	60	1	0	-7.14%

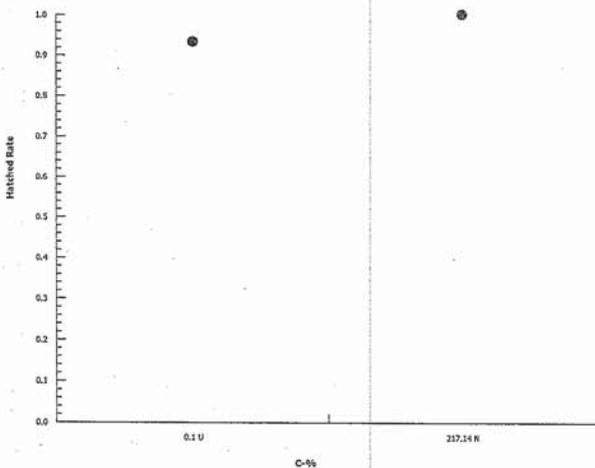
Hatched Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.8	0.9333	1	1
217.14	Negative Control	1	1	1	1

Hatched Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	12/15	14/15	15/15	15/15
217.14	Negative Control	15/15	15/15	15/15	15/15

Graphics



upstream control = site water without Cu
 Negative control = site water with Cu

CETIS Analytical Report

Report Date: 25 Jan-17 16:56 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 09-9015-5261	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:55	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes survival rate

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		217.14	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	13	47	60	0.2167	0.7833	0.0%
217.14	Negative Contr	50	10	60	0.8333	0.1667	-284.6%

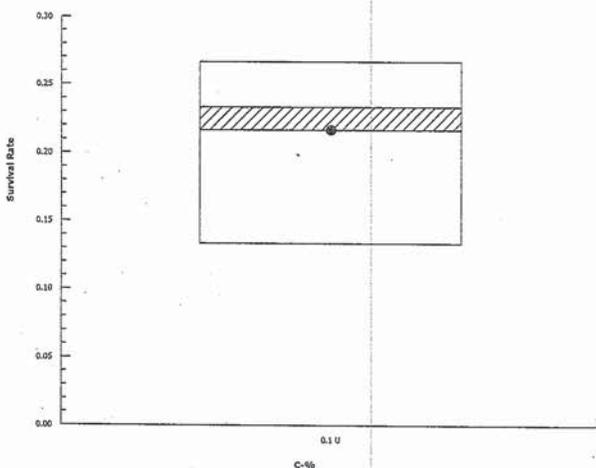
Survival Rate Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.2667	0.1333	0.2667	0.2
217.14	Negative Control	0.8	0.8667	0.9333	0.7333

Survival Rate Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	4/15	2/15	4/15	3/15
217.14	Negative Control	12/15	13/15	14/15	11/15

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:56 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 14-5446-2347	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:56	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	93.4%	Passes mean dry biomass-mg

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
0.1	217.14	-3.688	1.943	0.344	6	0.9949	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.8515216	0.8515216	1	13.6	0.0102	Significant Effect
Error	0.3755497	0.06259163	6			
Total	1.227071		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	45.97	47.47	0.0105	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8173	0.6451	0.0437	Normal Distribution

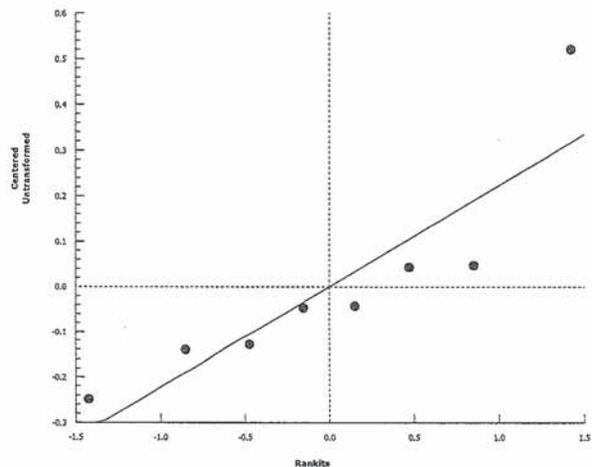
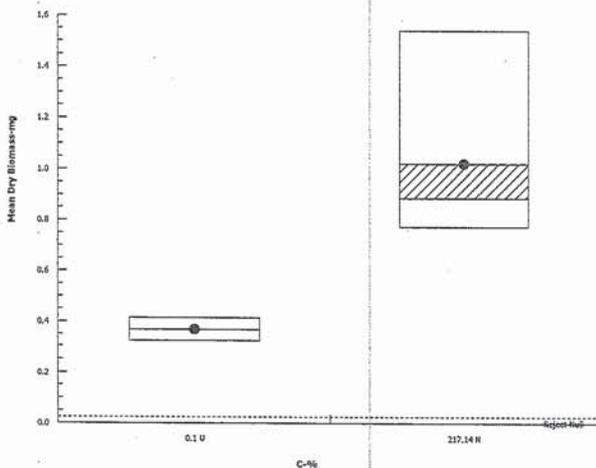
Mean Dry Biomass-mg Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.1	Upstream Contr	4	0.368	0.2858	0.4501	0.368	0.3213	0.4147	0.02581	14.03%	0.0%
217.14	Negative Control	4	1.021	0.4635	1.577	0.8853	0.772	1.539	0.175	34.3%	-177.3%

Mean Dry Biomass-mg Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	0.4107	0.3213	0.4147	0.3253
217.14	Negative Control	0.8793	0.8913	0.772	1.539

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:56 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 04-1927-9168	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:56	Analysis: Nonparametric-Two Sample	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.93%	Passes length-mm

Wilcoxon Rank Sum Two-Sample Test

Control	vs Control	Test Stat	Critical	Ties	DF	P-Value	P-Type	Decision(α:5%)
0.1	217.14	18	NA	1	6	0.7143	Exact	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	1	0	1.0000	Non-Significant Effect
Error	2	0.3333333	6			
Total	2		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Mod Levene Equality of Variance	3	13.75	0.1340	Equal Variances
Variances	Levene Equality of Variance	3	13.75	0.1340	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.7322	0.6451	0.0052	Non-normal Distribution

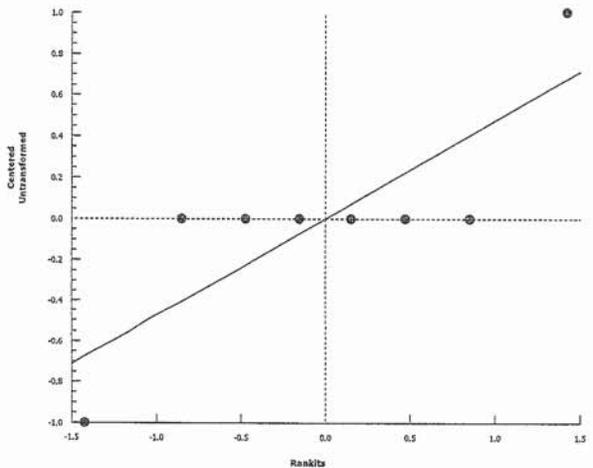
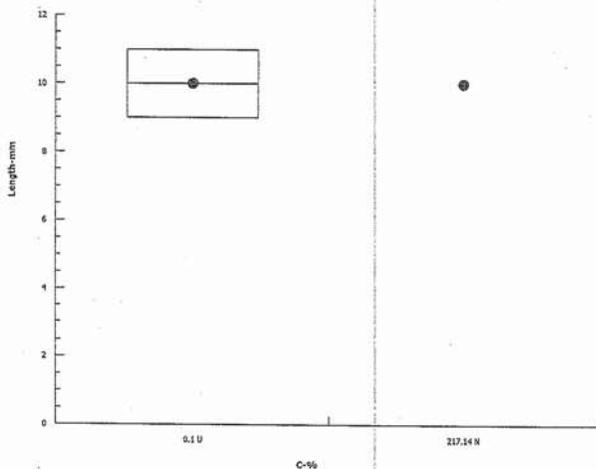
Length-mm Summary

C-%	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0.1	Upstream Contr	4	10	8.701	11.3	10	9	11	0.4082	8.17%	0.0%
217.14	Negative Control	4	10	10	10	10	10	10	0	0.0%	0.0%

Length-mm Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	10	11	10	9
217.14	Negative Control	10	10	10	10

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:56 (p 1 of 1)
 Test Code: 161396b | 14-0200-4843

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 05-8489-5926	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:56	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 15-4012-3439	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent: GH_FR1
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 05-7317-6432	Code: 2229FA70	Client: Teck Coal
Sample Date: 25 Oct-16	Material: Water Sample	Project:
Receive Date: 25 Oct-16 12:30	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 14h	Station: GH_FR1	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
0.1		217.14	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-%	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0.1	Upstream Contr	13	0	13	1	0	0.0%
217.14	Negative Contr	50	0	50	1	0	0.0%

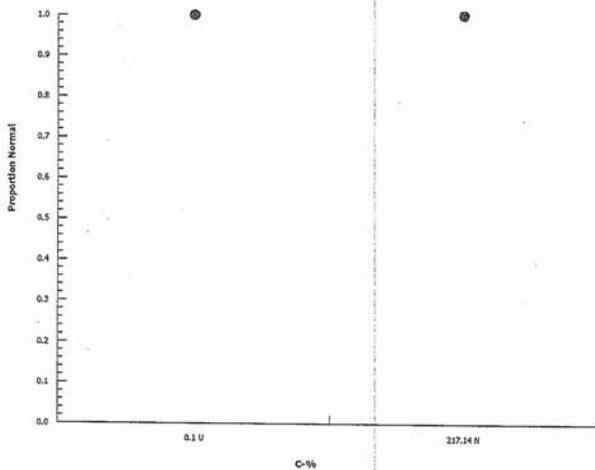
Proportion Normal Detail

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	1	1	1	1
217.14	Negative Control	1	1	1	1

Proportion Normal Binomials

C-%	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.1	Upstream Contr	4/4	2/2	4/4	3/3
217.14	Negative Control	12/12	13/13	14/14	11/11

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 16:04 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 13-7631-9657	Endpoint: Hatched Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 10:55	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4 / GH-FR1 / GH-ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes hatched rate

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Unamended Sampl		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Unamended Sa	59	1	60	0.9833	0.01667	0.0%
73.1	Lab Water	60	0	60	1	0	-1.7%

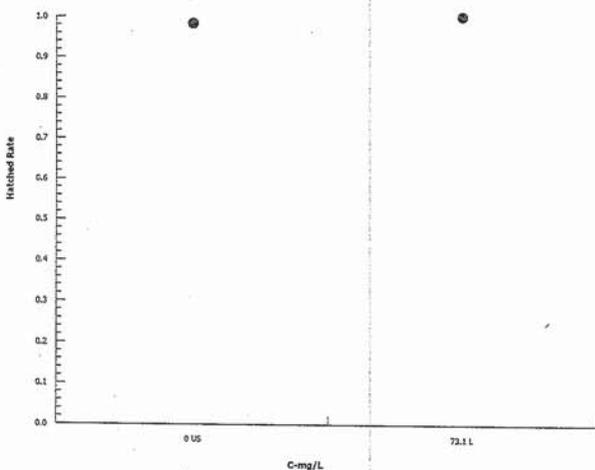
Hatched Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9333	1	1	1
73.1	Lab Water	1	1	1	1

Hatched Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	14/13	15/15	15/15	15/15
73.1	Lab Water	15/15	15/15	15/15	15/15

Graphics



Lab control without Cu Rep A hatched rate is calculated with initial # exposed eggs as 15, even though 2 fish were lost on Day 6 of test. All other analyses were run with initial # exposed as 13 eggs.

unamended sample = lab control without Cu
 Lab water = lab control with Cu

CETIS Analytical Report

Report Date: 03 Feb-17 16:08 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 11-5729-4898	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 16:07	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4 / GH-PR / GH-ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes survival rate

Fisher Exact Test

Control vs C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Unamended Sampl 73.1	0.3157	0.3157	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Unamended Sa	52	6	58	0.8966	0.1034	0.0%
73.1	Lab Water	51	9	60	0.85	0.15	5.19%

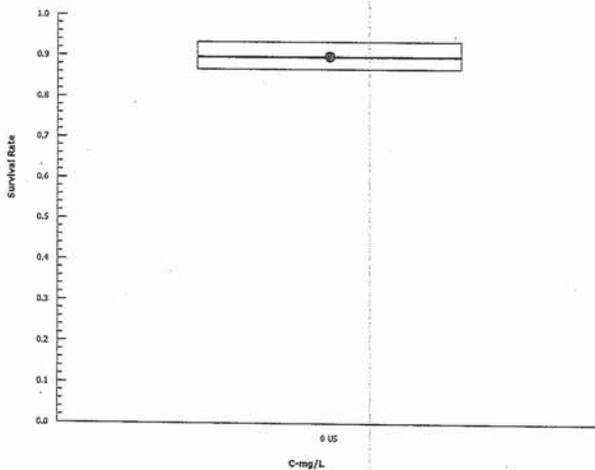
Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	0.9231	0.8667	0.8667	0.9333
73.1	Lab Water	0.8667	0.8	0.9333	0.8

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/13	13/15	13/15	14/15
73.1	Lab Water	13/15	12/15	14/15	12/15

Graphics



CETIS Analytical Report

Report Date: 03 Feb-17 16:12 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 06-0159-7729	Endpoint: Mean Dry Biomass-mg	CETIS Version: CETISv1.8.7
Analyzed: 03 Feb-17 16:11	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Sulphate	Project:
Receive Date: 26 Oct-16 11:45	Source: Teck Coal (TECK COAL)	
Sample Age: 9d 5h	Station: EV_ER4 / GH-FR1 / GH-FR2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	13.4%	Passes mean dry biomass-mg

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Unamended Sampl	73.1	-0.788	1.943	0.121	6	0.7697	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.004777025	0.004777025	1	0.621	0.4607	Non-Significant Effect
Error	0.04615495	0.007692492	6			
Total	0.05093198		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	6.73	47.47	0.1517	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9651	0.6451	0.8574	Normal Distribution

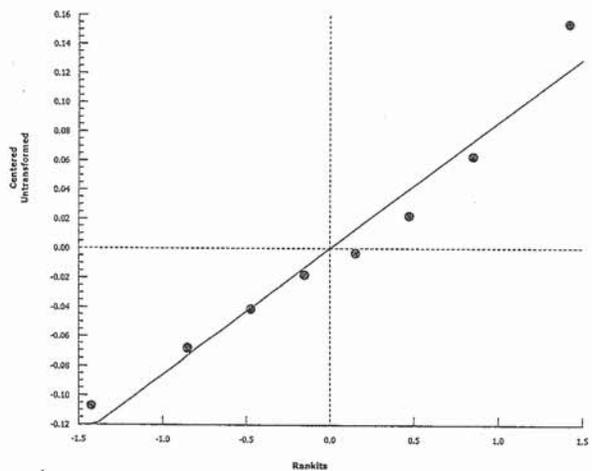
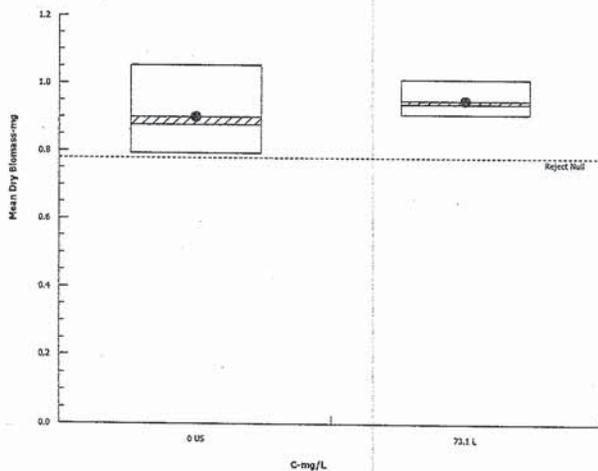
Mean Dry Biomass-mg Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Unamended Sa	4	0.9005	0.7163	1.085	0.8773	0.7933	1.054	0.05787	12.85%	0.0%
73.1	Lab Water	4	0.9493	0.8783	1.02	0.9387	0.908	1.012	0.02231	4.7%	-5.43%

Mean Dry Biomass-mg Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1.054	0.7933	0.832	0.9227
73.1	Lab Water	0.946	0.9313	1.012	0.908

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:40 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 11-4468-9775	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:40	Analysis: Parametric-Two Sample	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16 ⁰⁵³⁵ 01 Nov-16 ^{01 25/16}	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: ^{02h} 02h ^{01 26/16} ₁₄₅	Station: EV_ER4/GH-FRI/GH-ER2	

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	11.3%	Passes length-mm

Equal Variance t Two-Sample Test

Control	vs Control	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Unamended Sampl	73.1	0	1.943	1.049	6	0.5000	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	1	0	1.0000	Non-Significant Effect
Error	3.5	0.5833333	6			
Total	3.5		7			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Variance Ratio F	3.667	47.47	0.3142	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.8272	0.6451	0.0555	Normal Distribution

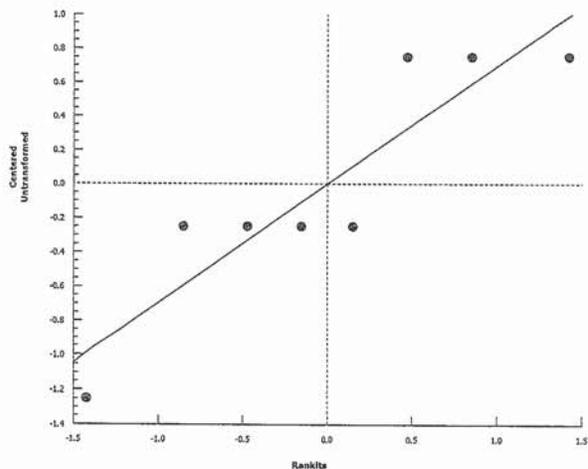
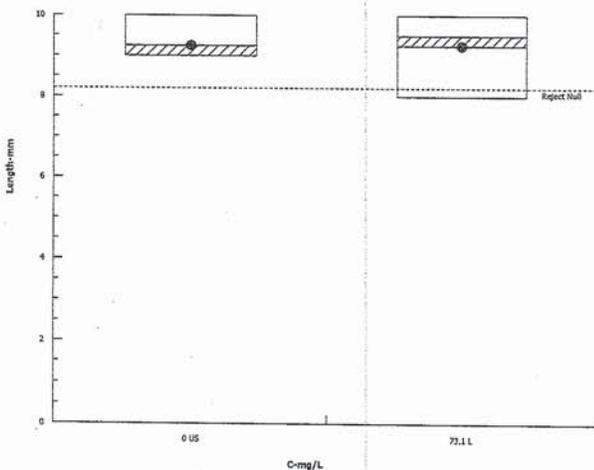
Length-mm Summary

C-mg/L	Control Type	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	Unamended Sa	4	9.25	8.454	10.05	9	9	10	0.25	5.41%	0.0%
73.1	Lab Water	4	9.25	7.727	10.77	9.5	8	10	0.4787	10.35%	0.0%

Length-mm Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	10	9	9	9
73.1	Lab Water	10	9	8	10

Graphics



CETIS Analytical Report

Report Date: 25 Jan-17 16:41 (p 1 of 1)
 Test Code: 161396a | 04-0134-6493

Fathead Minnow 32-d Survival and Growth Test

Nautilus Environmental

Analysis ID: 04-5594-6896	Endpoint: Proportion Normal	CETIS Version: CETISv1.8.7
Analyzed: 25 Jan-17 16:40	Analysis: Single 2x2 Contingency Table	Official Results: Yes
Batch ID: 02-1000-6674	Test Type: Survival-Development-Growth	Analyst: Karen Lee
Start Date: 03 Nov-16 14:00	Protocol: ASTM E1241-05 (2013)	Diluent:
Ending Date: 05 Dec-16 11:00	Species: Pimephales promelas	Brine:
Duration: 31d 21h	Source: Aquatox, AR	Age:
Sample ID: 03-8761-9869	Code: 171A9C1D	Client: Teck Coal
Sample Date: 01 Nov-16	Material: Sulphate	Project:
Receive Date: 02 Nov-16 10:30	Source: Teck Coal (TECK COAL)	
Sample Age: 62h	Station: EV_ER4 (GH-FR/GH-ER2)	

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	Passes proportion normal

Fisher Exact Test

Control	vs	C-mg/L	Test Stat	P-Value	P-Type	Decision(α:5%)
Unamended Sampl		73.1	1	1.0000	Exact	Non-Significant Effect

Data Summary

C-mg/L	Control Type	NR	R	NR + R	Prop NR	Prop R	%Effect
0	Unamended Sa	52	0	52	1	0	0.0%
73.1	Lab Water	51	0	51	1	0	0.0%

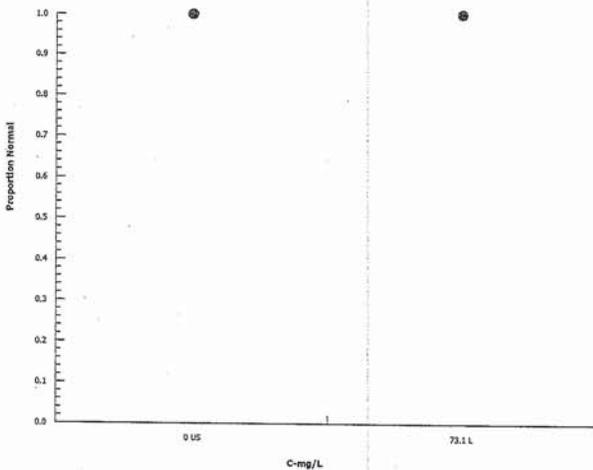
Proportion Normal Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	1	1	1	1
73.1	Lab Water	1	1	1	1

Proportion Normal Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0	Unamended Sa	12/12	13/13	13/13	14/14
73.1	Lab Water	13/13	12/12	14/14	12/12

Graphics



APPENDIX C – *Oncorhynchus mykiss* Toxicity Test Data

Embryo-Alevin Test Summary Sheet

Client: Teck (SO4 testing)
 Work Order No.: 161183

Test Date: November 1 - November 29, 2016
 Test Species: Oncorhynchus mykiss

Sample Information:

Sample ID: Various - see table below
 Sample Date: October 25, November 1, November 8 & November 15, 2016
 Date Received: October 26, November 2, November 9 & November 16, 2016
 Sample Volume: (1 - 4) x 200 L per refresh

Dilution Water:

Type: Dechlorinated Tap Water
 Hardness (mg/L CaCO₃): 7 - 9
 Alkalinity (mg/L CaCO₃): 2 - 5

Test Organism Information:

Batch No: 110116
 Source: Vancouver Island Trout Hatchery, Duncan, BC Number male broodstock used: 3
 Loading Density: 1.22 g / L Number female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE90
 Stock Solution ID: 16SO2 (1000 mg/L SDS)
 Date Initiated: November 1, 2016
 7-d EC50 (95% CL): 7.5 (7.4 - 7.5) mg/L SDS

Reference Toxicant Mean and Range: 4.0 (2.1 - 7.6) mg/L SDS
 Reference Toxicant CV (%): 38

Test Results:

Sample ID	Survival (%) (Mean ± SD)	Viability (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet weight (mg) (Mean ± SD)
Control	79.04 ± 10.53	71.53 ± 15.11	17.95 ± 1.31	98.13 ± 13.18
GH_ER2	69.04 ± 19.52 *	61.43 ± 21.22 *	16.91 ± 1.12	96.59 ± 9.24
EV_ER4	79.03 ± 13.54	72.30 ± 19.42	17.72 ± 1.22	100.50 ± 13.84
GH_FR1	62.58 ± 19.27 *	58.39 ± 19.22 *	18.34 ± 1.48	94.37 ± 10.82

* Indicates results that were significantly lower relative to laboratory control

Sample ID - EV_ER4_WS_2016-10-25_N				
	Survival	Normality (Viability)	Length	Wet weight
EC25 (mg/L SO4) (95% CL)	792.10 (543.70 - N/A)	865.20 (519.80 - N/A)	-	-
EC50 (mg/L SO4) (95% CL)	>1008.00	>1008.00	-	-
IC25 (mg/L SO4) (95% CL)	-	-	>1008.00	>1008.00
IC50 (mg/L SO4) (95% CL)	-	-	>1008.00	>1008.00

Sample ID - GH_FR1_WS_2016-10-25_N				
	Survival	Normality (Viability)	Length	Wet weight
EC25 (mg/L SO4) (95% CL)	850.50 (N/A)	860.50 (N/A)	-	-
EC50 (mg/L SO4) (95% CL)	993.40 (N/A)	>1001.00	-	-
IC25 (mg/L SO4) (95% CL)	-	-	>1001.00	>1001.00
IC50 (mg/L SO4) (95% CL)	-	-	>1001.00	>1001.00

Reviewed by: JGh

Date reviewed: Feb. 15/17

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: various
 Work Order #: 161183

Start Date & Time: November 1 10:16e 1620h
 Stop Date & Time: Nov 29/16 e 1020h
 Test Species: Oncorhynchus mykiss

Low Control Concentration	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	15.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.1		9.7		9.5	9.8	9.8		9.7		9.6	9.9	9.5	
pH	7.2		6.9		6.7	6.8	6.9		7.1		7.0	7.0	7.0	
Cond. (µS/cm)	30	32		33		28		29		30		29		
Initials	KL	YML		KL		KL		KL		KL		YML		

GH ERZ Concentration (unamended)	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.5		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.4		9.6		9.5	10.0	9.8		9.8		9.7	9.8	9.7	
pH	8.1		8.0		8.1	8.2	8.1		8.2		8.2	8.2	8.1	
Cond. (µS/cm)	312	316		314		314		314		314		312		
Initials	YML	YML		KL		KL		KL		KL		YML		

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

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

Thermometer: CER-9 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C2/3

	Control	GH ERZ HOOP (unamended)	KL
Hardness*	9	167-16 ^{KL}	
Alkalinity*	4	147	

Analysts: AWB, YML, KL

Reviewed by: JCA
 Date reviewed: Jan. 25/17

* mg/L as CaCO3

Sample Description: (clear, odourless), odourless, no particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EVER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

EVER4 Concentration (unamended)	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.8		9.7	9.9	9.8		9.8		9.7	9.6	9.7
pH	8.1		8.1		8.1	8.2	8.2		8.2		8.3	8.2	8.2
Cond. (µS/cm)	468		475		472	466		465		477		473	
Initials	KL		VMC		KL		KL		A		KL		VMC

400 Concentration mg/L SO4	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.8		9.8	9.8	9.8		9.7		9.7	9.8	9.8
pH	8.0		8.0		8.1	8.1	8.2		8.3		8.3	8.2	8.2
Cond. (µS/cm)	1014		1012		1015	1013		1015		1018		1013	
Initials	KL		VMC		KL		KL		A		KL		VMC

480 Concentration mg/L SO4	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.7		9.8	9.8	9.8		9.8		9.7	9.5	9.8
pH	8.0		8.0		8.1	8.2	8.2		8.3		8.3	8.2	8.2
Cond. (µS/cm)	1014		1133		1136	1134		1135		1138		1133	
Initials	KL		VMC		KL		KL		A		KL		VMC

576 Concentration mg/L SO4	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.8		9.8	9.9	9.8		9.8		9.7	9.7	9.9
pH	8.0		8.0		8.1	8.2	8.2		8.3		8.3	8.1	8.2
Cond. (µS/cm)	1268		1271		1271	1269		1271		1274		1271	
Initials	KL		VMC		KL		KL		A		KL		VMC

Thermometer: CER-9 DO meter: DO-213 pH meter: PH-113 Conductivity meter: C-213

	Control	EVER4 (unamended)	EVER4 (100mg/L)	480mg/L SO4	576mg/L SO4
Hardness*	218-52	214	249	576-81	692-55
Alkalinity*	4	163			

Analysts: AWD, VMC, KL
 Reviewed by: JGA
 Date reviewed: Jan 25/17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 9/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.6		14.5	15.0	14.8
DO (mg/L)	10.3		9.8		9.8	9.9	9.8		9.7		9.7	9.7	9.9
pH	8.0		8.0		8.1	8.2	8.2		8.3		8.3	8.2	8.2
Cond. (µS/cm)	1431		1436		1435	1431		1434		1438		1433	
Initials	K	MM		K		K		A		K		MM	

829 Concentration mg/L SO ₄	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.6		9.8	9.9	9.8		9.8		9.7	9.9	9.8
pH	8.1		8.0		8.1	8.2	8.1		8.2		8.3	8.2	8.2
Cond. (µS/cm)	1619		1628		1627	1626		1628		1637		1631	
Initials	K	MM		K		K		A		K		MM	

995 Concentration mg/L SO ₄	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.6		14.5	15.0	14.5
DO (mg/L)	10.3		9.7		9.8	9.9	9.8		9.8		9.7	9.8	9.8
pH	8.0		8.0		8.1	8.2	8.1		8.3		8.3	8.2	8.2
Cond. (µS/cm)	1814		1824		1818	1824	1826		1826		1834	1836	1829
Initials	K	MM		K		K		A		K		MM	

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

Thermometer: CER-9 DO meter: DO-213 pH meter: PH-113 Conductivity meter: C-213

	Control	<u>EV-ER4 (100%)</u>	(unamended)	<u>K</u>
Hardness*	9	219		
Alkalinity*	4	163		

* mg/L as CaCO₃

Analysts: AWD, MML, K

Reviewed by: Joe

Date reviewed: Jan-25/17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FRI
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

GH-FRI Concentration (unamended)	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.7		9.8	10.0	9.8		9.8		9.7	9.6	9.9
pH	8.0		8.1		8.2	8.3	8.1		8.2		8.4	8.1	8.3
Cond. (µS/cm)	804		814		804	799		801		810		813	
Initials	KC	MML		K		K		A		K		YML	

400 Concentration mg/L SO ₄	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.8		9.8	9.7	9.8		9.7		9.7	9.9	10.0
pH	8.1		8.1		8.2	8.3	8.1		8.2		8.4	8.2	8.3
Cond. (µS/cm)	1086		1090		1092	1085		1089		1093		1083	
Initials	KC	MML		K		K		A		K		MML	

480 Concentration mg/L SO ₄	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.7		9.8	9.8	9.8		9.8		9.7	9.7	9.9
pH	8.1		8.1		8.2	8.3	8.1		8.2		8.4	8.2	8.3
Cond. (µS/cm)	1204		1206		1206	1202		1205		1209		1194	
Initials	KC	MML		K		K		A		K		MML	

576 Concentration mg/L SO ₄	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.7		9.8	9.8	9.8		9.8		9.7	9.9	9.9
pH	8.2		8.1		8.2	8.3	8.1		8.2		8.4	8.2	8.3
Cond. (µS/cm)	1347		1352		1351	1346		1350		1353		1342	
Initials	KC	MML		K		K		A		K		MML	

Thermometer: CER-9 DO meter: DO-213 pH meter: PH-113 Conductivity meter: C-213

	Control	GH-FRI (400) K 445-448	(unamended)	K
Hardness*	9			
Alkalinity*	4	193		

Analysts: A.D. MML, K
 Reviewed by: JGL
 Date reviewed: Jan-25/17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29 16:2 1030h
 Test Species: Oncorhynchus mykiss

Concentration mg/L SO ₄	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.3		9.7		9.8	9.8	9.8		9.8		9.7	9.7	9.9	
pH	8.2		8.1		8.2	8.3	8.1		8.2		8.4	8.2	8.3	
Cond. (µS/cm)	1507		1516		1512	1506		1510		1518		1498		
Initials	YML		YML		K	K		A		K		YML		

Concentration mg/L SO ₄	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.2		9.8		9.8	9.8	9.8		9.8		9.7	9.7	10.0	
pH	8.1		8.1		8.2	8.2	8.1		8.2		8.4	8.2	8.3	
Cond. (µS/cm)	1698		1710		1700	1696		1699		1708		1700		
Initials	KL		YML		K	K		A		K		YML		

Concentration mg/L SO ₄	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.0		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.3		9.8		9.8	9.8	9.8		9.8		9.7	9.5	9.9	
pH	8.1		8.1		8.2	8.2	8.1		8.1		8.4	8.2	8.3	
Cond. (µS/cm)	1885		1901		1893	1906		1910		1913		1912		
Initials	KL		YML		K	K		A		K		YML		

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

Thermometer: CER-9 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH FR1 (unamended)	
Hardness*	9	1435 448	
Alkalinity*	4	193	

Analysts: AND, YML, KL
 Reviewed by: JBL
 Date reviewed: Jan. 25/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: various
 Work Order #: 161183

Start Date & Time: Nov 11/16 e 1620h
 Stop Date & Time: Nov 29/16 e 1030h
 Test Species: Oncorhynchus mykiss

Low control Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	9.9	9.8		9.7	9.9	9.8		9.8		10.0	10.2	9.8
pH		6.9	7.0	6.8		6.9	7.0	6.9		7.2		6.8	7.1	7.2
Cond. (µS/cm)		30	30			29	28			28		32		27
Initials		W		W		WML	WML			A		A		WML

CH-ER2 Concentration (unamended)	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.2	15.0		15.0	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.0	9.9		9.8		10.1	10.1	9.9
pH		8.0	8.1	8.2		8.1	8.1	8.1		8.2		8.1	8.3	8.2
Cond. (µS/cm)		314	307			313	311			311		315		311
Initials		W		WML		WML	WML			A		A		WML

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-9 DO meter: DO-2/3 pH meter: PH-113 Conductivity meter: C-2/3

	Control	CH-ER2 (unamended)	(unamended)
Hardness*	7	179	
Alkalinity*	5	146	

Analysts: A, W, M, L, W
 Reviewed by: Jfb
 Date reviewed: Jan 25/17

* mg/L as CaCO3

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TECL
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: Nov 11/16 1620h
 Stop Date & Time: Nov 29/16 1030h
 Test Species: Oncorhynchus mykiss

EV-ER4 Concentration (unamended)	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.5	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	9.7	9.8		10.1		10.0	10.1	9.8
pH		8.1	8.1	8.1		8.0	8.2	8.1		8.1		8.1	8.2	8.2
Cond. (µS/cm)		472	464		470		471		468		472		469	
Initials		KL	YML		YML		YML		A		A		YML	

400 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.8	9.9	9.7		10.0		10.0	10.0	9.9
pH		8.1	8.1	8.1		8.0	8.2	8.1		8.1		8.1	8.2	8.2
Cond. (µS/cm)		1020	472	1007		1017		1002		1006		1019		1009
Initials		KL	A	YML		YML		YML		A		A		YML

480 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	9.8	9.7		10.0		10.1	10.0	9.8
pH		8.1	8.1	8.1		8.0	8.1	8.1		8.2		8.1	8.2	8.2
Cond. (µS/cm)		1137		1094		1115		1136		1129		1139		1141
Initials		KL		YML		YML		YML		A		A		YML

576 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		10.0	10.0	9.7		10.0		10.1	10.1	9.9
pH		8.1	8.1	8.1		8.0	8.1	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		126	1275	1268		1279		1274		1269		1289		1278
Initials		KL		A		YML		YML		A		A		YML

Thermometer: CE-9 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	EV-ER4 (100%)	Unamended
Hardness*	7	257	
Alkalinity*	5	162	

Analysts: AND, YML, KL

Reviewed by: JOU

Date reviewed: Jan. 25/17

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TecU
 Sample ID: EV-EP4
 Work Order #: 161183

Start Date & Time: Nov 11/16 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5 th	13.0	13.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	12.3	9.8		9.9	10.1	9.9		10.1		10.0	9.9	10.0
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		1441		1446		1453		1462		1452		1468		1461
Initials		ku		YML		YML		YML		A		A		YML

829 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5 th	13.0	13.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	12.3	9.8		9.9	10.0	9.8		10.0		10.1	9.9	10.0
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.2	8.2	8.3
Cond. (µS/cm)		1637		1609		1628		1620		1623		1640		1627
Initials		ku		YML		YML		YML		A		A		YML

995 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5 th	13.0	13.0		14.5	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	12.3	9.8		10.0	9.9	9.9		10.0		9.9	9.8	10.0
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.2	8.2	8.3
Cond. (µS/cm)		1835		1831		1841		1852		1845		1860		1857
Initials		ku		YML		YML		YML		A		A		YML

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials		ku												

Thermometer: CER-9 DO meter: DO-2/3 pH meter: HI-1/3 Conductivity meter: C-2/3

	Control	<u>EV-EP4 (unamended)</u>	<u>ku</u>
Hardness*	7	257	
Alkalinity*	5	162	

Analysts: AWO, YML, ku

Reviewed by: John
 Date reviewed: Jan. 28/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FP1
 Work Order #: 161183

Start Date & Time: Nov 16 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

GH-FP1 Concentration (unamended)	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.5	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		10.0	12.3	9.8		9.8	9.7	9.9		10.1		10.1	10.1	10.0
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		811	792			809		812		805		812	812	812
Initials		KL	YML			YML		YML		A		A		YML

400 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.5	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		10.0	12.3	9.8		9.8	9.7	10.0		10.1		10.1	10.1	10.0
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		1090	1075			1066		1075		1081		1107	1085	1085
Initials		KL	YML			YML		YML		A		A		YML

480 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.5	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	12.3	9.9		9.9	9.8	10.0		10.1		10.0	10.0	10.0
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		1203	1195			1213		1197		1203		1215	1189	1189
Initials		KL	YML			YML		YML		A		A		YML

576 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	13.0		14.5	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		10.0	12.3	9.9		10.0	9.8	9.9		10.3		10.1	10.0	10.1
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.2		8.1	8.2	8.2
Cond. (µS/cm)		1348	1328			1342		1330		1339		1350	1335	1335
Initials		KL	YML			YML		YML		A		A		YML

Thermometer: CGR-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH-FP1 (100%)	(unamended)	KL
Hardness*	7	465		
Alkalinity*	5	192		

Analysts: AWD, YML, KL

Reviewed by: JGL

Date reviewed: Jan 25/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TECC
 Sample ID: AH-FR1
 Work Order #: 161183

Start Date & Time: Nov 11/16 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.5	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		10.0	10.3	9.9		9.9	9.6	9.7		10.1		10.0	9.8	10.1
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		1513		1501		1522		1507		1509		1527		1514
Initials		ku		YML		YML		YML		A		A		YML

829 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		14.5	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		9.9	12.9	9.9		9.9	9.8	9.9		10.0		10.0	9.9	10.1
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		1705		1682		1710		1674		1692		1715		1693
Initials		ku		YML		YML		YML		A		A		YML

995 Concentration mg/L SO ₄	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		14.5	14.0	14.5		15.0		15.0	15.0	14.5
DO (mg/L)		9.9	10.3	9.8		9.8	9.6	9.9		10.0		10.1	9.8	10.1
pH		8.1	8.1	8.2		8.1	8.2	8.1		8.2		8.2	8.2	8.2
Cond. (µS/cm)		1928		1920		1925		1925		1918		1940		1935
Initials		ku		YML		YML		YML		A		A		YML

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-9 DO meter: DD-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	AH-FR1 (unamended)	
Hardness*	7	465	
Alkalinity*	5	192	

Analysts: AWD, YML, ku

Reviewed by: JGU
 Date reviewed: Jan-25/17

* mg/L as CaCO₃

Sample Description: Clear, colorless, odorless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: various
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Lab Control Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.0	14.5		14.5	14.5	14.5		14.5		14.5	14.5	14.5
DO (mg/L)		10.1	10.1	10.0		9.8	9.9	9.6		9.5		9.7	10.0	9.6
pH		6.8	7.0	6.9		7.0	7.0	7.1		7.1		6.9	6.5	7.2
Cond. (µS/cm)		29		28		27		28		28		29		27
Initials		YML		YML		YML		YML		A		A		KL

GH-ER2 Concentration (unamended)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		10.1	10.2	10.0		9.8	9.6	9.5		9.8		9.9	9.5	9.7
pH		8.0	7.7	8.0		7.9	8.0	8.0		8.1		8.2	7.8	8.1
Cond. (µS/cm)		314		310		310	306	306		309		313		324
Initials		YML		YML		YML		YML		A		A		YML

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-9 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-ER2 (unamended)	in
Hardness*	7	182	
Alkalinity*	2	149	

Analysts: AWD, YML, KL
 Reviewed by: JBL
 Date reviewed: Jan. 25/17

Sample Description: Clear colourless, odourless, fine particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

EV-ER4 Concentration (unamended)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.6		14.5		14.5	14.5	14.5
DO (mg/L)		10.0	10.3	10.0		9.8	9.9	9.6		9.8		9.7	9.6	9.6
pH		8.1	7.9	8.0		7.9	7.9	8.0		8.2		8.2	7.9	8.1
Cond. (µS/cm)		473		470		474		468		471		472		467
Initials		YML		YML		K		YML		A		A		K

400 Concentration mg/L SO ₄	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.6		14.5		14.5	15.0	14.5
DO (mg/L)		10.0	10.1	9.9		9.8	9.6	9.7		9.8		9.9	9.6	9.7
pH		8.1	8.0	8.0		8.0	8.1	8.0		8.3		8.3	8.0	8.1
Cond. (µS/cm)		1018		1007		1017		991		1000		1000	1004	1004
Initials		YML		YML		K		YML		A		A		K

480 Concentration mg/L SO ₄	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.7		14.6		14.6	15.0	14.5
DO (mg/L)		10.2	10.2	9.9		9.8	9.7	9.6		9.8		9.9	9.7	9.7
pH		8.1	8.0	8.0		8.1	8.1	8.0		8.2		8.2	8.0	8.1
Cond. (µS/cm)		1144		1139		1145		1131		1134		1139		1139
Initials		YML		YML		K		YML		A		A		K

576 Concentration mg/L SO ₄	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.6		14.5		14.6	15.0	14.5
DO (mg/L)		10.1	10.2	9.9		9.8	9.6	9.7		9.7		9.8	9.7	9.7
pH		8.1	8.0	8.0		8.1	8.0	8.0		8.1		8.2	8.0	8.0
Cond. (µS/cm)		1284		1279		1283		1272		1278		1279		1277
Initials		YML		YML		K		YML		A		A		K

Thermometer: CER-9 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	EV-ER4 (100%)	(unamended)	in
Hardness*	7	283		
Alkalinity*	2	167		

Analysts: AWD, YML, JL

Reviewed by: JLW
 Date reviewed: Jan-25/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 16483

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: NOV 29 16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration mg/L SO ₄	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		10.2	10.1	10.0		9.8	9.6	9.5		9.6		9.7	9.5	9.7
pH		8.1	8.0	8.0		8.1	8.0	8.1		8.2		8.2	8.0	8.0
Cond. (µS/cm)		1470		1439		1452		1431		1441		1450		1433
Initials		MM		MM		K		YL		A		A		K

Concentration mg/L SO ₄	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		10.2	10.2	10.0		9.8	9.8	9.6		9.6		9.8	9.4	9.7
pH		8.1	8.0	8.0		8.1	8.0	8.1		8.2		8.3	8.0	8.0
Cond. (µS/cm)		1635		1594		1615		1606		1608		1616		1620
Initials		MM		MM		K		YL		A		A		K

Concentration mg/L SO ₄	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		10.2	10.2	9.9		9.8	9.8	9.7		9.7		9.8	9.5	9.7
pH		8.1	8.0	8.0		8.1	8.0	8.1		8.2		8.3	8.0	8.0
Cond. (µS/cm)		1871		1848		1849		1844		1841		1848		1842
Initials		MM		MM		K		YL		A		A		K

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-9 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	EV-ER4 (100%)	(unamended)	
Hardness*	7	253		
Alkalinity*	2	167		

Analysts: AWO, MM, K
 Reviewed by: JBL
 Date reviewed: Jan-25/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 16:20h
 Stop Date & Time: Nov 29 16e 10:30h
 Test Species: Oncorhynchus mykiss

GH-FR1 Concentration (unamended)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	14.5	14.5 14.5
DO (mg/L)		9.9	10.3	10.1		9.8	9.9	9.7		9.6		9.7	9.5	9.6
pH		8.1	7.9	8.0		8.1	8.0	8.1		8.1		8.1	8.0	8.1
Cond. (µS/cm)		820	807		805		808		811		810		801	
Initials		YML	YML		K		YML		A		A		K	

400 Concentration mg/L SO4	Days													
	14		15		16		17		18		19		20	
	new	old												
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.9	10.3	10.1		9.9	9.8	9.6		9.7		9.8	9.5	9.6
pH		8.1	8.0	8.0		8.1	8.0	8.1		8.2		8.1	8.0	8.1
Cond. (µS/cm)		1091	1096		1091		1085		1094		1101		1089	
Initials		YML	YML		K		YML		A		A		K	

480 Concentration mg/L SO4	Days													
	14		15		16		17		18		19		20	
	new	old												
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.8	10.3	10.1		9.9	9.6	9.7		9.7		9.8	9.6	9.6
pH		8.1	8.0	8.1		8.1	8.1	8.1		8.2		8.2	8.0	8.1
Cond. (µS/cm)		1207	1208		1209		1195		1196		1201		1179	
Initials		YML	YML		K		YML		A		A		K	

576 Concentration mg/L SO4	Days													
	14		15		16		17		18		19		20	
	new	old												
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.9	10.3	10.0		9.9	9.7	9.7		9.6		9.8	9.5	9.7
pH		8.1	8.0	8.1		8.1	8.1	8.1		8.2		8.2	8.0	8.1
Cond. (µS/cm)		1348	1343		1341		1332		1335		1344		1321	
Initials		YML	YML		K		YML		A		A		K	

Thermometer: CER-9 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FR1 (unamended)	(unamended)	is
Hardness*	7	460		
Alkalinity*	2	204		

Analysts: AWD, YML, K

Reviewed by: JBL

Date reviewed: Jan. 25/17

Sample Description: Clear, colourless, odorless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FRI
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days														
	14		15		16		17		18		19		20		
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		10.2	10.3	10.0		9.9	9.6	9.7		9.7		9.9	9.8	9.7	9.7
pH		8.2	8.0	8.1		8.1	8.1	8.1		8.2		8.2	8.2	8.1	8.1
Cond. (µS/cm)		1528	1536			1521		1502		1513		1520		1497	
Initials		YML	YML			K		YML		A		A		K	

829 Concentration mg/L SO ₄	Days														
	14		15		16		17		18		19		20		
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		10.2	10.3	10.2		9.9	9.6	9.7		9.7		9.9	9.8	9.7	9.7
pH		8.2	8.0	8.1		8.1	8.1	8.1		8.1		8.2	8.2	8.0	8.0
Cond. (µS/cm)		1720	1683			1677	1697	1691		1692		1698		1697	
Initials		YML	YML			K		YML		A		A		K	

995 Concentration mg/L SO ₄	Days														
	14		15		16		17		18		19		20		
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)		14.5	13.5	14.5		14.5	14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		10.2	10.3	10.2		9.9	9.6	9.6		9.7		9.8	9.8	9.7	9.5
pH		8.2	8.0	8.1		8.1	8.1	8.1		8.1		8.2	8.2	8.0	8.1
Cond. (µS/cm)		1958	1918			1927		1913		1920		1929		1912	
Initials		YML	YML			K		YML		A		A		K	

Concentration	Days														
	14		15		16		17		18		19		20		
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)															
DO (mg/L)															
pH															
Cond. (µS/cm)															
Initials															

Thermometer: CER-9 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FRI (unamended)	
Hardness*	7	460	
Alkalinity*	2	204	

Analysts: AWD, YML, K

Reviewed by: JOB

Date reviewed: Jan-25/17

* mg/L as CaCO₃

Sample Description: Clear, colourless, odourless, no ^{wt} sony particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TecE
 Sample ID: various
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Lab control Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.5	14.5		14.5	14.0	14.5		14.5		14.5	14.5	14.5
DO (mg/L)		9.5	10.0	9.8		9.9	10.1	9.8		10.1		9.9	10.0	9.6
pH		7.0	6.9	7.1		6.7	6.8	6.8		7.1		7.0	7.0	7.0
Cond. (µS/cm)		29	28	28		30		27		30		31		26
Initials		KL		A		A		A		A		A		KL

GH-ER2 Concentration (unamended)	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.0	14.5		14.5		14.5	14.0	14.5
DO (mg/L)		9.4	10.3	9.8		9.9	10.1	9.9		10.0		9.9	10.0	9.7
pH		8.1	8.1	8.0		8.0	8.2	8.2		8.1		7.9	8.0	8.1
Cond. (µS/cm)		312		303		309		308		308		314		332
Initials		KL		A		A		A		A		A		KL

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)			13.0	14.5				14.5						
DO (mg/L)			10.7	9.8										
pH			8.1	8.0										
Cond. (µS/cm)				32										
Initials														

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)			13.0	14.5										
DO (mg/L)			10.7	9.9										
pH			8.0	8.1										
Cond. (µS/cm)				32										
Initials														

Thermometer: TERR-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH-ER2 (not)	(unamended)
Hardness*	8	173	
Alkalinity*	5	144	

Analysts: AWD, KL
 Reviewed by: JOU
 Date reviewed: Jan-25/17

Sample Description: clear, odourless, colourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TecE
 Sample ID: EV-EP4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: November 9, 2016 @ 1030h
 Test Species: Oncorhynchus mykiss

EV-EP4 Concentration (Unamended)	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.2	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.4	10.2	10.0		9.9	10.1	9.8		10.1		10.0	9.9	9.7
pH		8.2	8.0	8.1		8.1	8.1	7.9		8.0		7.9	8.1	8.1
Cond. (µS/cm)		472	460		464		461		474		478		461	
Initials		W	A		A		A		A		A		KL	

400 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.4	10.2	9.8		9.9	10.1	9.9		10.0		10.1	10.0	9.8
pH		8.2	8.1	8.1		8.0	8.0	7.9		8.0		7.9	8.1	8.1
Cond. (µS/cm)		1008	1005		1007		1055		1059		1060		1008	
Initials		W	A		A		A		A		A		KL	

480 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.4	10.2	9.8		9.9	10.2	9.9		10.0		10.0	10.0	9.8
pH		8.2	8.0	7.9		8.1	8.0	8.0		8.1		7.9	8.1	8.1
Cond. (µS/cm)		1134	1195		1189		1178		1161		1157		1125	
Initials		W	A		A		A		A		A		KL	

576 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.4	10.2	9.8		9.9	9.8	9.8		10.0		10.0	10.0	9.8
pH		8.2	8.0	8.1		8.1	8.0	8.0		8.1		8.0	8.2	8.1
Cond. (µS/cm)		1281	1326		1309		1323		1303		1294		1253	
Initials		W	A		A		A		A		A		KL	

Thermometer: CER-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-EP4 (400)	(unamended)	W
Hardness*	8	253		
Alkalinity*	5	162		

*mg/L as CaCO₃

Analysts: AW, W
 Reviewed by: JOU
 Date reviewed: Jan 25/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TecE
 Sample ID: EV-EP4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.4	10.1	10.0		9.9	10.1	9.9		9.9		10.1	9.9	9.7
pH		8.2	8.0	8.1		8.1	8.1	8.0		8.1		8.1	8.1	8.0
Cond. (µS/cm)		1445		1479		1394		1485		1419		1400		1432
Initials		K		A		A		A		A		A		KL

829 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.4	10.1	10.0		9.8	10.1	9.9		9.8		10.0	9.9	9.8
pH		8.1	8.0	8.1		8.0	8.1	8.0		8.1		8.2	8.1	8.0
Cond. (µS/cm)		1626		1688		1621		1678		1619		1601		1602
Initials		K		A		A		A		A		A		KL

905 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.5	10.2	9.8		9.9	10.1	9.8		9.8		10.0	10.0	9.9
pH		8.1	8.0	8.0		8.0	8.0	8.0		8.1		8.2	8.1	8.1
Cond. (µS/cm)		1854		1858		1842		1871		1840		1847		1850
Initials		K		A		A		A		A		A		KL

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: TERR-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	<u>EV-EP4(1001)</u> (unamended)	<u>in</u>
Hardness*	8	253	
Alkalinity*	5	162	

Analysts: AWD, KL

Reviewed by: JBL
 Date reviewed: Jan. 25/17

* mg/L as CaCO₃

Sample Description: Clear, colorless, odorless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29 16 @ 1030h
 Test Species: Oncorhynchus mykiss

GH FR1 Concentration (unamended)	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	14.5		14.5	14.0	14.5		14.5		14.5	14.0	14.5
DO (mg/L)		9.5	10.2	10.0		9.8	10.2	9.9		9.9		9.9	9.9	9.8
pH		8.3	8.1	8.0		8.1	8.1	8.0		8.1		8.0	8.2	8.2
Cond. (µS/cm)		813		801		802		802		820		812		800
Initials		KL		A		A		A		A		A		KL

400 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.5	10.2	10.0		9.8	10.1	9.8		9.8		9.8	10.0	9.8
pH		8.3	8.0	8.0		8.1	8.1	8.0		8.1		8.0	8.1	8.2
Cond. (µS/cm)		1096		991		1004		993		1027		1049		1089
Initials		KL		A		A		A		A		A		KL

480 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.87	10.2	9.8		9.7	10.1	9.8		10.0		9.9	10.0	9.7
pH		8.3	8.1	8.0		8.0	8.1	8.0		8.0		8.0	8.1	8.2
Cond. (µS/cm)		1193		1187		1203		1209		1202		1200		1187
Initials		KL		A		A		A		A		A		KL

576 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.7	10.2	10.0		9.8	10.0	9.8		10.1		9.7	10.0	9.8
pH		8.3	8.1	8.0		8.1	8.1	8.0		8.1		8.0	8.1	8.2
Cond. (µS/cm)		1335		1324		1338		1331		1337		1342		1333
Initials		KL		A		A		A		A		A		KL

Thermometer: TERR-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH FR1 (unamended)	(unamended)
Hardness*	8	459	
Alkalinity*	5	197	

Analysts: AWD, KL

Reviewed by: K/Teck

Date reviewed: Jan - 25 / 17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.7	10.2	9.8		9.9	10.1	10.0		10.0		9.6	9.9	9.7
pH		8.3	8.0	7.9		8.0	8.0	8.0		8.1		8.0	8.1	8.2
Cond. (µS/cm)		1506	1420	1481		1499	1499	1498		1498		1508	1487	1487
Initials		W	A	A		A	A	A		A	A	A	KC	KC

829 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.5	10.1	9.8		9.9	10.1	9.9		10.0		9.9	9.9	9.9
pH		8.3	8.0	8.0		8.1	8.0	8.0		8.1		8.0	8.2	8.2
Cond. (µS/cm)		1701	1601	1687		1615	1615	1701		1701		1707	1695	1695
Initials		W	A	A		A	A	A		A	A	A	KC	KC

995 Concentration mg/L SO ₄	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5	14.5	14.5		14.5		14.5	15.0	14.5
DO (mg/L)		9.5	10.1	9.8		9.9	10.0	9.8		10.0		9.9	10.0	9.9
pH		8.3	8.0	8.0		8.1	8.0	8.1		8.1		8.0	8.2	8.1
Cond. (µS/cm)		1927	1837	1896		1842	1842	1890		1890		1899	1886	1886
Initials		W	A	A		A	A	A		A	A	A	KC	KC

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH-FR1 (100%)	(unamended)	
Hardness*	8	459		
Alkalinity*	5	197		

Analysts: AWD, KC
 Reviewed by: JKH
 Date reviewed: Jan - 25/17

* mg/L as CaCO₃

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: teck
 Sample ID: various
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Lab Control Concentration	Days													
	28													
	Final new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5	14.5												
DO (mg/L)	10.0	10.2												
pH	6.9													
Cond. (µS/cm)		27												
Initials		W												

GH-ERZ Concentration (unamended)	Days													
	28													
	Final new	old	new	old										
Temperature (°C)	14.5													
DO (mg/L)	9.9													
pH	8.0													
Cond. (µS/cm)		316												
Initials		W												

Concentration	Days													
	28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CG-9 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	GH-ERZ (100%)	(unamended)	
Hardness*	8	W-173		
Alkalinity*	5	W-144		

Analysts: W

Reviewed by: Jlu
 Date reviewed: Jan. 25/17

Sample Description: clear / colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TEEC
 Sample ID: EV-EP4
 Work Order #: 161183

Start Date & Time: November 5, 2016 @ 1620h
 Stop Date & Time: March 9/16 @ 1030h
 Test Species: Oncorhynchus mykiss

EV-EP4 Concentration (unamended)	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.9														
pH	8.1														
Cond. (µS/cm)	470														
Initials	W														

400 Concentration mg/L SO ₄	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.8														
pH	8.0														
Cond. (µS/cm)	1016														
Initials	W														

480 Concentration mg/L SO ₄	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.8														
pH	8.0														
Cond. (µS/cm)	1132														
Initials	W														

576 Concentration mg/L SO ₄	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.9														
pH	8.1														
Cond. (µS/cm)	1253														
Initials	W														

Thermometer: C2-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-EP4 (100%)	(unamended)
Hardness*	8	W 255 253	
Alkalinity*	5	162	

Analysts: W

Reviewed by: Joh

Date reviewed: Jan. 28/17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TECK
 Sample ID: EV-ER4
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days													
	Final 28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5													
DO (mg/L)	9.9													
pH	8.0													
Cond. (µS/cm)	1445													
Initials	W													

829 Concentration mg/L SO ₄	Days													
	Final 28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5													
DO (mg/L)	9.8													
pH	8.0													
Cond. (µS/cm)	1613													
Initials	W													

995 Concentration mg/L SO ₄	Days													
	Final 28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5													
DO (mg/L)	9.8													
pH	8.0													
Cond. (µS/cm)	1860													
Initials	W													

Concentration	Days													
	28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CEP-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-ER4 (100%)	(unamended)	W
Hardness*	8	W 265-283		
Alkalinity*	5	162		

Analysts: W
 Reviewed by: Joh
 Date reviewed: Jan. 25/17

* mg/L as CaCO₃

Sample Description: clear, colorless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: teck
 Sample ID: AH FP1
 Work Order #: 161183

Start Date & Time: November 5, 2016 2:16:20h
 Stop Date & Time: Nov 29 16 2 10:36h
 Test Species: Oncorhynchus mykiss

AH FP1 Concentration (unamended)	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.8														
pH	8.2														
Cond. (µS/cm)	810														
Initials	W														

400 Concentration mg/L SO ₄	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.8														
pH	8.2														
Cond. (µS/cm)	1096														
Initials	W														

480 Concentration mg/L SO ₄	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.8														
pH	8.2														
Cond. (µS/cm)	1194														
Initials	W														

576 Concentration mg/L SO ₄	Days														
	Final 28														
	new	old	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	14.5														
DO (mg/L)	9.8														
pH	8.2														
Cond. (µS/cm)	1341														
Initials	W														

Thermometer: CSP-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	AH FP1 (600h)	(unamended)	W
Hardness*	8	W-482-459		
Alkalinity*	5	W-495-197		

Analysts: W
 Reviewed by: JOU
 Date reviewed: Jan. 28/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: teck
 Sample ID: AHL FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

691 Concentration mg/L SO ₄	Days													
	Final 28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5													
DO (mg/L)	9.8													
pH	8.2													
Cond. (µS/cm)	1495													
Initials	WL													

829 Concentration mg/L SO ₄	Days													
	Final 28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5													
DO (mg/L)	9.8													
pH	8.2													
Cond. (µS/cm)	62 18 1695													
Initials	WL													

995 Concentration mg/L SO ₄	Days													
	Final 28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.5													
DO (mg/L)	9.7													
pH	8.2													
Cond. (µS/cm)	1899													
Initials	WL													

Concentration	Days													
	28													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CE-9 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	AHL FR 1 (100%) (unamended)	
Hardness*	8	WL 462 459	
Alkalinity*	5	WL 195 197	

Analysts: WL

Reviewed by: JOU
 Date reviewed: Jan - 25/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teek
 Sample ID: (various)
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/Alevins			
		1	2	3	4	5	6	7	8	9	10	11	12				
Lab Control	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
	2							0					0	0			0
	3												1	2			3
	4												0	0			0
	15												1				1
	26							↓					0				0
	37							1					0				1
	48							0					0				0
GH-ER2 (unamended)	1								↓	1			0				1
	2								1	0			0				1
	3							↓	0				1				1
	4						↓		1				0				1
	51						1						0				2
	62						0			0			1				1
	73						0			0			0				0
	84	↓	↓	↓	↓	0	↓	1	↓	↓	↓	↓	0	↓			1
	1																
	2																
	3																
	4																
	1																
	2																
	3																
	4																
	1																
	2																
	3																
	4																
Tech Initials		MM	KL	KL	AM	KL	MM	KL	MM	MM	MM	MM	MM	KL	KL		

Comments: _____

Reviewed by: JKL

Date reviewed: Jan. 25/17
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teche
 Sample ID: (new bus)
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: November 16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/Alevins	
		13 ^①	14	15	16	17	18	19	20	21	22	23	24		
Lab Control	1	0	0	0	0	0	0	0	1	0 ^②	0 ^③	0	1	0	2
	2		0	0		0			0 ^②	0 ^③	0	0	0	0	0
	3		1	1		1			0 ^②	0 ^③	0	1	0	4	
	4		0	0		1			1 ^②	0 ^③	0	0	0	2	
	5					0			0	0 ^②	0 ^③	0	1	1	2
	6					↓			0	0 ^②	0 ^③	0	0	0	0
	7					1			0	0	0	0	0	1	
	8				↓	0			↓	1 ^②	2 ^③	0	0	0	0 ^④
Lit Egg (unwashed)	1			1				0	0 ^②	4 ^③	3 ^④	0	1 ^⑤	14	
	2	↓	↓	0				0	0 ^②	0	0 ^③	0	0	0	
	3	1	2					0	0 ^②	5 ^③	0	0	0	12	
	4	0	0		↓			0	0 ^②	0 ^③	1	0	0	1	
	5	1			1	↓		2	2 ^②	3 ^③	4 ^④	0	0	1	12
	6	0			0	1		3	2 ^②	2 ^③	0 ^④	1	0	1	8
	7	0	↓		0	0		0	0 ^②	4	0	0	0	2	7
	8	0	1	↓	0	0	↓	2	0 ^②	1	0	0	1	5	
	1														
	2														
	3														
	4														
	1														
	2														
	3														
	4														
	1														
	2														
	3														
	4														
Tech Initials		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm

Comments: ① at eyed stage (all reps) ② starting to hatch ③ >50% hatched ④ 2 fuzzy ⑤ 1 half-hatched

Reviewed by: JGK Date reviewed: Jan 25/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Tech
 Sample ID: (various)
 Work Order #: 16483

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: NOV 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration	Rep	Day of Test - No. of Mortalities					Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		25	26	27	28	29				
Lab control	1	0	0	0	0		8	3	19	30
	2	1	1	1	1		2	0	28	30
	3	1	1	0	1		8	4	15	27
	4	2	0	0	0		4	2	24	30
	5	1	1	1	1		5	5	18	28
	6	0	0	2	1		3	0	28	31
	7	1	1	4	3		10	3	15	28
	8	1	0	0	0		9	0	23	32
GH-EP2 (unamended)	1	1	2	1	0		18	1	12	31
	2	0	1	1	1		2	3	25	30
	3	1	0	1	1		14	4	9	27
	4	0	0	1	1		2	2	25	29
	5	0	0	1	1		14	4	13	31
	6	0	0	1	1		9	1	20	30
	7	1	0	1	1		9	3	19	31
	8	0	0	0	1		6	0	24	30
	1									
	2									
	3									
	4									
	1									
	2									
	3									
	4									
	1									
	2									
	3									
	4									
Tech Initials		A	A	W	W		W	W	W	W

Comments: (1) oil sheen on surface (2) 5 dead (3) seabirds

Reviewed by: JCh

Date reviewed: Jan. 25/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: November 2, 2016 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
EV-ER4 (unamended)	1	0	0	1	0	0	0	0	1	0	0	0	0	2
	2			0					0				0	0
	3								0				1	1
	4												0	0
	5					2							1	4
400	6			↓		0		↓					0	0
	7													0
	8			0					↓					0
	9													0
	10													0
480	11													0
	12													0
	13													0
	14													0
	15													0
576	16													0
	17													0
	18													0
	19													0
	20													0
Tech Initials	21													0
	22													0
	23													0
	24													0
	25													0

Comments:

Reviewed by: JCH
 Version 1.1 Issued October 6, 2015

Date reviewed: Jan 25/17
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h.
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins	
		1	2	3	4	5	6	7	8	9	10	11	12		
691	1	0	0	0	0	1	0	1	1	0	0	0	1	4	
	2					0		0	0		0		0	0	
	3										0			1	
	4										1			1	
829	51						6				0			6	
	62						0							0	
	73						1							1	
	84 ^{HL}						1		↓		↓			1	
995	1						0		1		1 ^{HL}			2	
	2								0		0 ^{HL}			0	
	3								0		3 ^{HL}			3	
	4							↓	0		0 ^{HL}			0	
995	51								3		2			5	
	62								0		0			0	
	73								0		0			0	
	84 ^{HL}					↓			0		0		↓	1	
995	1					1		1	↓		3 ^{HL}		0	6	
	2					0		0	↓		2			2	
	3							0	0		0			2	
	4							0	0		0			0	
995	51							1	1		0			2	
	62							0	0		0			0	
	73							0	0		0			0	
	84 ^{HL}	↓	↓	↓	↓	↓	1	0	0	↓	1	↓	↓	2	
995	1														
	2														
	3														
	4														
995	1														
	2														
	3														
	4														
Tech Initials		MM	W	W	R	W	W	W	MM	YH	MM	A	R	W	

Comments: _____

Reviewed by: JAN Date reviewed: Jan. 25/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 10:30h
 Stop Date & Time: Nov 29/16 @ 10:30h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13 ^o	14	15	16	17	18	19	20	21	22	23	24	
EV-ER4 (unamended)	1	0	0	0	0	1	0	0	35 ^o	1 ^o	0	0	0	7
	2	0	0	↓	↓	0	0	0	2 ^o	4 ^o	0 ^o	0	1	7
	3	1	1	↓	↓	0	1	1	0	3 ^o	0	0	0	7
	4	0	0	↓	↓	0	0	1	0 ^o	1 ^o	0	0	0	2
400	51	0	0	↓	↓	1	↓	3	0 ^o	0 ^o	1	0	0	5
	62	0	0	↓	↓	0	↓	0	0 ^o	0 ^o	0	0	0	0
	73	1	0	2	↓	0	↓	0	0 ^o	0 ^o	0	0	0	0
	84 ^m	1	1	0	↓	0	↓	0	1	1 ^o	0 ^o	0	23	8
400	1	0	0	1	↓	1	↓	3	2 ^o	3 ^o	1 ^o	0	1 ^o	12
	2	↓	↓	0	↓	0	↓	0	0 ^o	0	0	1	0	1
	3	↓	↓	0	1	0	↓	1	0	2 ^o	0	0	2 ^o	6
	4	↓	↓	3	0	1	↓	0	0 ^o	0 ^o	0	0	2 ^o	7
480	51	↓	↓	0	↓	↓	↓	1	2	2 ^o	3 ^o	0 ^o	1	8
	62	↓	↓	0	↓	↓	↓	0	0	0 ^o	0	0	0	0
	73	↓	↓	0	↓	0	↓	0	0	0 ^o	0	0	0	0
	84 ^m	↓	↓	1	↓	0	↓	0	0	0 ^o	0 ^o	0	1	2
480	1	1	↓	1	↓	2	↓	0	2	1 ^o	1 ^o	0	1 ^o	10
	2	0	↓	0	0	0	↓	0	0	0 ^o	0 ^o	0	3	3
	3	1	↓	1	0	0	↓	2 ^m	4 ^o	5 ^o	4 ^o	0	0 ^m	13
	4	↓	1	0	0	↓	↓	0	0 ^o	1 ^o	1	0	1 ^o	5
576	51	↓	0	1	1	3	↓	2	3 ^o	1 ^o	0	0	0	12
	62	↓	↓	0	0	0	↓	0	0	0 ^o	0	0	0	0
	73	↓	↓	0	0	0	↓	0	1 ^o	0	0 ^o	0	0	0
	84 ^m	↓	↓	0	0	0	↓	0	0	0	2 ^o	0	0	1
576	1	↓	↓	2	1	3	↓	4	4 ^o	1 ^o	4 ^o	0	1	14
	2	↓	↓	0	0	0	↓	0	0 ^o	0	0	0	1	1
	3	↓	↓	0	0	0	↓	1	1	4 ^o	3 ^o	0	1	7
	4	↓	↓	0	0	1	↓	0	1	1 ^o	3 ^o	0	0	7
576	51	1	↓	2	3	3	↓	1	0	3 ^o	0	1 ^o	1 ^o	17
	62	0	↓	0	1	0	↓	0	0	0 ^o	0 ^o	0	0	1
	73	1	↓	0	1	23	↓	2	2	1 ^o	3 ^o	0	0	13
	84 ^m	1	↓	3	4	1	↓	0	0	0 ^o	0	0	0	10
Tech Initials		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm

Comments: Out read stage (all reps) 2 fuzzy + 3 attached 3 starting to hatch
4 75% hatched 5 2 fuzzy, 2 attached 6 1 fuzzy + 5 attached 7 1 fuzzy + 2 attached
8 swimmer shaped body 9 thin sheen of oil on surface of water 10 1 4th stage 11 2 headed (1 unhatched)
12 half-hatched 13 yolk sac almost fully absorbed 14 1 survivor

Reviewed by: JKH Date reviewed: Jan 25/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: EMER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 24/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13	14	15	16	17	18	19	20	21	22	23	24	
699	1	2	0	2	4	3	1	1	0	1	0	0	0	14
	2	0	0	0	0	0	0	1	0	0	1	0	2	
	3	0	0	3	2	0	1	1	1	0	2	0	12	
	4	1	0	0	0	0	0	0	0	0	1	0	3	
	5	0	1	0	1	0	1	0	1	0	0	0	6	
	6	1	0	0	1	2	0	0	3	0	0	0	6	
	7	1	0	2	1	5	1	0	3	2	0	0	13	
	8	0	0	0	0	0	1	3	0	0	0	0	3	
829	1	2	0	1	1	1	1	3	0	0	2	2	23	
	2	0	0	0	0	0	0	1	4	1	0	0	6	
	3	0	1	1	1	1	1	0	1	0	0	3	9	
	4	0	0	2	0	0	0	0	0	0	0	0	2	
	5	6	8	1	1	2	0	0	1	—	—	—	19	
	6	0	0	0	0	0	1	0	1	2	0	0	4	
	7	0	1	0	0	0	0	2	1	2	1	0	10	
	8	0	0	0	0	1	1	0	0	2	0	0	4	
995	1	7	3	4	2	1	0	0	1	0	0	0	21	
	2	0	0	0	0	2	1	4	0	1	0	0	8	
	3	0	0	0	0	9	1	0	5	0	0	2	16	
	4	0	2	0	0	3	1	0	2	0	0	3	10	
	5	1	0	0	7	2	1	3	1	2	0	0	17	
	6	0	0	3	0	1	0	2	3	0	0	0	12	
	7	0	1	0	0	0	1	0	1	0	0	2	5	
	8	0	0	0	0	3	0	0	0	0	0	0	3	
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	

Comments: Day 24ed slope (all reps) (1) fuzzy eggs + 5 attached (2) fuzzy (3) 2 fuzzy (4) start to hatch (5) 3 fuzzy + 2 attached (6) 1 cloudy (7) snowman shaped body (8) partially hatched (9) yolk sac almost full absorbed (10) cloudy (11) 3 fuzzy and 1 of them hatched (12) 1 two-headed fuzzy (13) 1 fuzzy egg, 1 fuzzy hatched (14) 2 fuzzy

Reviewed by: JOU

Date reviewed: Jan. 25/17
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Tecta
 Sample ID: EV-EP4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities						Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		25	26	27	28						
EV-EP4 (unamended)	1	0	0	0	0		9	4	17	30	
	2		0				7	1	22	30	
	3		0				8	1	22	31	
	4		0	↓			2	0	26	28	
	5		1	10			11	4	15	30	
	6		0	0			0	1	29	30	
	7		1				10	5	14	29	
	8		0				3	0	26	29	
400	1						13	4	w 1612	29	
	2			↓			1	0	w 2925	30	
	3			2			8	3	w 2219	30	
	4		↓	0			7	1	w 2522	30	
	5		1	1			11	4	w 1915	30	
	6		0	1	↓		1	1	29	30	
	7		0	1	2		6	4	w 2218	28	
	8		0	10	0		5	2	w 2321	28	
480	1		1	0	0		12	3	w 1815	30	
	2		0	0			3	0	27	30	
	3		0	0			13	2	w 1715	30	
	4		0	0			5	0	w 2727	32	
	5		1	10			15	4	w 1410	29	
	6		0	0			1	0	25	26	
	7			1	2		2	6	w 2822	30	
	8			1	0		3	0	27	30	
576	1			0			20	1	90 ^m	30	
	2						1	0	25	26	
	3						7	2	w 2321	30	
	4						7	1	w 2222	30	
	5						25	1	w 54	30	
	6			↓			1	0	29	30	
	7			1	4		14	3	w 1916	33	
	8		↓	0	↓		10	0	19	29	
Tech Initials		m	m	w	w		w	w	w	w	

Comments: ① 1 karyosis ② egg yolk edema ③ twin separate body, 1 bigger than other ④ fuzzy egg est^r

Reviewed by: JCh

Date reviewed: Jan 15/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: ELER4
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities					Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		25	26	27	28					
691	1	0	2	23	0		27	2	w 86	30
	2	0	0	0	0		2	2	w 2624	28
	3	1	4	4	2		24	2	w 53	29
	4	0	0	0	0		4	0	27	31
	5	1	0	0			12	2	w 1513	27
	6	2	0	0			6	0	22	28
	7	3	0	0			14	3	w 1510	27
	8	4	0	0			4	0	27	31
829	1	2	0	1			28	0	0	28 22 w
	2	0		0			6	0	23	29
	3			0			12	2	w 19	30 33
	4			1			3	0	27	30
	5	1		0			27	0	0	27
	6	2			1		4	0	26	30
	7	3		3		1	14	5	w 1510	29
	8	4		0		0	5	0	26	31
995	1						27	1	w 32	30
	2						10	0	21	31
	3						18	3	w 1512	33
	4				2		12	1	20	w 2833
	5	1			0		19	3	w 46	w 2928
	6	2			0		w 12	0	17	w 2629
	7	3	10		1		7	2	w 1417	w 326
	8	4	0		0		5	1	w 2827	33
	1									
	2									
	3									
	4									
	1									
	2									
	3									
	4									
Tech Initials		A	A	w	w		w	w	w	w

Comments:
 ① 200 present
 ② sample appears cloudy
 ③ 1 edema, 1 snowman shaped body
 ④ 1 fuzzy

Reviewed by: Jan

Date reviewed: Jan 15/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Tech
 Sample ID: GH-FRI
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
GH-FRI (unamended)	1	0	0	0	0	0	0	4	0	0	0	0	0	4
	2	↓	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	1	0	↓	↓	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	2	3	↓	↓	↓	↓	5
	51	↓	↓	↓	↓	↓	↓	1	1	0	↓	↓	↓	3
400	62	↓	↓	↓	↓	↓	0	1	↓	↓	↓	↓	0	
	73	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
	84 ⁴⁰⁰	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
	1	↓	↓	↓	↓	↓	3	0	↓	↓	↓	↓	4	
	2	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
480	3	↓	↓	↓	↓	↓	4	1	↓	↓	↓	↓	1 4 ⁴⁸⁰	
	4	↓	↓	↓	↓	↓	1	0	↓	↓	↓	↓	6	
	51	↓	↓	↓	↓	↓	0	2	0	↓	↓	↓	3	
	62	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
	73	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
576	84 ⁴⁰⁰	↓	↓	↓	↓	↓	0	↓	↓	↓	↓	↓	0	
	1	↓	↓	↓	↓	↓	1	↓	↓	↓	↓	↓	3	
	2	↓	↓	↓	↓	↓	0	1	↓	↓	↓	↓	1	
	3	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	1	
	4	↓	↓	↓	↓	↓	1	0	↓	↓	↓	↓	4	
Tech Initials	51	↓	↓	↓	↓	↓	0	1	4	0	↓	↓	7	
	62	↓	↓	↓	↓	↓	1	0	0	↓	↓	↓	1	
	73	↓	↓	↓	↓	↓	0	0	0	↓	↓	↓	0	
	84 ⁴⁰⁰	↓	↓	↓	↓	↓	0	0	2	↓	↓	↓	3	
	1	↓	↓	↓	↓	↓	1	1	0	↓	↓	↓	2	
Tech Initials	2	↓	↓	↓	↓	↓	0	0	0	↓	↓	↓	0	
	3	↓	↓	↓	↓	↓	0	1	↓	↓	↓	↓	1	
	4	↓	↓	↓	↓	↓	2	0	↓	↓	↓	↓	4	
	51	↓	↓	↓	↓	↓	0	1	↓	↓	↓	↓	2	
	62	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	1	
Tech Initials	73	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
	84 ⁴⁰⁰	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
	1	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
	2	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	
	3	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	0	

Comments:

Reviewed by: JCH
 Version 1.1 Issued October 6, 2015

Date reviewed: Feb. 15/17
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH-FRI
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h.
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
691	1	0	0	0	0	0	1	0	0	0	0	0	0	1
	2						0		0					0
	3						0		0					0
	4						0		0					0
	5						2		1					1
	6						0		0					0
	7						0							0
	8						0							0
829	1						2			1	3		1	7
	2						0			0	0		0	0
	3													0
	4								1					0
	5								2		1			3
	6								0		0			0
	7													0
	8													0
995	1						1			1				1
	2						1		1	0				1
	3						0		2					2
	4						0		1					1
	5						4	2	0		1			6
	6					1	1	0	1	1	0			2
	7					1	0	2	2	1	0			2
	8		1	1	1	0	0	0	2	0	0	2	2	15
1													4	
2														
3														
4														
1														
2														
3														
4														
Tech Initials		MM	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM	MM

Comments: _____

Reviewed by: JON

Date reviewed: Feb 7/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH-FRI
 Work Order #: 16118

Start Date & Time: November 1, 2016 @ 1630h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13	14	15	16	17	18	19	20	21	22	23	24	
GH-FRI (unamended)	1	2	0	2	2	0	0	3	4	0	0	0	1	12
	2	0	0	0	0	0	1	0	1	0	0	0	1	1
	3	1	1	0	0	0	1	0	8	0	1	0	1	12
	4	0	1	2	0	0	1	0	0	0	1	0	0	4
200	51	1	0	2	2	8	1	1	2	0	0	0	0	14
	62	0	0	0	0	8	0	0	3	2	2	0	1	8
	73	1	0	0	4	0	1	0	0	0	2	0	0	7
	84	1	1	1	0	0	2	4	0	0	0	0	0	9
400	1	0	0	11	4	4	0	0	0	1	0	0	0	20
	2	0	0	0	0	0	0	0	0	0	1	0	1	2
	3	0	0	1	2	4	1	7	2	0	0	0	1	18
	4	0	0	2	0	0	0	2	0	0	0	0	0	4
480	51	3	0	2	2	1	4	0	0	1	0	0	0	13
	62	0	0	0	0	0	0	2	1	0	0	0	0	3
	73	4	4	0	6	2	6	0	0	0	0	0	0	22
	84	0	0	0	0	0	2	0	1	0	0	0	0	3
576	1	0	1	1	0	1	1	2	2	2	0	0	0	9
	2	0	0	0	0	0	0	0	0	0	0	1	1	11
	3	2	1	0	4	0	0	0	1	0	0	0	1	8
	4	0	0	0	0	0	1	2	2	0	0	0	0	5
576	51	2	2	6	2	1	0	2	4	0	0	0	0	14
	62	0	0	1	0	0	0	0	2	0	0	0	0	3
	73	1	0	2	2	2	0	1	2	0	1	0	0	15
	84	0	0	2	0	0	1	1	2	0	0	0	1	7
576	1	2	2	3	2	5	0	3	1	1	1	0	1	21
	2	0	0	0	0	2	0	0	0	3	4	0	0	10
	3	0	0	0	0	0	0	0	4	0	0	0	0	4
	4	0	0	0	4	0	1	0	5	0	0	1	0	11
576	51	0	0	0	1	3	0	2	8	0	0	0	0	15
	62	0	0	0	0	0	0	0	5	0	0	0	0	5
	73	0	0	0	5	1	0	1	6	0	1	0	0	14
	84	1	0	1	0	0	1	0	2	0	0	0	0	5
Tech Initials		K	M	W	K	K	A	A	K	K	K	K	K	K

Comments: ① not eyed stage (all reps) ② 1 fuzzy egg + 2 attached ③ 1 fuzzy + 4 attached
 ④ 2 fuzzy + 2 attached ⑤ 2 fuzzy + 3 attached ⑥ start to hatch ⑦ > 50% hatch
 ⑧ 2 fuzzy ⑨ swimmer - unusual ⑩ egg sac almost fully absorbed ⑪ 1 body w/ 4 eyes
 ⑫ 214, 24, 1 scoliosis ⑬ lordosis ⑭ egg yolk edema ⑮ big head, small body

Reviewed by: Joh Date reviewed: Feb 7/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Toek
 Sample ID: GH-FRI
 Work Order #: 161183

Start Date & Time: November 1, 2016 8:16am
 Stop Date & Time: Nov 29/16 8:10am
 Test Species: Oncorhynchus mykiss

Concentration (mg/L Sol)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13	14	15	16	17	18	19	20	21	22	23	24	
691	1	0	0	1	0	0	0	0	5 [Ⓢ]	1 [Ⓢ]	0	0	1 [Ⓢ]	8
	2	0	0	0	0	0	0	0	2 [Ⓢ]	0	0 [Ⓢ]	0	0	2
	3	5	0	2	2	1	1	1	3 [Ⓢ]	0 [Ⓢ]	1 [Ⓢ]	0	2 [Ⓢ]	17
	4	7	0	1	3	1	1	1	1 [Ⓢ]	0	0 [Ⓢ]	0	0	14
829	51	0	0	0	1	5	2	1	0 [Ⓢ]	2 [Ⓢ]	1 [Ⓢ]	0	0	12
	62	1	0	0	0	0	0	0	5 [Ⓢ]	0 ^{2Ⓢ}	0	0	0	6
	73	3	1	0	0	0	0	3	3 [Ⓢ]	0	0 [Ⓢ]	0	1 [Ⓢ]	11
	84 ^m	0	0	0	0	0	0	0	0	0 [Ⓢ]	0 [Ⓢ]	0	0	0
995	1	3	0	5	8	3 [Ⓢ]	0	2	2	—	—	0	0 [Ⓢ]	23
	2	0	0	0	0	0	0	0	0 [Ⓢ]	0 [Ⓢ]	0	0 [Ⓢ]	8 [Ⓢ]	9
	3	3	1	4 [Ⓢ]	1	4 [Ⓢ]	2	2	7 [Ⓢ]	0 [Ⓢ]	2 [Ⓢ]	0	0	27
	4	0	0	0	0	0	1	0	0 [Ⓢ]	0 [Ⓢ]	2	0	0	3
995	51 ^m	6	7	7	2	1	0	0	0 [Ⓢ]	1 [Ⓢ]	0	1	—	26
	62	0	0	0	0	0	0	0	0 [Ⓢ]	0 [Ⓢ]	2	0	5	15
	73	0	0	0	2	0	0	0	0 [Ⓢ]	1 [Ⓢ]	3	0	0	11
	84 ^m	0	0	1	0	0	2	1	2 [Ⓢ]	3 [Ⓢ]	0	0	1	10
995	1	1 [Ⓢ]	2	2	1	0	1	2	0 [Ⓢ]	0	0	0	0	27
	2	0	0	1	0	0	0	3	4 [Ⓢ]	0	0	0	0	8
	3	2	0	4	0	1	0	4	0 [Ⓢ]	0 [Ⓢ]	0 ^{3m}	0	0	21
	4	0	0	0	0	0	1	2	3 [Ⓢ]	0	4 [Ⓢ]	0	1	11
995	51	16	2	3	0	1	0	0	0 [Ⓢ]	0	0 [Ⓢ]	0	0	22
	62	0	1	0	0	1	0	0	1 [Ⓢ]	0 [Ⓢ]	1 [Ⓢ]	1 [Ⓢ]	0	5
	73	4	2	2	0	0	0	1	1 [Ⓢ]	0 [Ⓢ]	0	1	0	11
	84 ^m	5	1	0	2	0	2	1	2 [Ⓢ]	0	0	0	3	16
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		W	W	W	W	W	W	W	W	W	W	W	W	W

Comments: [Ⓢ] 2 fuzzy [Ⓢ] start to hatch [Ⓢ] >50% hatch [Ⓢ] 6 fuzzy [Ⓢ] two-headed [Ⓢ] small body and [Ⓢ] bent tail [Ⓢ] snowman-shaped body [Ⓢ] egg sac almost fully absorbed [Ⓢ] fuzzy [Ⓢ] thin shell oil [Ⓢ] cloudy [Ⓢ] 7 & 11

Reviewed by: Joh

Date reviewed: Feb. 7/17
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH_F21
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities						Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		25	26	27	28						
GH_F21 (unamended)	1	0	0	0	0		16	2	13	31	
	2			0			1	2	27	30	
	3			2 ^③			15	2	15	32	
	4			0			9	0	21	30	
400	51			0			20	1	8	29	
	62			1			11	0	19	30	
	73			10			8	3	17	28	
	84 ^w			2 ^②			11	0	22	33	
480	1			0			24	0	6	30	
	2			0			2	0	28	30	
	3			0			19	1	9	29	
	4			0			10	1	21	32	
576	51			0			16	1	13	30	
	62			1 ^②			4	1	25	30	
	73			0			22	2	6	30	
	84 ^w			0			16 ^w 6	0	24	30	
576	1			0			12	4	14	30	
	2			1			13	0	17	30	
	3			1			10	5	15	30	
	4			0			9	0	21	30	
576	51			0			26	0	4	30	
	62			0			4	0	26	30	
	73			1			15	0	14	^w 29	
	84 ^w			1			10	1	18	29	
576	1		1				24	1	5	30	
	2		0				10	0	20	30	
	3		0				5	1	24	30	
	4		0				15	0	16	31	
576	51		0	1			17	1	11	29	
	62		0	1			7	0	23	30	
	73		1	0			15	1	13	29	
	84 ^w		0	0	1		5	0	26	31	
Tech Initials		A	A	R	R		R	R	R	R	

Comments: ① fuzzy egg ② yolk sac edema ③ 1 egg yolk almost fully absorbed

Reviewed by: Jon

Date reviewed: Feb. 7/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Tech
 Sample ID: Alt FE1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Nov 29/16 @ 1030h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L SO ₄)	Rep	Day of Test - No. of Mortalities						Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched <small>(abnormal)</small>	Total No. Alevins <small>(normal)</small>	Total Exposed Eggs
		25	26	27	28	h					
691	1	0	0	2 ⁰	0		4	3	15	29	
	2		0	3			5	0	26	31	
	3		1	0			18	2	10	30	
	4		0	1			15	0	14	29	
	5		0	1			14	3	10	27	
	6		0	0			6	1	25	32	
	7		0	0			11	0	20	31	
	8		0	2			2	0	27	29	
829	1		0	0			30	0	0	30	
	2	①	6	0	↓		15	0	15	30	
	3		0	0	1		28	0	0	28	
	4		0	1 ⁰	0		4	0	27	31	
	5		0	0	0		29	0	0	29	
	6		0	0	1		8	0	21	29	
	7		1	2	0		14	2	12	28	
	8		0	1 ⁰	0		11	0	20	31	
995	1		0	0	0		28 28	0	2	30	
	2		0	0	0		9	0	18	27	
	3		1	0	3 ²		26	0	4	30	
	4		0	2	0		14	1	17	32	
	5		0	0	0		28	0	2	30	
	6		0	1	0		7	0	21	28	
	7		1	↓	0		27	1	0	28	
	8		2	↓	3 ⁷		23	0	8	31	
	1										
	2										
	3										
	4										
	1										
	2										
	3										
	4										
Tech Initials		A	A	W	W		W	W	W	W	

Comments: ① sample appears cloudy ② 1 half hatched, 1 egg yolk almost fully absorbed
 ③ edema ④ 1 egg yolk almost fully absorbed ⑤ fuzzy

Reviewed by: JGW

Date reviewed: Feb-7/17

Client: Teck
 WO#: 161183

CONTROL

Fish #	Control A	Control B	Control C	Control D	Control E	Control F	Control G	Control H
1	18.0	22.0	18.0	20.0	16.0	21.0	17.0	16.0
2	19.5	20.0	19.0	19.0	20.0	20.0	18.5	19.0
3	19.5	18.0	18.0	19.0	18.0	21.5	18.0	17.0
4	17.0	19.5	18.0	18.0	18.5	20.0	18.0	16.0
5	20.5	18.0	19.0	18.0	18.5	20.0	17.0	16.5
6	20.0	20.0	16.0	19.0	18.0	20.5	19.5	17.5
7	19.0	17.0	17.0	19.0	18.5	20.0	17.5	17.0
8	18.0	21.5	18.0	17.0	19.0	20.5	17.0	17.5
9	18.5	20.5	19.0	17.0	18.0	19.5	16.0	17.0
10	19.5	21.0	18.0	17.5	19.5	20.5	16.0	17.0
11	20.0	19.0	19.0	19.0	18.0	20.5	18.5	16.5
12	20.0	20.5	17.5	18.5	18.0	20.5	18.0	16.0
13	15.0	19.5	18.0	18.0	19.0	20.0	18.0	16.5
14	18.0	20.0	17.0	18.0	19.0	20.0	18.0	17.0
15	17.5	22.0	19.0	19.0	18.0	20.5	18.0	16.0
16	19.0	19.5	15.0	16.5	17.0	19.5	16.5	16.0
17	19.0	20.0	14.5	17.5	16.0	21.0	15.0	17.0
18	18.0	21.5	12.0	19.0	16.0	20.5	14.0	16.5
19	16.0	16.0	17.0	19.0	14.0	19.0		17.0
20	14.0	20.0		19.0	10.0	20.0		17.0
21	14.0	20.0		18.0	13.0	20.0		17.5
22	15.0	19.0		16.0	12.0	20.0		18.0
23		20.0		16.0	9.0	20.0		16.0
24		21.0		16.5		20.0		
25		18.0		11.0		21.0		
26		19.5		15.5		19.5		
27		19.0				20.5		
28		20.0				20.0		
29								
30								
31								
# Survivors	22	28	19	26	23	28	18	23
Average Length (mm)	17.95	19.71	17.32	17.69	16.65	20.21	17.25	16.85
Pooled Weight (mg)	2220.00	3110.00	1720.00	2184.00	2360.00	3320.00	1760.00	1830.00
Pooled Weight (g)	2.22	3.11	1.72	2.18	2.36	3.32	1.76	1.83
Average Weight (g)	0.101	0.111	0.091	0.084	0.103	0.119	0.098	0.080

= abnormal

JGH
 Feb. 7/12

Client: Teck
WO#: 161183

GH_ER2 (Unamended)

Fish #	100 A	100 B	100 C	100 D	100 E	100 F	100 G	100 H
1	16.0	16.0	16.0	20.0	15.5	17.0	16.0	18.0
2	15.5	18.0	16.0	19.0	18.0	18.0	18.0	19.0
3	16.0	18.0	16.0	17.0	18.5	19.0	18.0	18.0
4	16.5	18.0	15.5	18.0	18.5	18.5	16.0	17.0
5	16.0	19.0	17.0	18.0	17.5	18.0	17.5	19.0
6	15.0	19.0	17.0	19.5	18.0	18.0	16.0	16.5
7	15.5	17.0	17.0	18.0	18.0	19.0	17.5	19.0
8	15.5	16.0	16.0	18.0	16.0	19.0	18.0	18.0
9	16.0	20.0	17.0	17.0	18.0	18.0	17.5	18.0
10	16.0	20.0	13.0	18.5	19.0	17.0	17.5	18.0
11	15.0	17.0	14.0	18.0	15.5	17.0	18.0	18.0
12	15.5	18.0	13.0	18.0	16.5	18.0	18.0	17.0
13	10.0	18.0	15.0	16.5	19.0	18.0	17.0	17.0
14		19.0		20.0	10.0	20.0	18.0	17.5
15		17.0		19.0	11.0	18.5	17.0	18.5
16		18.0		15.5	13.0	18.0	17.0	19.5
17		18.0		17.0	15.0	18.0	17.0	17.0
18		19.0		18.0		19.0	18.0	17.5
19		16.0		18.0		18.0	19.0	18.0
20		17.0		16.0		18.0	13.0	19.0
21		17.0		19.0		15.0	11.0	18.0
22		18.0		17.5			11.0	19.0
23		17.0		19.0				17.0
24		18.5		19.0				18.5
25		17.0		17.5				
26		17.0		15.0				
27		14.0		16.0				
28		15.5						
29								
30								
31								
# Survivors	13	28	13	27	17	21	22	24
Average Length (mm)	15.27	17.57	15.58	17.85	16.29	18.05	16.64	18.00
Pooled Weight (mg)	1230.00	3120.00	1310.00	2360.00	1560.00	2220.00	2140.00	2010.00
Pooled Weight (g)	1.23	3.12	1.31	2.36	1.56	2.22	2.14	2.01
Average Weight (g)	0.095	0.111	0.101	0.087	0.092	0.106	0.097	0.084

= abnormal

JGA
Feb. 7/17

Client: Teck
 WO#: 161183

EV_ER4 (Unamended)

Fish #	100 A	100 B	100 C	100 D	100 E	100 F	100 G	100 H
1	19.0	20.0	17.0	19.0	15.5	20.0	18.0	18.0
2	19.0	18.0	19.5	18.5	16.0	20.5	18.0	18.0
3	20.0	20.0	19.0	19.5	18.0	20.5	16.0	17.0
4	18.0	18.0	17.0	18.5	18.5	21.0	16.5	17.0
5	18.0	18.0	17.0	19.0	18.0	20.0	17.5	19.0
6	19.0	19.0	17.0	18.5	18.0	20.0	16.0	16.0
7	17.0	17.5	18.5	18.0	16.0	21.0	17.0	17.0
8	18.0	18.5	18.0	19.0	16.0	20.0	16.0	18.0
9	18.0	18.0	17.5	19.0	16.0	21.0	15.0	16.0
10	19.0	16.0	17.0	18.0	19.0	19.0	17.0	19.0
11	18.0	18.0	17.0	18.0	18.0	20.0	16.0	19.0
12	19.0	18.5	18.0	18.5	18.0	20.0	16.0	17.0
13	18.0	20.5	18.0	19.0	18.0	20.5	18.5	17.0
14	18.0	19.0	19.0	20.0	15.0	21.0	15.0	15.0
15	19.0	17.0	18.5	19.0	17.0	20.0	13.0	17.0
16	18.0	16.0	17.0	18.0	16.0	20.0	13.0	17.0
17	17.0	18.5	17.0	17.0	15.0	20.0	13.0	18.0
18	16.0	17.5	16.0	18.5	16.0	19.0	15.0	18.0
19	14.0	17.5	16.0	19.0	15.0	19.5	15.0	16.0
20	14.0	18.0	17.0	17.5		20.0		17.0
21	15.0	18.0	16.5	20.0		19.0		18.0
22		19.0	17.0	19.0		21.0		18.0
23		14.0	14.0	19.0		21.0		18.0
24				18.0		20.5		18.0
25				17.0		21.0		18.0
26				20.0		19.0		19.0
27						19.5		
28						19.0		
29						20.0		
30						16.0		
31								
# Survivors	21	23	23	26	19	30	19	26
Average Length (mm)	17.67	18.02	17.33	18.63	16.79	19.97	15.87	17.50
Pooled Weight (mg)	2220.00	2650.00	2290.00	2390.00	1830.00	3690.00	1760.00	2070.00
Pooled Weight (g)	2.22	2.65	2.29	2.39	1.83	3.69	1.76	2.07
Average Weight (g)	0.106	0.115	0.100	0.092	0.096	0.123	0.093	0.080

= abnormal

JGN
 Feb. 7/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L SO4)

Fish #	400 A	400 B	400 C	400 D	400 E	400 F	400 G	400 H
1	17.0	17.0	16.0	18.0	18.0	19.0	18.0	19.0
2	18.0	19.0	16.0	18.0	18.0	19.0	18.0	18.0
3	17.0	18.0	17.0	19.0	18.0	19.0	18.5	16.0
4	17.0	19.0	18.0	18.5	18.0	16.0	18.0	17.0
5	19.0	18.0	18.0	18.0	18.5	19.5	18.0	16.0
6	15.5	17.0	15.5	19.0	18.5	19.0	18.5	16.0
7	15.5	18.0	16.0	18.0	15.0	19.0	16.0	16.0
8	16.0	19.0	15.0	18.0	18.0	19.0	16.0	16.0
9	16.5	17.0	16.5	18.0	18.0	19.0	18.0	16.0
10	15.5	18.0	16.0	20.0	18.5	19.0	18.0	18.0
11	17.0	17.0	18.0	18.0	18.0	20.0	17.0	17.0
12	15.5	16.0	16.5	18.0	18.0	19.0	16.5	17.5
13	15.0	17.5	17.0	16.5	18.0	19.0	18.5	17.0
14	12.0	17.0	17.0	18.0	18.5	18.5	17.0	17.0
15	11.5	15.0	16.0	18.0	15.5	19.0	19.0	15.0
16	11.0	16.0	15.0	18.5	12.0	20.0	18.0	15.5
17		17.0	15.0	18.5	9.0	19.5	18.0	16.0
18		15.5	15.0	18.0	9.0	20.0	18.0	17.0
19		18.0	17.0	18.0	9.0	19.0	16.0	17.0
20		18.0	12.0	19.0		19.5	12.0	17.0
21		17.0	14.0	18.0		17.0	16.0	15.0
22		15.0	12.0	19.0		20.0	16.0	13.0
23		16.5		16.0		20.5		11.5
24		17.0				20.0		
25		17.0				17.0		
26		17.0				19.5		
27		17.5				18.0		
28		19.0				20.5		
29		14.0				13.0		
30								
31								
# Survivors	16	29	22	23	19	29	22	23
Average Length (mm)	15.56	17.14	15.84	18.17	16.08	18.84	17.23	16.24
Pooled Weight (mg)	1560.00	3240.00	1980.00	1950.00	1950.00	3390.00	2310.00	1710.00
Pooled Weight (g)	1.56	3.24	1.98	1.95	1.95	3.39	2.31	1.71
Average Weight (g)	0.098	0.112	0.090	0.085	0.103	0.117	0.105	0.074

= abnormal

JG
 Feb-7/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L SO4)

Fish #	480 A	480 B	480 C	480 D	480 E	480 F	480 G	480 H
1	17.0	17.0	16.0	19.0	18.0	19.0	18.0	17.0
2	18.0	16.0	18.0	19.0	20.0	20.5	18.0	18.0
3	16.0	18.0	18.0	19.5	17.0	18.0	18.5	19.0
4	16.5	17.0	18.0	18.0	19.0	21.0	18.0	18.0
5	16.5	16.5	17.0	19.5	17.0	19.0	14.0	18.0
6	17.0	17.5	16.0	19.0	16.0	21.0	16.5	18.0
7	16.5	17.0	18.0	19.0	17.0	20.0	16.0	17.0
8	15.0	17.0	17.5	20.0	17.0	20.0	18.0	17.0
9	16.0	18.0	18.0	19.0	20.0	20.0	16.0	18.0
10	16.5	16.5	18.0	19.0	18.0	19.0	17.5	15.0
11	15.0	17.5	16.0	19.0	15.0	19.0	15.5	18.0
12	15.5	19.0	18.0	17.0	15.0	18.0	15.0	16.0
13	16.0	18.0	16.0	18.0	14.5	20.0	15.0	15.0
14	16.0	18.0	18.0	18.0	11.5	20.0	16.0	16.5
15	17.0	18.0	15.0	20.0		20.0	18.0	17.0
16	16.0	18.0	15.0	19.0		20.5	18.0	16.0
17	14.0	17.5	11.5	19.0		20.0	16.0	18.0
18	15.0	17.0		18.0		20.0	16.0	18.0
19		18.0		18.0		20.0	17.0	17.0
20		17.0		20.0		20.0	16.0	17.0
21		18.0		17.0		19.0	15.0	16.5
22		18.0		18.0		19.0	18.0	17.0
23		16.0		18.0		19.5	15.0	18.0
24		20.0		19.5		20.0	16.0	15.0
25		18.0		18.0		19.0	15.0	18.5
26		17.0		18.0			15.0	16.0
27		16.0		19.0			15.0	18.0
28							14.0	
29								
30								
31								
# Survivors	18	27	17	27	14	25	28	27
Average Length (mm)	16.08	17.46	16.71	18.69	16.79	19.66	16.29	17.13
Pooled Weight (mg)	1560.00	2900.00	1580.00	2310.00	1370.00	2910.00	2640.00	2190.00
Pooled Weight (g)	1.56	2.90	1.58	2.31	1.37	2.91	2.64	2.19
Average Weight (g)	0.087	0.107	0.093	0.086	0.098	0.116	0.094	0.081

= abnormal

Joh
 Feb. 7/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L SO4)

Fish #	576 A	576 B	576 C	576 D	576 E	576 F	576 G	576 H
1	17.0	21.0	17.0	19.0	16.0	19.0	16.0	18.0
2	16.0	20.0	17.0	19.0	17.0	21.0	15.0	15.5
3	16.0	20.0	18.0	19.0	18.0	19.0	16.0	17.0
4	16.0	18.0	17.0	19.0	16.0	21.0	16.0	18.0
5	17.0	20.5	16.0	18.0	17.0	19.0	16.0	18.5
6	17.5	20.0	16.0	15.0		21.0	17.0	18.0
7	18.0	19.0	16.0	18.0		21.0	16.0	16.0
8	15.0	20.0	16.0	18.0		20.0	15.0	18.0
9	17.0	20.5	15.5	18.0		21.0	15.0	18.0
10	11.0	20.0	16.0	18.0		20.0	16.0	18.0
11		20.0	16.0	18.0		18.0	15.5	17.0
12		20.0	15.5	19.5		20.0	16.0	16.0
13		17.0	15.5	15.0		20.0	16.0	18.0
14		21.0	17.0	19.0		19.5	15.0	16.0
15		17.0	15.0	18.5		19.0	13.0	16.0
16		19.0	15.0	18.0		19.0	16.0	16.0
17		20.0	16.0	14.0		19.0	10.5	18.0
18		20.0	14.0	17.0		20.5	14.0	18.0
19		19.0	15.0	16.5		20.0	13.0	17.0
20		19.0	16.0	17.5		19.0		
21		19.5	15.0	17.0		19.0		
22		21.0	8.0	16.5		20.5		
23		19.5	9.0	14.0		20.0		
24		20.0				20.0		
25		19.0				19.0		
26						20.0		
27						20.0		
28						19.0		
29						20.0		
30								
31								
# Survivors	10	25	23	23	5	29	19	19
Average Length (mm)	16.05	19.60	15.28	17.46	16.80	19.78	15.11	17.21
Pooled Weight (mg)	970.00	2880.00	2070.00	1840.00	490.00	3630.00	1670.00	1490.00
Pooled Weight (g)	0.97	2.88	2.07	1.84	0.49	3.63	1.67	1.49
Average Weight (g)	0.097	0.115	0.090	0.080	0.098	0.125	0.088	0.078

= abnormal

JCH
 Feb. 7/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L SO4)

Fish #	691 A	691 B	691 C	691 D	691 E	691 F	691 G	691 H
1	14.0	20.0	15.0	18.0	18.0	20.0	19.0	18.0
2	16.0	18.0	15.0	19.0	19.0	19.5	16.0	16.0
3	16.0	18.5	16.0	20.0	18.0	19.5	18.0	18.0
4	18.0	18.0	12.0	18.0	18.0	19.0	18.0	19.0
5	17.0	17.0	13.0	18.0	19.5	19.0	19.0	17.0
6	16.0	18.0		18.0	18.0	20.0	19.0	16.0
7	15.0	16.0		18.0	17.0	17.5	16.5	18.5
8	14.0	19.0		19.0	16.5	20.0	19.5	18.0
9		19.0		19.5	18.0	16.0	19.0	17.0
10		18.0		19.0	17.0	20.0	18.0	17.5
11		20.0		19.0	15.0	19.0	17.0	17.0
12		18.0		17.0	17.0	19.0	17.0	18.5
13		19.0		17.0	18.0	20.0	16.0	18.0
14		19.0		18.5	13.0	19.0		18.0
15		18.0		19.0	14.0	20.0		19.0
16		20.5		17.0		18.5		17.0
17		20.0		19.0		19.0		17.0
18		19.0		19.0		19.0		18.0
19		18.0		17.0		17.0		18.0
20		19.0		19.0		19.0		18.0
21		19.0		18.0		18.0		16.0
22		20.5		18.0		18.0		17.0
23		19.0		16.5				18.0
24		19.0		18.0				20.0
25		17.0		19.0				15.5
26		15.0		18.5				18.0
27				19.5				18.0
28								
29								
30								
31								
# Survivors	8	26	5	27	15	22	13	27
Average Length (mm)	15.75	18.52	14.20	18.35	17.07	18.91	17.85	17.63
Pooled Weight (mg)	760.00	2900.00	440.00	2300.00	1500.00	2490.00	1230.00	2170.00
Pooled Weight (g)	0.76	2.90	0.44	2.30	1.50	2.49	1.23	2.17
Average Weight (g)	0.095	0.112	0.088	0.085	0.100	0.113	0.095	0.080

= abnormal

JGU
 Feb. 7/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L SO4)

Fish #	829 A (no survival)	829 B	829 C	829 D	829 E (no survival)	829 F	829 G	829 H
1		18.0	17.0	19.0		19.0	15.5	18.0
2		17.0	15.0	19.0		16.0	17.0	19.0
3		19.0	15.0	18.0		19.0	15.0	16.5
4		20.0	17.0	19.0		17.0	16.0	17.5
5		17.0	16.5	19.5		18.0	15.5	19.5
6		17.0	15.0	20.0		16.5	15.0	18.0
7		17.0	14.0	18.0		16.5	15.0	18.0
8		17.0	16.0	19.0		18.0	17.0	19.0
9		17.0	16.5	19.5		16.0	15.5	18.0
10		18.0	15.0	20.0		17.0	16.0	20.0
11		18.0	14.5	18.5		19.0	12.0	17.0
12		17.0	15.0	19.0		18.0	14.0	18.0
13		17.0	15.0	18.0		19.0	11.0	19.0
14		17.0	15.0	20.0		17.0	15.0	17.0
15		17.0	14.0	18.5		19.0	15.0	18.0
16		16.5	16.5	17.5		17.5		19.0
17		18.0	16.0	19.0		19.5		17.0
18		16.0	15.0	19.0		18.0		17.0
19		16.0	16.0	19.0		19.0		17.0
20		17.0	16.0	18.0		17.0		19.0
21		16.0	13.0	18.0		19.0		18.0
22		19.0		18.0		18.0		19.0
23		16.0		18.0		16.5		19.0
24				18.0		18.0		17.0
25				15.0		17.0		17.5
26				20.0		20.0		16.0
27				18.5				
28								
29								
30								
31								
# Survivors	0	23	21	27	0	26	15	26
Average Length (mm)	-	17.28	15.38	18.63	-	17.87	14.97	18.00
Pooled Weight (mg)	0.00	2400.00	1910.00	2260.00	0.00	2830.00	1360.00	2150.00
Pooled Weight (g)	0.00	2.40	1.91	2.26	0.00	2.83	1.36	2.15
Average Weight (g)	0.000	0.104	0.091	0.084	0.000	0.109	0.091	0.083

= abnormal

JOK
 Feb - 7/12

Client: Teck
WO#: 161183

EV_ER4 (mg/L SO4)

Fish #	995 A	995 B	995 C	995 D	995 E	995 F	995 G	995 H
1	15.0	19.0	16.0	19.0	18.0	16.0	17.0	17.0
2	15.5	16.0	16.0	19.5	19.0	16.0	16.0	16.0
3	14.0	19.0	16.0	16.5	17.5	16.0	15.0	18.0
4		17.0	17.0	17.0	18.5	17.0	16.0	18.0
5		18.0	17.0	19.0	18.0	15.0	15.5	17.5
6		18.0	17.0	16.0	16.0	17.0	16.0	18.0
7		17.0	17.0	17.0	16.5	16.5	17.0	18.0
8		18.0	17.0	17.5	17.0	17.5	16.0	19.5
9		17.0	17.0	18.5	10.0	16.0	15.0	18.5
10		17.0	15.0	16.0		16.0	15.0	18.0
11		19.0	16.0	16.5		15.0	16.5	17.0
12		18.0	16.0	17.0		15.0	17.0	18.0
13		19.0	16.0	17.5		19.0	16.0	18.0
14		17.0	13.0	17.0		15.5	17.0	18.0
15		18.0	14.5	18.0		16.5	14.0	17.0
16		18.0		18.0		18.0	14.5	18.0
17		18.0		17.0		17.0	16.0	19.5
18		15.5		17.0			16.0	18.0
19		17.0		18.0			14.0	18.5
20		17.0		16.0				19.0
21		18.0		14.0				18.5
22								17.5
23								17.5
24								18.0
25								17.0
26								19.5
27								17.0
28								18.0
29								
30								
31								
# Survivors	3	21	15	21	9	17	19	28
Average Length (mm)	14.83	17.64	16.03	17.24	16.72	16.41	15.76	17.95
Pooled Weight (mg)	280.00	2270.00	1400.00	1730.00	930.00	1880.00	1750.00	2330.00
Pooled Weight (g)	0.28	2.27	1.40	1.73	0.93	1.88	1.75	2.33
Average Weight (g)	0.093	0.108	0.093	0.082	0.103	0.111	0.092	0.083

= abnormal

JGK
Feb. 7/12

Client: Teck
 WO#: 161183

GH_FR1 (Unamended)

Fish #	100 A	100 B	100 C	100 D	100 E	100 F	100 G	100 H
1	18.5	20.0	17.0	20.0	18.5	20.0	17.0	19.0
2	19.0	19.0	19.0	20.0	17.5	20.0	16.5	21.0
3	17.0	18.5	18.5	20.5	18.0	20.5	17.0	20.0
4	19.0	20.0	17.0	20.0	18.0	20.0	16.0	20.0
5	16.5	20.5	17.0	20.5	17.0	20.0	17.0	19.5
6	19.5	20.0	16.0	20.0	15.5	19.5	15.5	20.5
7	17.0	20.5	18.0	19.5	15.5	18.0	17.0	20.0
8	18.5	20.5	18.5	19.0	18.0	18.5	18.5	20.0
9	19.0	20.5	18.0	19.0	14.0	20.0	15.0	20.0
10	19.0	20.0	17.0	20.0		21.5	18.5	20.5
11	20.0	20.0	19.0	19.5		20.5	16.0	21.0
12	19.5	18.5	16.5	19.0		20.5	17.0	18.5
13	17.0	19.0	15.5	18.0		20.0	18.0	20.0
14	11.0	20.0	14.5	20.0		19.0	16.0	19.5
15	15.5	17.5	18.0	18.5		20.0	15.5	20.0
16		19.5	15.5	19.5		19.5	15.0	19.5
17		20.0	15.0	19.0		19.5	17.0	20.0
18		20.0		19.5		20.5	13.0	20.5
19		19.5		20.5		20.5	16.0	20.0
20		20.0		20.0			16.0	20.0
21		19.0		19.0				19.5
22		19.0						20.5
23		18.5						
24		19.0						
25		19.5						
26		18.5						
27		20.0						
28		15.0						
29		15.0						
30								
31								
# Survivors	15	29	17	21	9	19	20	22
Average Length (mm)	17.73	19.21	17.06	19.57	16.89	19.89	16.38	19.98
Pooled Weight (mg)	1560.00	3120.00	1540.00	1760.00	830.00	2060.00	1740.00	1790.00
Pooled Weight (g)	1.56	3.12	1.54	1.76	0.83	2.06	1.74	1.79
Average Weight (g)	0.104	0.108	0.091	0.084	0.092	0.108	0.087	0.081

= abnormal

JOU
 Feb. 7/12

Client: Teck
 WO#: 161183

GH_FR1 (mg/L SO4)

Fish #	400 A	400 B	400 C	400 D	400 E	400 F	400 G	400 H
1	18.0	20.0	18.5	19.5	18.0	19.5	19.5	20.0
2	20.0	20.5	17.0	20.5	17.0	20.5	19.0	20.0
3	19.0	20.5	20.0	19.5	20.0	20.0	18.0	19.5
4	20.0	19.0	18.5	19.0	18.5	20.5	19.0	20.0
5	18.5	20.5	17.5	19.0	18.0	18.5	19.5	19.0
6	18.0	19.0	15.0	20.0	19.0	20.5	19.0	19.5
7		18.5	18.5	18.5	20.0	20.5	15.0	20.0
8		21.0	18.5	18.0	19.0	19.5	13.0	20.5
9		17.5	18.5	18.5	20.0	20.0		19.5
10		19.0	17.0	18.0	17.0	20.0		19.5
11		20.0		18.0	16.5	19.0		20.0
12		19.0		17.0	19.0	20.5		20.0
13		19.5		19.0	18.0	19.0		19.0
14		20.0		19.0	15.5	20.5		18.0
15		17.0		18.5		18.0		20.0
16		17.0		17.0		19.5		20.0
17		17.0		18.5		20.0		20.0
18		18.5		19.0		18.5		18.5
19		18.5		19.0		20.0		19.5
20		17.0		19.5		19.0		20.0
21		18.5		15.5		20.0		20.0
22		20.5		14.5		20.5		20.0
23		20.0				20.5		19.5
24		20.0				20.5		20.0
25		19.5				21.0		
26		20.5				18.0		
27		20.0						
28		20.5						
29								
30								
31								
# Survivors	6	28	10	22	14	26	8	24
Average Length (mm)	18.92	19.23	17.90	18.41	18.25	19.77	17.88	19.67
Pooled Weight (mg)	640.00	3080.00	920.00	1730.00	1400.00	2900.00	750.00	2070.00
Pooled Weight (g)	0.64	3.08	0.92	1.73	1.40	2.90	0.75	2.07
Average Weight (g)	0.107	0.110	0.092	0.079	0.100	0.112	0.094	0.086

= abnormal

JGh
 Feb. 7/11

Client: Teck
 WO#: 161183

GH_FR1 (mg/L SO4)

Fish #	480 A	480 B	480 C	480 D	480 E	480 F	480 G	480 H
1	20.0	19.5	20.0	20.0	18.0	20.0	18.5	19.0
2	18.5	20.0	18.5	19.5	17.5	20.5	17.0	19.5
3	20.0	20.5	19.5	19.0	19.5	20.0	20.0	18.5
4	19.5	20.5	18.0	20.0	17.0	20.5	19.5	19.0
5	20.0	19.5	18.5	18.5		21.0	18.5	19.0
6	19.0	18.0	17.0	18.5		19.0	19.5	19.0
7	20.5	18.0	17.5	18.0		20.5	18.0	20.0
8	19.5	20.0	18.5	19.0		20.0	19.0	20.0
9	18.5	20.0	18.0	19.0		20.5	19.0	19.5
10	18.0	20.5	18.0	18.5		19.5	18.0	20.5
11	18.0	20.5	18.5	20.0		18.5	20.0	17.5
12	18.0	19.5	18.5	20.0		20.5	19.0	20.0
13	17.5	18.0	19.5	19.5		18.5	16.0	17.5
14	17.0	20.5	19.5	16.0		20.0	17.5	19.0
15	13.5	20.5	17.0	18.5		20.0		20.0
16	15.5	18.0	13.5	19.0		20.0		18.0
17	15.0	20.0	15.0	19.0		18.0		18.0
18	16.0		16.0	18.0		20.5		18.0
19			16.0	20.5		21.0		13.5
20			12.5	19.5		20.0		
21				19.0		19.0		
22						20.0		
23						20.0		
24						18.0		
25						20.0		
26						19.0		
27								
28								
29								
30								
31								
# Survivors	18	17	20	21	4	26	14	19
Average Length (mm)	18.00	19.62	17.48	19.00	18.00	19.79	18.54	18.71
Pooled Weight (mg)	1870.00	1870.00	1790.00	1650.00	340.00	2900.00	1310.00	1520.00
Pooled Weight (g)	1.87	1.87	1.79	1.65	0.34	2.90	1.31	1.52
Average Weight (g)	0.104	0.110	0.090	0.079	0.085	0.112	0.094	0.080

= abnormal

JCh
 Feb. 7/12

Client: Teck
WO#: 161183

GH_FR1 (mg/L SO4)

Fish #	576 A	576 B	576 C	576 D	576 E	576 F	576 G	576 H
1	16.0	19.0	18.0	17.0	18.0	20.0	18.5	20.0
2	18.5	19.5	17.0	17.0	18.5	21.0	16.0	19.0
3	19.0	19.0	18.0	17.5	18.5	20.0	17.0	19.0
4	17.5	19.0	15.5	17.5	18.0	20.0	17.0	19.0
5	17.5	18.5	17.0	16.5	16.5	20.0	18.0	19.5
6	15.0	19.0	19.5	18.0	17.0	17.5	19.0	19.5
7		17.0	17.0	18.0	18.5	18.0	18.5	19.0
8		19.0	18.5	19.0	18.0	20.0	18.0	20.0
9		19.0	15.5	17.5	17.0	20.0	19.5	20.0
10		18.0	19.0	19.0	16.5	18.5	19.0	18.0
11		18.0	16.0	15.0	17.0	18.0	18.0	20.0
12		19.0	15.5	17.0	13.5	20.0	19.0	18.0
13		20.0	17.0	17.0		18.5	19.0	18.0
14		18.5	17.0	15.0		19.0	15.0	17.0
15		20.0	17.5	15.0		19.5		20.0
16		19.0	18.0	17.0		18.0		19.5
17		20.0	17.0			19.0		19.5
18		19.0	18.0			20.0		19.0
19		18.5	17.0			18.5		19.0
20		19.0	15.5			17.0		20.0
21			17.0			20.0		19.0
22			16.0			17.0		19.0
23			17.5			19.0		19.0
24			18.0					18.5
25			15.0					19.0
26								20.0
27								
28								
29								
30								
31								
# Survivors	6	20	25	16	12	23	14	26
Average Length (mm)	17.25	18.90	17.08	17.06	17.25	19.07	17.96	19.13
Pooled Weight (mg)	500.00	2050.00	2210.00	1130.00	1220.00	3530.00	1310.00	2110.00
Pooled Weight (g)	0.50	2.05	2.21	1.13	1.22	3.53	1.31	2.11
Average Weight (g)	0.083	0.103	0.088	0.071	0.102	0.153	0.094	0.081

= abnormal

JGH
Feb. 7/12

Client: Teck
 WO#: 161183

GH_FR1 (mg/L SO4)

Fish #	691 A	691 B	691 C	691 D	691 E	691 F	691 G	691 H
1	18.0	17.0	17.5	19.0	20.0	20.0	17.5	17.0
2	19.0	19.5	18.0	18.0	17.0	20.5	18.0	18.5
3	18.5	18.0	17.0	17.0	18.0	19.0	17.0	18.5
4	18.0	19.0	17.0	18.0	19.0	20.5	18.5	17.5
5	20.0	18.0	16.5	19.0	18.0	20.0	17.0	20.0
6	18.5	18.0	21.0	20.0	18.0	19.0	17.0	19.0
7	18.0	20.5	18.5	17.0	18.5	20.0	16.5	20.0
8	18.5	18.5	17.0	18.0	18.0	19.5	15.5	20.0
9	17.0	18.5	16.5	18.5	17.5	20.0	16.0	20.0
10	18.0	19.5	15.5	17.0	18.5	20.5	15.0	19.0
11	18.0	19.0	15.0	17.0	15.0	20.5	16.0	19.0
12	16.0	18.0	14.5	18.5	14.0	18.0	16.0	18.5
13	17.0	18.0		16.5	11.0	20.5	16.5	18.0
14	17.0	18.5		14.5		20.5	16.0	19.0
15	16.5	18.0				20.5	17.0	19.5
16	13.0	18.5				20.0	15.0	20.0
17	15.0	19.0				19.0	16.0	19.0
18	12.0	19.5				20.0	16.0	19.0
19		18.0				15.0	19.0	19.0
20		18.0				17.5	15.0	18.5
21		18.0				20.5		18.0
22		19.0				19.5		19.0
23		18.0				20.5		18.0
24		17.5				18.0		18.5
25		18.0				20.0		19.0
26		18.0				18.0		19.0
27								18.5
28								
29								
30								
31								
# Survivors	18	26	12	14	13	26	20	27
Average Length (mm)	17.11	18.44	17.00	17.71	17.19	19.50	16.53	18.85
Pooled Weight (mg)	1760.00	2770.00	1170.00	1040.00	1330.00	2870.00	1730.00	2170.00
Pooled Weight (g)	1.76	2.77	1.17	1.04	1.33	2.87	1.73	2.17
Average Weight (g)	0.098	0.107	0.098	0.074	0.102	0.110	0.087	0.080

= abnormal

JGH
 Feb. 7/12

pg 15/16

Client: Teck
 WO#: 161183

GH_FR1 (mg/L SO4)

Fish #	829 A (no survival)	829 B	829 C (no survival)	829 D	829 E (no survival)	829 F	829 G	829 H
1		18.0		20.0		18.0	18.0	17.0
2		20.5		18.5		19.0	18.0	18.5
3		19.0		20.0		21.0	18.5	18.0
4		20.0		18.5		18.0	17.0	18.5
5		17.0		18.5		17.0	16.5	16.0
6		16.0		18.0		17.0	16.0	16.5
7		18.0		17.0		18.0	15.0	17.0
8		20.0		19.0		18.0	16.5	20.0
9		19.5		17.0		18.0	15.5	16.5
10		18.5		19.0		17.5	16.0	16.0
11		19.0		19.0		18.5	12.0	18.0
12		18.0		18.0		18.5	14.0	18.5
13		20.0		18.5		19.5	15.0	18.5
14		18.5		20.0		17.0	16.0	17.0
15		20.5		18.0		18.0		18.0
16				20.0		18.0		18.0
17				18.0		17.5		17.0
18				18.0		19.0		18.5
19				18.0		19.0		16.5
20				18.0		16.5		16.5
21				17.5		20.0		
22				17.0				
23				18.0				
24				18.5				
25				20.0				
26				18.0				
27				18.0				
28								
29								
30								
31								
# Survivors	0	15	0	27	0	21	14	20
Average Length (mm)	-	18.83	-	18.44	-	18.24	16.00	17.53
Pooled Weight (mg)	0.00	1540.00	0.00	2220.00	0.00	2220.00	1240.00	1420.00
Pooled Weight (g)	0.00	1.54	0.00	2.22	0.00	2.22	1.24	1.42
Average Weight (g)	0.000	0.103	0.000	0.082	0.000	0.106	0.089	0.071

= abnormal

JGh
 Feb. 7/12

Client: Teck
WO#: 161183

GH_FR1 (mg/L SO4)

Fish #	995 A	995 B	995 C	995 D	995 E	995 F	995 G	995 H
1	17.5	20.0	17.5	18.5	18.0	17.5	14.0	16.0
2	19.0	20.0	17.0	18.0	16.0	16.0		17.0
3		19.5	15.5	18.0		16.0		17.5
4		20.0	17.5	17.0		17.5		17.5
5		20.5		17.5		16.0		17.0
6		19.0		18.0		16.0		18.0
7		21.0		16.5		17.0		18.0
8		20.0		18.5		18.0		15.5
9		20.5		15.5		18.0		
10		17.0		20.0		17.0		
11		20.5		15.0		16.0		
12		18.0		18.0		18.0		
13		18.5		19.0		17.0		
14		20.5		18.5		17.5		
15		20.0		18.0		16.0		
16		21.5		17.5		16.0		
17		19.5		18.0		18.0		
18		20.0		15.0		15.0		
19						18.0		
20						16.0		
21						15.0		
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
# Survivors	2	18	4	18	2	21	1	8
Average Length (mm)	18.25	19.78	16.88	17.58	17.00	16.74	14.00	17.06
Pooled Weight (mg)	220.00	2020.00	370.00	1330.00	150.00	2050.00	140.00	590.00
Pooled Weight (g)	0.22	2.02	0.37	1.33	0.15	2.05	0.14	0.59
Average Weight (g)	0.110	0.112	0.093	0.074	0.075	0.098	0.140	0.074

= abnormal

Jls
Feb 6/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: Control
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Control A	1	18.0	/			
	2	19.5	/			
	3	19.5	/			
	4	17.0	/			
	5	20.5	/			
	6	20.0	/			
	7	19.0	/			
	8	18.0	/		lordosis JW	
	9	18.5	/			
	10	19.5	/			
	11	20.0	/			
	12	20.0	/			
	13	15.0	/			
	14	18.0	/			
	15	17.5	/			
	16	19.0	/			
	17	19.0	/			
	18	18.0	/			
	19	16.0	/			
	20	14.0			/	Lordosis
	21	14.0			/	2-head, Abnormal size
	22	15.0			/	Abnormal size
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 22.19^{JW} 2.219^K 2.22g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 3/3
 Initials: WIK/JW
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: Control

Termination Date: November 29, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Control B	1	22.0	/		
	2	20.0	/		
	3	18.0	/		
	4	19.5	/		
	5	18.0	/		
	6	20.0	/		
	7	17.0	/		
	8	21.5	/		
	9	20.5	/		
	10	21.0	/		
	11	19.0	/		
	12	20.5	/		
	13	19.5	/		
	14	20.0	/		
	15	22.0	/		
	16	19.5	/		
	17	20.0	/		
	18	21.5	/		
	19	16.0	/		
	20	20.0	/		
	21	20.0	/		
	22	19.0	/		
	23	20.0	/		
	24	21.0	/		
	25	18.0	/		
	26	19.5	/		
	27	19.0	/		
	28	20.0	/		
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 3114g² 311g

Number of survivors: 28

Number of deformed/have difficulty swimming: 0 / 0

Initials: W/KS/JW

Reviewed by: JG

Date Reviewed: Feb-7/17

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: Control
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Control C	1	18.0	/			
	2	19.0	/			
	3	18.0	/			
	4	18.0	/			
	5	19.0	/			
	6	16.0	/			
	7	17.0	/			
	8	18.0	/			
	9	19.0	/			
	10	18.0	/			
	11	19.0	/			
	12	17.5	/			
	13	18.0	/			
	14	17.0	/			
	15	19.0	/			
	16	15.0			✓	Bent tail
	17	14.5			✓	
	18	12.0			✓	↓ , edema (yolk sac)
	19	17.0			✓	Fungal infection
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.723^g
Number of survivors: 19
Number of deformed/have difficulty swimming: 4 / 14.3
Initials: WKS/SW JW
Reviewed by: JW

Date Reviewed: Feb 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: Control
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Control D	1	20.0	/			
	2	19.0	/			
	3	19.0	/			
	4	18.0	/			
	5	18.0	/			
	6	19.0	/			
	7	19.0	/			
	8	17.0	/			
	9	17.0	/			
	10	17.5	/			
	11	19.0	/			
	12	18.5	/			
	13	18.0	/			
	14	18.0	/			
	15	19.0	/			
	16	16.5	/			
	17	17.5	/			
	18	19.0	/			
	19	19.0	/			
	20	19.0	/			
	21	18.0	/			
	22	16.0	/			
	23	16.0	/			
	24	16.5	/			
	25	11.0			✓	Lordosis
	26	15.5			✓	Small tail fin
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.184th g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 2/2
 Initials: KJL/KL 26/16/JW

Reviewed by: JKH

Date Reviewed: Feb-7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: Control
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Control E	1	16.0	/			
	2	20.0	/			
	3	18.0	/			
	4	18.5 ^{mm}	/			
	5	18.5	/			
	6	18.0	/			
	7	18.5	/			
	8	19.0	/			
	9	18.0	/			
	10	19.5	/			
	11	18.0	/			
	12	18.0	/			
	13	19.0	/			
	14	19.0	/			
	15	18.0	/			
	16	17.0	/			
	17	16.0	/			
	18	16.0	/			
	19	14.0			✓	2 headed
	20	10.0			✓	skoliosis ^{scallops} , facial deformity
	21	13.0			✓	2 bodies, ^{scallops} lordosis, abnormal size
	22	12.0			✓	2 headed
	23	9.0			✓	Facial deformity
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.356^g 2.36g
 Number of survivors: 23
 Number of deformed/have difficulty swimming: 5/5
 Initials: WJL/JW
 Reviewed by: JGW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: Control
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
CONTROL F	1	21.0	/		
	2	20.0	/		
	3	21.5	/		
	4	20.0	/		
	5	20.0	/		
	6	20.5	/		
	7	20.0	/		
	8	20.5	/		
	9	19.5	/		
	10	20.5	/		
	11	20.5	/		
	12	20.5	/		
	13	20.0	/		
	14	20.0	/		
	15	20.5	/		
	16	19.5	/		
	17	21.0	/		
	18	20.5	/		
	19	19.0	/		
	20	20.0	/		
	21	20.0	/		
	22	20.0	/		
	23	20.0	/		
	24	20.0	/		
	25	21.0	/		
	26	19.5	/		
	27	20.5	/		
	28	20.0	/		
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 3.322g
 Number of survivors: 28
 Number of deformed/have difficulty swimming: 0/0
 Initials: WJWJW
 Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: Control
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Control 6	1	17.0	/			
	2	18.5	/			
	3	18.0	/			
	4	18.0	/			
	5	17.0	/			
	6	19.5	/			
	7	17.5	/			
	8	17.0	/			
	9	16.0	/			
	10	16.0	/			
	11	18.5	/			
	12	18.0	/			
	13	18.0	/			
	14	18.0	/			
	15	18.0	/			
	16	16.5			✓	Bent tail, small tail fin
	17	15.0			✓	small tail fin
	18	14.0			✓	Bent tail
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.762^g
 Number of survivors: 18
 Number of deformed/have difficulty swimming: 3/3
 Initials: WHS/aw
 Reviewed by: JGR

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: Control
Work Order No.: 16483

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Control H	1	16.0	/		
	2	19.0	//		
	3	17.0	/		
	4	16.0	/		
	5	16.5	/		
	6	17.5	/		
	7	17.0	/		
	8	17.5	/		
	9	17.0	//		
	10	17.0			
	11	16.5	/		
	12	16.0	/		
	13	16.5	/		
	14	17.0	/		
	15	16.0	//		
	16	16.0	/		
	17	17.0	/		
	18	16.5	/		
	19	17.0	/		
	20	17.0	/		
	21	17.5	/		
	22	18.0	/		
	23	16.0	/		
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.83^mg
Number of survivors: 23
Number of deformed/have difficulty swimming: 0/0
Initials: W/KJL/SW
Reviewed by: JGW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_ER2
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unawarded A	1	16.0	/			
	2	15.5	/			
	3	16.0	/			
	4	16.5	/			
	5	16.0	/			
	6	15.0	/			
	7	15.5	/			
	8	15.5	/			
	9	16.0	/			
	10	16.0	/			
	11	15.0	/			
	12	15.5	/			
	13	10.0			✓	skoliosis ^h scoliosis.
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.229g^h 1.23g
Number of survivors: 13
Number of deformed/have difficulty swimming: 1/1
Initials: WHL/SW
Reviewed by: JGh

Date Reviewed: Feb-7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_ER2
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unwounded B	1	16.0	/			
	2	18.0	/			
	3	18.0	/			
	4	18.0	/			
	5	19.0	/			
	6	19.0	/			
	7	17.0	/			
	8	16.0	/			
	9	20.0	/			
	10	20.0	/			
	11	17.0	/			
	12	18.0	/			
	13	18.0	/			
	14	19.0	/			
	15	17.0	/			
	16	18.0	/			
	17	18.0	/			
	18	19.0	/			
	19	16.0	/			
	20	17.0	/			
	21	17.0	/			
	22	18.0	/			
	23	17.0	/			
	24	18.5	/			
	25	17.0	/			
	26	17.0			✓	Small tail
	27	14.0			✓	↓, pale color
	28	16.5			✓	Small tail
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 3.122^g
Number of survivors: 28
Number of deformed/have difficulty swimming: 3/3
Initials: WHSJ/SW
Reviewed by: JGK

Date Reviewed: Feb - 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_ER2
Work Order No.: 16083

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unwounded C	1	16.0	/			
	2	16.0	/			
	3	16.0	/			
	4	15.5	/			
	5	17.0	/			
	6	17.0	/			
	7	17.0	/			
	8	16.0	/			
	9	17.0	/			
	10	13.0			✓	Bent tail
	11	14.0			✓	↓
	12	13.0			✓	
	13	15.0			✓	
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 305g^w 1-31g

Number of survivors: 13

Number of deformed/have difficulty swimming: 4/4

Initials: W/KJLW

Reviewed by: JOU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_ER2
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Unamended D	1	20.0	/			
	2	19.0	/			
	3	17.0	/			
	4	18.0	/			
	5	18.0	/			
	6	19.5	/			
	7	18.0	/			
	8	18.0	/			
	9	17.0	/			
	10	18.5	/			
	11	18.0	/			
	12	18.0	/			
	13	16.5	/			
	14	20.0	/			
	15	19.0	/			
	16	15.5	/			
	17	17.0	/			
	18	18.0	/			
	19	18.0	/			
	20	16.0	/			
	21	19.0	/			
	22	17.5	/			
	23	19.0	/			
	24	19.0	/			
	25	17.5	/			
	26	15.0			✓	small tail, lordosis, egg yolk edema
	27	16.0			✓	small tail.
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.356 g¹⁴ 2.36g
Number of survivors: 27
Number of deformed/have difficulty swimming: 2 / 2
Initials: W/KJL/SW
Reviewed by: JLW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_ER2
Work Order No.: 16183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Wormended E	1	15.5	/			
	2	18.0	/			
	3	18.5	/			
	4	18.5	/			
	5	17.5	/			
	6	18.0	/			
	7	18.0	/			
	8	16.0	/			
	9	18.0	/			
	10	19.0	/			
	11	15.5	/			
	12	16.5	/			
	13	19.0	/			
	14	10.0			✓	skeliosis scoliosis
	15	11.0			✓	2 bodies, 1 of them is lordosis
	16	13.0			✓	small tail fin
	17	15.0			✓	↓
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.56^g
Number of survivors: 17
Number of deformed/have difficulty swimming: 4/14
Initials: ML/LJSW
Reviewed by: JGR

Date Reviewed: Feb. 9/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_ER2
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended F	1	17.0	/			
	2	18.0	/			
	3	19.0	/			
	4	18.5	/			
	5	18.0	/			
	6	18.0	/			
	7	19.0	/			
	8	19.0	/			
	9	18.0	/			
	10	17.0	/			
	11	17.0	/			
	12	18.0	/			
	13	18.0	/			
	14	20.0	/			
	15	18.5	/			
	16	18.0	/			
	17	18.0	/			
	18	19.0	/			
	19	18.0	/			
	20	18.0	/			
	21	15.0			✓	NO tail fin
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.22^g

Number of survivors: 21

Number of deformed/have difficulty swimming: 1/1

Initials: W/KJL/SW

Reviewed by: JGN

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended G	1	16.0	/			
	2	18.0	/			
	3	18.0	/			
	4	16.0	/			
	5	17.5	/			
	6	16.0	/			
	7	17.5	/			
	8	18.0	/			
	9	17.5	/			
	10	17.5	/			
	11	18.0	/			
	12	18.0	/			
	13	17.0	/			
	14	18.0	/			
	15	17.0	/			
	16	17.0	/			
	17	17.0	/			
	18	18.0	/			
	19	19.0	/			
	20	13.0			✓	NO tail fin
	21	11.0			✓	Bent tail
	22	11.0			✓	NO tail fin
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.135g 2.14g

Number of survivors: 22

Number of deformed/have difficulty swimming: 3/3

Initials: W/MSL/BW

Reviewed by: JCh

Date Reviewed: Feb 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_ER2
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
unamended H	1	18.0	/		
	2	19.0	/		
	3	18.0	/		
	4	17.0	/		
	5	19.0	/		
	6	16.5	/		
	7	19.0	/		
	8	18.0	/		
	9	18.0	/		
	10	18.0	/		
	11	18.0	/		
	12	17.0	/		
	13	17.0	/		
	14	17.5	/		
	15	18.5	/		
	16	19.5	/		
	17	17.0	/		
	18	17.5	/		
	19	18.0	/		
	20	19.0	/		
	21	18.0	/		
	22	19.0	/		
	23	17.0	/		
	24	18.5	/		
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.006 g^u 2.01g
Number of survivors: 24
Number of deformed/have difficulty swimming: 0/0
Initials: W-K/SJW
Reviewed by: JGh

Date Reviewed: Feb - 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended A	1	19.0	/			
	2	19.0	/			
	3	20.0	/			
	4	18.0	/			
	5	18.0	/			
	6	19.0	/			
	7	17.0	/			
	8	18.0	/			
	9	18.0	/			
	10	19.0	/			
	11	18.0	/			
	12	19.0	/			
	13	18.0	/			
	14	18.0	/			
	15	19.0	/			
	16	18.0	/			
	17	17.0	/			
	18	16.0			✓	lordosis
	19	14.0			✓	2 bodies attached @ the tail, facial deformity
	20	14.0			✓	↓ no facial deformity
	21	15.0			✓	Bent tail, small tail fin
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.22g
 Number of survivors: 21
 Number of deformed/have difficulty swimming: 4 / 4
 Initials: KLSLW
 Reviewed by: JGh

Date Reviewed: Feb. 2/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended 6	1	20.0	/			
	2	18.0	/			
	3	20.0	/			
	4	18.0	/			
	5	18.0	/			
	6	19.0	/			
	7	17.5	/			
	8	18.5	/			
	9	18.0	/			
	10	16.0	/			
	11	18.0	/			
	12	18.5	/			
	13	20.5	/			
	14	19.0	/			
	15	17.0	/			
	16	16.0	/			
	17	18.5	/			
	18	17.5	/			
	19	17.5	/			
	20	18.0	/			
	21	18.0	/			
	22	19.0	/			
	23	14.0			✓	Pale, small tail fin
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ~~2.646g~~^h 2.65g
 Number of survivors: 23
 Number of deformed/have difficulty swimming: 1/1
 Initials: A/KJ/JW
 Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended C	1	17.0	/			
	2	19.5	/			
	3	19.0	/			
	4	17.0	/			
	5	17.0	/			
	6	17.0	/			
	7	18.5	/			
	8	18.0	/			
	9	17.5	/			
	10	17.0	/			
	11	17.0	/			
	12	18.0	/			
	13	18.0	/			
	14	19.0	/			
	15	18.5	/			
	16	17.0	/			
	17	17.0	/			
	18	16.0	/			
	19	16.0	/			
	20	17.0	/			
	21	16.5	/			
	22	17.0	/			
	23	14.0			✓	NO tail fin
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.29g^w
 Number of survivors: 23
 Number of deformed/have difficulty swimming: 1/1
 Initials: W/ST/W
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: EV_ER4
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Unamended D	1	19.0	/		
	2	18.5	/		
	3	19.5	/		
	4	18.5	/		
	5	19.0	/		
	6	18.5	/		
	7	18.0	/		
	8	19.0	/		
	9	19.0	/		
	10	18.0	/		
	11	18.0	/		
	12	18.5	/		
	13	19.0	/		
	14	20.0	/		
	15	19.0	/		
	16	18.0	/		
	17	17.0	/		
	18	18.5	/		
	19	19.0	/		
	20	17.5	/		
	21	20.0	/		
	22	19.0	/		
	23	19.0	/		
	24	18.0	/		
	25	17.0	/		
	26	20.0	/		
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.390^g
Number of survivors: 26
Number of deformed/have difficulty swimming: 0/0
Initials: W/LSI/JW
Reviewed by: JGh

Date Reviewed: Feb-7/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: November 29, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended E	1	15.5	/			
	2	16.0	/			
	3	18.0	/			
	4	18.9	/			
	5	18.0	/			
	6	18.0	/			
	7	16.0	/			
	8	16.0	/			
	9	16.0	/			
	10	19.0	/			
	11	18.0	/			
	12	18.0	/			
	13	18.0	/			
	14	15.0	/			
	15	17.0	/			
	16	16.0			✓	small tail fin
	17	15.0			✓	↓ , facial deformity
	18	16.0			✓	Bent tail fin
	19	15.0			✓	small tail fin
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.83g^u

Number of survivors: 11

Number of deformed/have difficulty swimming: 4/14

Initials: W/KS/aw

Reviewed by: JOU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: November 29, 2016

Work Order No.: 6683

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Unamended F	1	20.0	/			
	2	20.5	/			
	3	20.5	/			
	4	21.0	/			
	5	20.0	/			
	6	20.0	/			
	7	21.0	/			
	8	20.0	/			
	9	JW 20 21.0	/			
	10	JW 21 19.0	/			
	11	20.0	/			
	12	20.0	/			
	13	20.5	/			
	14	21.0	/			
	15	20.0	/			
	16	20.0	/			
	17	20.0	/			
	18	19.0	/			
	19	19.5	/			
	20	20.0	/			
	21	19.0	/			
	22	21.0	/			
	23	21.0	/			
	24	20.5	/			
	25	21.0	/			
	26	19.0	/			
	27	19.5	/			
	28	19.0	/			
	29	20.0	/			
	30	16.0			✓	2 bodies, one of them has lordosis & facial deformities
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 3.690^g

Number of survivors: 30

Number of deformed/have difficulty swimming: 1/1

Initials: W/K/SW

Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: November 29, 2016

Work Order No.: 16183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Unamended G	1	18	/			
	2	18	/			
	3	16	/			
	4	16.5	/			
	5	17.5	/			
	6	16	/			
	7	17	/			
	8	16	/			
	9	15	/			
	10	17	/			
	11	16	/			
	12	16	/			
	13	18.5	/			
	14	15	/			
	15	13			✓	Bent tail
	16	13			✓	↓
	17	13			✓	Lordosis, small tail fin
	18	15			✓	small tail fin
	19	15			✓	NO tail fin
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.764g

Number of survivors: 19

Number of deformed/have difficulty swimming: 5/5

Initials: W/K/S/W

Reviewed by: Jou

Date Reviewed: Feb-7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
unamended H	1	18	/		
	2	18	/		
	3	17	/		
	4	17	/		
	5	19	/		
	6	16	/		
	7	17	/		
	8	18	/		
	9	16	/		
	10	19	/		
	11	19	/		
	12	17	/		
	13	17	/		
	14	15	/		
	15	17	/		
	16	17	/		
	17	18	/		
	18	18	/		
	19	16	/		
	20	17	/		
	21	18	/		
	22	18	/		
	23	18	/		
	24	18	/		
	25	18	/		
	26	19	/		
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.074^g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 0/0
 Initials: WJESLW
 Reviewed by: JCW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400 mg/L SO ₂ A	1	17.0	/			
	2	18.0	/			
	3	17.0	/			
	4	17.0	/			
	5	19.0	/			
	6	15.5	/			
	7	15.5	/			
	8	16.0	/			
	9	16.5	/			
	10	15.5	/			
	11	17.0	/			
	12	15.5	/			
	13	15.0			✓	^{JW} Bent NO tail
	14	12.0			✓	Bent tail, pale color
	15	11.5			✓	2 bodies
	16	11.0			✓	↓
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ^{JW} ~~1.560~~ + ~~558g~~ 1.56g
 Number of survivors: 16
 Number of deformed/have difficulty swimming: 4/4
 Initials: W/ESL/JW
 Reviewed by: JGW

Date Reviewed: Feb-7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400 mg/L SO ₄ B	1	17.0	/			
	2	19.0	/			
	3	18.0	/			
	4	19.0	/			
	5	18.0	/			
	6	17.0	/			
	7	18.0	/			
	8	19.0	/			
	9	17.0	/			
	10	18.0	/			
	11	17.0	/			
	12	16.0	/			
	13	JW 18 17.5	/			
	14	17.0	/			
	15	15.0	/			
	16	16.0	/			
	17	17.0	/			
	18	15.5	/			
	19	18.0	/			
	20	18.0	/			
	21	17.0	/			
	22	15.0	/			
	23	16.5	/			
	24	17.0	/			
	25	17.0	/			
	26	17.0	/			
	27	17.5	/			
	28	19.0	/			
	29	14.0	✓			pale
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 3.235g ~ 3.24g

Number of survivors: 29

Number of deformed/have difficulty swimming: 0 / 0

Initials: M/HS/LW

Reviewed by: JG

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400mg/L SO ₂ C	1	16.0	/			
	2	16.0	/			
	3	17.0	/			
	4	18.0	/			
	5	18.0	/			
	6	15.5	/			
	7	16.0	/			
	8	15.0	/			
	9	16.5	/			
	10	16.0	/			
	11	18.0	/			
	12	16.5	/			
	13	17.0	/			
	14	17.0	/			
	15	16.0	/			
	16	15.0	/			
	17	15.0	/			
	18	15.0	/			
	19	17.0	/			
	20	12.0			✓	curved tail fin
	21	14.0			✓	NO tail fin
	22	12.0			✓	↓
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.98^ug
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 3/3
 Initials: WIKLAW
 Reviewed by: Job

Date Reviewed: Feb 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
400 mg/L SO ₄ D	1	18.0	/		
	2	18.0	/		
	3	19.0	/		
	4	18.5	/		
	5	18.0	/		
	6	19.0	/		
	7	18.0	/		
	8	18.0	/		
	9	18.0	/		
	10	20.0	/		
	11	18.0	/		
	12	18.0	/		
	13	16.5	/		
	14	18.0	/		
	15	18.0	/		
	16	18.5	/		
	17	18.5	/		
	18	18.0	/		
	19	18.0	/		
	20	19.0	/		
	21	18.0	/		
	22	19.0	/		
	23	16.0			✓
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.952^g
 Number of survivors: 23
 Number of deformed/have difficulty swimming: 1/1
 Initials: mlj/aw
 Reviewed by: JAW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 61183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400mg/L SO ₄ E	1	18.0	/			
	2	18.0	/			
	3	18.0	/			
	4	18.0	/			
	5	18.5	/			
	6	18.5	/			
	7	15.0	/			
	8	18.0	/			
	9	18.0	/			
	10	18.5	/			
	11	18.0	/			
	12	18.0	/			
	13	18.0	/			
	14	18.5	/			
	15	15.5	/			
	16	12.0			✓	2 bodies attached @ tail
	17	9.0			✓	osteostosis scdiosis
	18	9.0			✓	↓ , facial deformity
	19	9.0			✓	2 bodies
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.947g^{wt} 1.95g
 Number of survivors: 9
 Number of deformed/have difficulty swimming: 4/4
 Initials: WHL/JSW
 Reviewed by: JGL

Date Reviewed: Feb. 2/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
400mg/L SA F	1	19.0	/		
	2	19.0	/		
	3	19.0	/		
	4	16.0	/		
	5	19.5	/		
	6	19.0	/		
	7	19.0	/		
	8	19.0	/		
	9	19.0	/		
	10	19.0	/		
	11	20.0	/		
	12	19.0	/		
	13	19.0	/		
	14	18.5	/		
	15	19.0	/		
	16	20.0	/		
	17	19.5	/		
	18	20.0	/		
	19	19.0	/		
	20	19.5	/		
	21	17.0	/		
	22	20.0	/		
	23	20.5	/		
	24	20.0	/		
	25	17.0	/		
	26	19.5	/		
	27	18.0	/		
	28	20.5	/		
	29	13.0			✓
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 3.386g^x 3.39g

Number of survivors: 29

Number of deformed/have difficulty swimming: 1/1

Initials: WJW/SW

Reviewed by: JGK

Date Reviewed: Feb. 2/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400 mg/L SO ₂ 6	1	18.0	/			
	2	18.0	/			
	3	18.5	/			
	4	18.0	/			
	5	18.0	/			
	6	18.5	/			
	7	16.0	/			
	8	16.0	/			
	9	18.0	/			
	10	18.0	/			
	11	17.0	/			
	12	16.5	/			
	13	18.5	/			
	14	17.0	/			
	15	19.0	/			
	16	18.0	/			
	17	18.0	/			
	18	18.0	/			
	19	16.0			✓	Bent tail
	20	12.0			✓	
	21	16.0			✓	↓
	22	16.0			✓	
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.312^hg

Number of survivors: 22

Number of deformed/have difficulty swimming: 4/4

Initials: R164fw

Reviewed by: JOU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400mg/L SQ ₄ H	1	19.0	/			
	2	18.0	/			
	3	16.0	/			
	4	17.0	/			
	5	16.0	/			
	6	16.0	/			
	7	16.0	/			
	8	16.0	/			
	9	16.0	/			
	10	18.0	/			
	11	17.0	/			
	12	17.5	/			
	13	17.0	/			
	14	17.0	/			
	15	15.0	/			
	16	15.5	/			
	17	16.0	/			
	18	17.0	/			
	19	17.0	/			
	20	17.0	/			
	21	15.0	/			
	22	13.0			✓	NO tail
	23	11.5			✓	Bent tail.
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.708g^m 1.71g
 Number of survivors: 23
 Number of deformed/have difficulty swimming: 2/2
 Initials: K/KJLW
 Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/L SQ A	1	17.0	/			
	2	18.0	/			
	3	16.0	/			
	4	16.5	/			
	5	16.5	/			
	6	17.0	/			
	7	16.5	/			
	8	15.0	/			
	9	16.0	/			
	10	16.5	/			
	11	15.0	/			
	12	15.9	/			
	13	16.0	/			
	14	16.0	/			
	15	17.0	/			
	16	16.0			✓	Abnormal tail fin
	17	14.0			✓	2 bodies
	18	15.0			✓	small tail fin
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.563^g

Number of survivors: 8

Number of deformed/have difficulty swimming: 3/3

Initials: W/KLW

Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: EV_ER4
Work Order No.: 16183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
480mg/L 504 B	1	17.0	/		
	2	16.0	/		
	3	18.0	/		
	4	17.0	/		
	5	16.5	/		
	6	17.5	/		
	7	17.0	/		
	8	17.0	/		
	9	18.0	/		
	10	16.5	/		
	11	17.5	/		
	12	19.0	/		
	13	18.0	/		
	14	18.0	/		
	15	18.0	/		
	16	18.0	/		
	17	17.5	/		
	18	17.0	/		
	19	18.0	/		
	20	17.0	/		
	21	18.0	/		
	22	18.0	/		
	23	16.0	/		
	24	20.0	/		
	25	18.0	/		
	26	17.0	/		
	27	16.0	/		
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): ~~2.878g~~ 2.90g
Number of survivors: 27
Number of deformed/have difficulty swimming: 0/0
Initials: KMJ/TW
Reviewed by: SBH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/L 504 C	1	16.0	/			
	2	18.0	/			
	3	18.0	/			
	4	18.0	/			
	5	17.0	/			
	6	16.0	/			
	7	18.0	/			
	8	17.5	/			
	9	18.0	/			
	10	18.0	/			
	11	16.0	/			
	12	18.0	/			
	13	16.0	/			
	14	18.0	/			
	15	15.0	/			
	16	15.0			✓	Bent tail
	17	JW 18 11.5			✓	↓
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ~~1.575g~~ 1.58g
 Number of survivors: A
 Number of deformed/have difficulty swimming: 2/2
 Initials: KJL/JW
 Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16483

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
40mg/L SA D	1	19.0	/			
	2	19.0	/			
	3	19.5	/			
	4	18.0	/			
	5	19.5	/			
	6	19.0	/			
	7	19.0	/			
	8	20.0	/			
	9	19.0	/			
	10	19.0	/			
	11	19.0	/			
	12	17.0	/			
	13	18.0	/			
	14	18.0	/			
	15	20.0	/			
	16	19.0	/			
	17	19.0	/			
	18	18.0	/			
	19	18.0	/			
	20	20.0	/			
	21	17.0	/			
	22	18.0	/			
	23	18.0	/			
	24	19.5	/			
	25	18.0	/			
	26	18.0	/			
	27	19.0	/			
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.307g^W 2.31g
 Number of survivors: 27
 Number of deformed/have difficulty swimming: 0/0
 Initials: KJS/JSW
 Reviewed by: JGn

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 6183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/L SO ₄ E	1	18.0	/			
	2	20.0	/			
	3	17.0	/			
	4	19.0	/			
	5	17.0	/			
	6	16.0	/			
	7	17.0	/			
	8	17.0	/			
	9	20.0	/			
	10	18.0	/			
	11	15.0			✓	2 bodies attached @ yolk sac
	12	15.0			✓	
	13	14.5			✓	↓
	14	11.5			✓	2 bodies attached @ tail
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.366g^h 1.37g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 4 / 4
 Initials: K/KJL/JW JW
 Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
480mg/L SW F	1	19.0	/		
	2	20.5	/		
	3	18.0	/		
	4	21.0	/		
	5	19.0	/		
	6	21.0	/		
	7	20.0	/		
	8	20.0	/		
	9	20.0	/		
	10	19.0	/		
	11	19.0	/		
	12	18.0	/		
	13	20.0	/		
	14	20.0	/		
	15	20.0	/		
	16	20.5	/		
	17	20.0	/		
	18	20.0	/		
	19	20.0	/		
	20	20.0	/		
	21	19.0	/		
	22	19.0	/		
	23	19.5	/		
	24	20.0	/		
	25	19.0	/		
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.915g
 Number of survivors: 25
 Number of deformed/have difficulty swimming: 0/0
 Initials: W/ALJSW
 Reviewed by: JGM

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/L SO ₂ G	1	18.0	/			
	2	18.0	/			
	3	18.5	/			
	4	18.0	/			
	5	14.0	/			
	6	16.5	/			
	7	16.0	/			
	8	18.0	/			
	9	16.0	/			
	10	17.5	/			
	11	15.5	/			
	12	15.0	/			
	13	15.0	/			
	14	16.0	/			
	15	18.0	/			
	16	18.0	/			
	17	16.0	/			
	18	16.0	/			
	19	17.0	/			
	20	16.0	/			
	21	15.0	/			
	22	18.0	/			
	23	15.0			✓	Bent tail
	24	16.0			✓	↓
	25	15.0			✓	
	26	15.0			✓	
	27	15.0			✓	
	28	14.0			✓	
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.637g^h 2.64g

Number of survivors: 28

Number of deformed/have difficulty swimming: 6/6

Initials: KLJLJW

Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 66183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
480mg/L SW H	1	17.0	/		
	2	18.0	/		
	3	19.0	/		
	4	18.0	/		
	5	18.0	/		
	6	18.0	/		
	7	17.0	/		
	8	17.0	/		
	9	18.0	/		
	10	15.0	/		
	11	18.0	/		
	12	16.0	/		
	13	15.0	/		
	14	16.5	/		
	15	17.0	/		
	16	16.0	/		
	17	18.0	/		
	18	18.0	/		
	19	17.0	/		
	20	17.0	/		
	21	16.5	/		
	22	17.0	/		
	23	18.0	/		
	24	15.0	/		
	25	18.5	/		
	26	16.0	/		
	27	18.0	/		
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.187g^W 2.19g
 Number of survivors: 27
 Number of deformed/have difficulty swimming: 0/0
 Initials: KNSL/SW
 Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: November 29, 2016

Work Order No.: 16183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
576 mg/L SO ₂ A	1	17.0	/			
	2	16.0	/			
	3	16.0	/			
	4	16.0	/			
	5	17.2	/			
	6	17.5	/			
	7	18.0	/			
	8	15.0	/			
	9	17.0	/			
	10	11.0			✓	2 bodies attached, 1 w/ cranial facial deformities
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ~~0.965 g~~ 0.97g

Number of survivors: 10

Number of deformed/have difficulty swimming: 1/1

Initials: W-H/L/SW

Reviewed by: JG

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 61183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Stingless B	1	21.0	/		
	2	20.0	/		
	3	20.0	/		
	4	18.0	/		
	5	20.5	/		
	6	20.0	/		
	7	19.0	/		
	8	20.0	/		
	9	20.5	/		
	10	20.0	/		
	11	20.0	/		
	12	20.0	/		
	13	17.0	/		
	14	21.0	/		
	15	17.0	/		
	16	19.0	/		
	17	20.0	/		
	18	20.0	/		
	19	19.0	/		
	20	19.0	/		
	21	19.5	/		
	22	21.0	/		
	23	19.5	/		
	24	20.0	/		
	25	19.0	/		
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): ~~2.877g~~ 2.88g
 Number of survivors: 25
 Number of deformed/have difficulty swimming: 0/0
 Initials: WLSJW
 Reviewed by: JGN

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Stingray C	1	17.0	/			
	2	17.0	/			
	3	18.0	/			
	4	17.0	/			
	5	16.0	/			
	6	16.0	/			
	7	16.0	/			
	8	16.0	/			
	9	15.5	/			
	10	16.0	/			
	11	16.0	/			
	12	15.5	/			
	13	15.5	/			
	14	17.0	/			
	15	15.0	/			
	16	15.0	/			
	17	16.0	/			
	18	14.0	/			
	19	15.0	/			
	20	16.0	/			
	21	15.0	/			
	22	8.0			✓	Bent tail
	23	9.0			✓	Small tail fin
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.069gⁱⁿ 2.07g
 Number of survivors: 23
 Number of deformed/have difficulty swimming: 2/2
 Initials: WJG/SW
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: November 29, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Stbmg/L504 D	1	19.0	/		
	2	19.0	/		
	3	19.0	/		
	4	19.0	/		
	5	18.0	/		
	6	15.0	/		
	7	18.0	/		
	8	18.0	/		
	9	18.0	/		
	10	18.0	/		
	11	18.0	/		
	12	19.5	/		
	13	15.0	/		
	14	19.0	/		
	15	18.5	/		
	16	18.0	/		
	17	14.0	/		
	18	17.0	/		
	19	16.5	/		
	20	17.5	/		
	21	17.0	/		
	22	16.5	/		
	23	14.0			✓
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): ~~1.839g~~ 1.84g

Number of survivors: 23

Number of deformed/have difficulty swimming: 1/1

Initials: m/KJL/SW

Reviewed by: JGN

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
576mg/L SA E	1	16.0	✓			
	2	17.0	✓			
	3	18.0	✓			
	4	16.0		✓	Extra growth in the body	
	5	17.0	✓			
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ~~0.486 g~~ 0.49g
 Number of survivors: 5
 Number of deformed/have difficulty swimming: 1/0
 Initials: KASL/SW
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Stibungil SQ4 P	1	19.0	/		
	2	21.0	/		
	3	19.0	/		
	4	21.0	/		
	5	19.0	/		
	6	21.0	/		
	7	21.0	/		
	8	20.0	/		
	9	21.0	/		
	10	20.0	/		
	11	18.0	/		
	12	20.0	/		
	13	20.0	/		
	14	19.5	/		
	15	19.0	/		
	16	19.0	/		
	17	19.0	/		
	18	20.5	/		
	19	20.0	/		
	20	19.0	/		
	21	19.0	/		
	22	20.5	/		
	23	20.0	/		
	24	20.0	/		
	25	19.0	/		
	26	20.0	/		
	27	20.0	/		
	28	19.0	/		
	29	20.0	/		
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 3.638^g
 Number of survivors: 29
 Number of deformed/have difficulty swimming: 0/0
 Initials: W/KJL/SW
 Reviewed by: JGH

Date Reviewed: Feb. 2/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Sibungit 504 6	1	16.0	/		
	2	15.0	/		
	3	16.0	/		
	4	16.0	/		
	5	16.0	/		
	6	17.0	/		
	7	16.0	/		
	8	15.0	/		
	9	15.0	/		
	10	16.0	/		
	11	15.5	/		
	12	16.0	/		
	13	16.0	/		
	14	15.0	/		
	15	13.0	/		
	16	16.0	/		
	17	10.5	+ JW	✓	Bent tail
	18	14.0		✓	cranial / facial, small tail fin
	19	13.0		✓	Bent tail
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.673^g
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 3/3
 Initials: W/KJL/SW
 Reviewed by: JCN

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Strongly 504 H	1	18.0	/		
	2	15.5	/		
	3	17.8 ^h	/		
	4	18.0	/		
	5	18.5	/		
	6	18.0	/		
	7	16.0	/		
	8	18.0	/		
	9	18.0	/		
	10	18.0	/		
	11	17.0	/		
	12	16.0	/		
	13	18.0	/		
	14	16.0	/		
	15	16.0	/		
	16	16.0	/		
	17	18.0	/		
	18	18.0	/		
	19	17.0	/		
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.49^hg
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 0/0
 Initials: WHSJSW
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
641 mg/L SO ₂ A	1	JW X 14.0	/			
	2	12.5 16.0	/			
	3	X 16.0	/			
	4	18.0	/			
	5	17.0	/			
	6	16.0	/			
	7	15.0		✓	2 bodies attached @ tail	
	8	14.0		✓	↓ one of the body	
	9				It has scotiosis ^{scotiosis} & a smaller body, & cranial facial deformity	
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.756g^u 0.76g
 Number of survivors: 8
 Number of deformed/have difficulty swimming: 2/2
 Initials: WHLJSW
 Reviewed by: JOK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
64 Long 1504 B	1	20.0	/			
	2	18.0	/			
	3	18.5	/			
	4	18.0	/			
	5	17.0	/			
	6	18.0	/			
	7	16.0	/			
	8	19.0	/			
	9	19.0	/			
	10	18.0	/			
	11	20.0	/			
	12	18.0	/			
	13	19.0	/			
	14	19.0	/			
	15	18.0	/			
	16	20.5	/			
	17	20.0	/			
	18	19.0	/			
	19	18.0	/			
	20	19.0	/			
	21	19.0	/			
	22	20.5	/			
	23	19.0	/			
	24	19.0	/			
	25	17.0			✓	NO tail fin
	26	15.0			✓	↓
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.875 g^m 2.90g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 2/2
 Initials: MLJL/SW
 Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
691 mg/L SO4 C	1	15.0	✓			
	2	15.0	✓			
	3	16.0	✓			
	4	12.0		✓	Bent tail	
	5	13.0		✓	No tail	
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ~~0.437g~~ 0.44g
 Number of survivors: 5
 Number of deformed/have difficulty swimming: 2 / 2
 Initials: WHL/SW
 Reviewed by: JBU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: November 29, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
691 mg/L SO ₄ D	1	18.0	/		
	2	19.0	/		
	3	20.0	/		
	4	18.0	/		
	5	18.0	/		
	6	18.0	/		
	7	18.0	/		
	8	19.0	/		
	9	19.5	/		
	10	19.0	/		
	11	19.0	/		
	12	17.0	/		
	13	17.0	/		
	14	18.5	/		
	15	19.0	/		
	16	17.0	/		
	17	19.0	/		
	18	19.0	/		
	19	17.0	/		
	20	19.0	/		
	21	18.0	/		
	22	18.0	/		
	23	16.5	/		
	24	18.0	/		
	25	19.0	/		
	26	18.5	/		
	27	19.5	/		
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.297g^W 2-30g

Number of survivors: 27

Number of deformed/have difficulty swimming: 0/0

Initials: W/LSJW

Reviewed by: JCH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
E91mg/L SO ₄ E	1	18.0	/		
	2	18.0	/		
	3	18.0	/		
	4	18.0	/		
	5	19.5	/		
	6	18.0	/		
	7	17.0	/		
	8	16.5	/		
	9	18.0	/		
	10	17.0	/		
	11	15.0	/		
	12	JW 16 17.0	/		
	13	18.0	/		
	14	13.0		✓	2 bodies attached @ tail
	15	14.0		✓	↓, small tail fin
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.50g
 Number of survivors: 6
 Number of deformed/have difficulty swimming: 2/2
 Initials: W/L/SW
 Reviewed by: JGW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 66183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
691mg/L SO4 F	1	20.0	/		
	2	JW 20 19.5	/		
	3	19.5	/		
	4	19.0	/		
	5	19.0	/		
	6	20.0	/		
	7	17.9	/		
	8	20.0	/		
	9	16.0	/		
	10	20.0	/		
	11	19.0	/		
	12	19.0	/		
	13	20.0	/		
	14	19.0	/		
	15	20.0	/		
	16	18.5	/		
	17	19.0	/		
	18	19.0	/		
	19	17.0	/		
	20	19.0	/		
	21	18.0	/		
	22	18.0	/		
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.493⁴g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 0/0
 Initials: K/LJL/SW
 Reviewed by: John

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
691 mg/L SQ4 G	1	19.0	/			
	2	16.0	/			
	3	18.0	/			
	4	18.0	/			
	5	19.0	/			
	6	19.0	/			
	7	16.5	/			
	8	19.5	/			
	9	19.0	/			
	10	18.0	/			
	11	17.0			✓	Twisted tail
	12	17.0			✓	↓
	13	16.0			✓	Bent / twisted tail
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.237g
 Number of survivors: 13
 Number of deformed/have difficulty swimming: 3/3
 Initials: WKL/JW
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 61183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
691mg/L SO4 H	1	18.0	/			
	2	16.0	/			
	3	18.0	/			
	4	19.0	/			
	5	17.0	/			
	6	16.0	/			
	7	18.5	/			
	8	18.0	/			
	9	17.0	/			
	10	17.5	/			
	11	17.0	/			
	12	18.5	/			
	13	18.0	/			
	14	18.0	/			
	15	19.0	/			
	16	17.0	/			
	17	17.0	/			
	18	18.0	/			
	19	18.0	/			
	20	18.0	/			
	21	16.0	/			
	22	17.0	/			
	23	18.0	/			
	24	20.0	/			
	25	15.5	/			
	26	18.0	/			
	27	18.0	/			
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.17Xg
 Number of survivors: 27
 Number of deformed/have difficulty swimming: 0/0
 Initials: WJSLTW
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: EV_ER4
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
829mg/L SO4 B	1	18.0	/		
	2	17.0	/		
	3	19.0	/		
	4	20.0	/		
	5	17.0	/		
	6	17.0	/		
	7	17.0	/		
	8	17.0	/		
	9	17.0	/		
	10	18.0	/		
	11	18.0	/		
	12	17.0	/		
	13	17.0	/		
	14	17.0	/		
	15	17.0	/		
	16	JW 17 16.5	/		
	17	JW 16.5 18.0	/		
	18	16.0	/		
	19	16.0	/		
	20	17.0	/		
	21	16.0	/		
	22	19.0	/		
	23	16.0	/		
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.404g
Number of survivors: 23
Number of deformed/have difficulty swimming: 0%
Initials: in HSL/SW
Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: EV_ER4
Work Order No.: 6163

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
829 mg/L SD4 C	1	17.0	/			
	2	15.0	/			
	3	15.0	/			
	4	17.0	/			
	5	16.5	/			
	6	15.0	/			
	7	14.0	/			
	8	16.0	/			
	9	16.5	/			
	10	15.0	/			
	11	14.5	/			
	12	15.0	/			
	13	15.0	/			
	14	15.0	/			
	15	14.0	/			
	16	16.5	/			
	17	16.0	/			
	18	15.0	/			
	19	16.0	/			
	20	16.0			✓	Small tail fin
	21	13.0			✓	Bent tail fin
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.91g
Number of survivors: 21
Number of deformed/have difficulty swimming: 2/2
Initials: WASL/TW
Reviewed by: JGW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161123

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
80 mg/L S4 D	1	19.0	/		
	2	19.0	/		
	3	18.0	/		
	4	19.0	/		
	5	19.5	/		
	6	20.0	/		
	7	18.0	/		
	8	19.0	/		
	9	19.5	/		
	10	20.0	/		
	11	18.5	/		
	12	19.0	/		
	13	18.0	/		
	14	20.0	/		
	15	18.5	/		
	16	17.5	/		
	17	19.0	/		
	18	19.0	/		
	19	19.0	/		
	20	18.0	/		
	21	18.0	/		
	22	18.0	/		
	23	18.0	/		
	24	18.0	/		
	25	15.0	/		
	26	20.0	/		
	27	18.5	/		
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): ~~2.256g~~ 2.26g

Number of survivors: 27

Number of deformed/have difficulty swimming: 0/0

Initials: WJL/JW

Reviewed by: JGN

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
829 mg/L SQ EF JW	1	19.0	/		
	2	16.0	/		
	3	19.0	/		
	4	17.0	/		
	5	18.0	/		
	6	16.5	/		
	7	16.5	/		
	8	18.0	/		
	9	16.0	/		
	10	17.0	/		
	11	19.0	/		
	12	18.0	/		
	13	19.0	/		
	14	17.0	/		
	15	19.0	/		
	16	17.5	/		
	17	19.5	/		
	18	18.0	/		
	19	19.0	/		
	20	17.0	/		
	21	19.0	/		
	22	18.0	/		
	23	16.5	/		
	24	18.0	/		
	25	17.0	/		
	26	20.0	/		
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 282.4g^h 2.83g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 0/0
 Initials: K/KJ/JW
 Reviewed by: JW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
829mg/L SO ₄ R G JW	1	15.5	/			
	2	17.0	/			
	3	15.0	/			
	4	16.0	/			
	5	15.5	/			
	6	15.0	/			
	7	15.0	/			
	8	17.0	/			
	9	15.5	/			
	10	16.0	/			
	11	12.0			✓	Bent tail
	12	14.0			✓	
	13	11.0			✓	↓
	14	15.0			✓	
	15	15.0			✓	Twisted tail
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.357g 1.36g

Number of survivors: 15

Number of deformed/have difficulty swimming: 5/5

Initials: K/SL/JW

Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
829 mg/L SO ₄ H	1	18.0	/		
	2	19.0	/		
	3	16.5	/		
	4	17.5	/		
	5	19.5	/		
	6	18.0	/		
	7	18.0	/		
	8	19.0	/		
	9	18.0	/		
	10	20.0	/		
	11	17.0	/		
	12	18.0	/		
	13	19.0	/		
	14	17.0	/		
	15	18.0	/		
	16	19.0	/		
	17	17.0	/		
	18	17.0	/		
	19	17.0	/		
	20	19.0	/		
	21	18.0	/		
	22	19.0	/		
	23	19.0	/		
	24	17.0	/		
	25	17.5	/		
	26	16.0	/		
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2 149 g⁴ 2.15g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 0/0
 Initials: W/KJLAW
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: EV_ER4
Work Order No.: 16183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
995mg/L SO4 A	1	15.0	✓			
	2	15.5	✓			
	3	14.0		✓	NO TAIL FIN	
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ~~0.278g~~ 0.28g
Number of survivors: 3
Number of deformed/have difficulty swimming: 1/1
Initials: WJL/JW
Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16683

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
99 Single / say B	1	19.0	/		
	2	16.0	/		
	3	19.0	/		
	4	17.0	/		
	5	18.0	/		
	6	18.0	/		
	7	17.0	/		
	8	18.0	/		
	9	17.0	/		
	10	17.0	/		
	11	19.0	/		
	12	18.0	/		
	13	19.0	/		
	14	17.0	/		
	15	18.0	/		
	16	18.0	/		
	17	18.0	/		
	18	15.5	/		
	19	17.0	/		
	20	17.0	/		
	21	18.0	/		
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.26g^h 2.27g
 Number of survivors: 21
 Number of deformed/have difficulty swimming: 0/0
 Initials: W/K/J/T/W
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: EV_ER4
Work Order No.: 161123

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
9915mg/L SO ₂ C	1	16.0	/			
	2	16.0	/			
	3	16.0	/			
	4	17.0	/			
	5	17.0	/			
	6	17.0	/			
	7	17.0	/			
	8	17.0	/			
	9	17.0	/			
	10	15.0	/			
	11	16.0	/			
	12	16.0	/			
	13	16.0			✓	NO tail
	14	13.0			✓	Bent tail
	15	14.5			✓	↓
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.40g
Number of survivors: 5
Number of deformed/have difficulty swimming: 3/3
Initials: W/KJLJW
Reviewed by: JGw

Date Reviewed: Feb-7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
94 Single SQ4 D	1	19.0	/		
	2	19.5	/		
	3	16.5	/		
	4	17.0	/		
	5	19.0	/		
	6	16.0	/		
	7	17.0	/		
	8	17.5	/		
	9	18.5	/		
	10	16.0	/		
	11	16.5	/		
	12	17.0	/		
	13	17.5	/		
	14	17.0	/		
	15	18.0	/		
	16	18.0	/		
	17	17.0	/		
	18	17.0	/		
	19	18.0	/		
	20	16.0	/		
	21	14.0			✓
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.732^g
 Number of survivors: 21
 Number of deformed/have difficulty swimming: 1 / 1
 Initials: WLSLJW
 Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161133

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
A95mg/L SO ₂ E	1	18.0	/			
	2	19.0	/			
	3	17.5	/			
	4	18.9	/			
	5	18.0	/			
	6	16.0		✓		Extra body / growth on yolk sac
	7	16.5	✓	X JW		
	8	17.0		✓		twisted tail
	9	10.0		✓		skeliosis scoliosis
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.932^g
 Number of survivors: 9
 Number of deformed/have difficulty swimming: 3 / 3
 Initials: EL / USL / JW
 Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
995mg/L SO4 F	1	16.0	/		
	2	16.0	/		
	3	16.0	/		
	4	17.0	/		
	5	15.0	/		
	6	17.0	/		
	7	16.5	/		
	8	17.5	/		
	9	16.0	/		
	10	16.0	/		
	11	15.0	/		
	12	15.0	/		
	13	19.0 _{SW}	/		
	14	19.0 15.5	/		
	15	16.5	/		
	16	18.0	/		
	17	17.0	/		
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.884^g
 Number of survivors: 17
 Number of deformed/have difficulty swimming: 0/0
 Initials: WKL/JV
 Reviewed by: JBL

Date Reviewed: Feb 7/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
995 Single Sel G	1	17.0	/			
	2	16.0	/			
	3	15.0	/			
	4	16.0	/			
	5	15.5	/			
	6	16.0	/			
	7	17.0	/			
	8	16.0	/			
	9	15.0	/			
	10	15.0	/			
	11	16.5	/			
	12	17.0	/			
	13	16.0	/			
	14	17.0	/			
	15	14.0	/			
	16	14.5	/			
	17	16.0	/			
	18	16.0			✓	Bent tail
	19	14.0			✓	↓
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.75^g
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 2 / 2
 Initials: MLKLSW
 Reviewed by: JOU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
095mg/L SO ₄ H	1	17.0	/		
	2	16.0		✓	Yolk sac edema
	3	18.0	/		
	4	18.0	/		
	5	17.5	/		
	6	18.0	/		
	7	18.0	/		
	8	19.5	/		
	9	18.5	/		
	10	18.0	/		
	11	JW 18 17.0	/		
	12	18.0	/		
	13	18.0	/		
	14	18.0	/		
	15	17.0	/		
	16	18.0	/		
	17	19.5	/		
	18	18.0	/		
	19	18.5	/		
	20	19.0	/		
	21	18.5	/		
	22	17.5	/		
	23	17.5	/		
	24	18.0	/		
	25	17.0	/		
	26	19.5	/		
	27	17.0	/		
	28	18.0	/		
29			xu		
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.326g^{*} 2.33g

Number of survivors: 28

Number of deformed/have difficulty swimming: 1 / 1

Initials: M/JL/JW

Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended unamended A	1	18.5	✓			
	2	19.0	✓			
	3	17.0	✓			
	4	19.0	✓			
	5	16.5	✓			
	6	19.5	✓			
	7	17.0	✓			
	8	18.5	✓			
	9	19.0	✓			
	10	19.0	✓			
	11	20.0	✓			
	12	19.5	✓			
	13	17.0	✓			
	14	11.0			✓	2 bodies attached to one yolk sac, shortened tails
	15	15.5			✓	2 bodies attached to one yolk sac
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 156 g

Number of survivors: 15

Number of deformed/have difficulty swimming: 2/2

Initials: ML/SS

Reviewed by: JGW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unamended B	1	20.0	✓			
	2	19.0	✓			
	3	18.5	✓			
	4	20.0	✓			
	5	20.5	✓			
	6	20.0	✓			
	7	20.5	✓			
	8	20.5	✓			
	9	20.5	✓			
	10	20.0	✓			
	11	20.0	✓			
	12	18.5	✓			
	13	19.0	✓			
	14	20.0	✓			
	15	17.5	✓			
	16	19.5	✓			
	17	20.0	✓			
	18	20.0	✓			
	19	19.5	✓			
	20	20.0	✓			
	21	19.0	✓			
	22	19.0	✓			
	23	18.5	✓			
	24	19.0	✓			
	25	19.5	✓			
	26	18.5	✓			
	27	20.0	✓			
	28	15.0			✓	for short body, pale body.
	29	15.0			✓	lordosis
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 3.12 g
 Number of survivors: 29
 Number of deformed/have difficulty swimming: 2/2
 Initials: YVL, JS, EL
 Reviewed by: JBL

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unintended C	1	17.0	✓			
	2	19.0	✓			
	3	18.5	✓			
	4	17.0	✓			
	5	17.0	✓			
	6	16.0	✓			
	7	18.0	✓			
	8	18.5	✓			
	9	18.0	✓			
	10	17.0	✓			
	11	19.0	✓			
	12	16.5	✓			
	13	15.5	✓			
	14	14.5	✓			
	15	18.0	✓			
	16	15.5			✓	Dent tail ^{EL} fin
	17	15.0			✓	shorten tail fin
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.54g^a +
 Number of survivors: 17
 Number of deformed/have difficulty swimming: as 2/2
 Initials: Y4LSS/EC
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: November 29, 2016

Work Order No.: 16183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
unmounded D	1	20.0	✓		
	2	20.0	✓		
	3	20.5	✓		
	4	20.0	✓		
	5	20.5	✓		
	6	20.0	✓		
	7	19.5	✓		
	8	19.0	✓		
	9	19.0	✓		
	10	20.0	✓		
	11	19.5	✓		
	12	19.0	✓		
	13	18.0	✓		
	14	20.0	✓		
	15	18.5	✓		
	16	19.5	✓		
	17	19.0	✓		
	18	19.5	✓		
	19	20.5	✓		
	20	20.0	✓		
	21	19.0	✓		
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.76 g

Number of survivors: 21

Number of deformed/have difficulty swimming: 0/0

Initials: YML/STK

Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unrecorded E	1	18.5	✓			
	2	17.5	✓			
	3	18.0	✓			
	4	18.0	✓			
	5	17.0	✓			
	6	15.5	✓			
	7	15.5	✓			
	8	18.0	✓			
	9	14.0			✓	two bodies attached to one yolk sac
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.83 g
 Number of survivors: 9
 Number of deformed/have difficulty swimming: 1/1
 Initials: YML/SS/EC
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
Unamended F	1	20.0	✓			
	2	20.0	✓			
	3	20.5	✓			
	4	20.0	✓			
	5	20.0	✓			
	6	19.5	✓			
	7	18.0	✓			
	8	18.5	✓			
	9	20.0	✓			
	10	21.5	✓			
	11	20.5	✓			
	12	20.5	✓			
	13	20.0	✓			
	14	19.0	✓			
	15	20.0	✓			
	16	19.5	✓			
	17	19.5	✓			
	18	20.5	✓			
	19	20.5	✓			
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.06 g
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 0/0
 Initials: JSL/JSK
 Reviewed by: JSL

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
unheaded G	1	17.0	✓			
	2	16.5	✓			
	3	17.0	✓			
	4	16.0	✓			
	5	17.0	✓			
	6	15.5	✓			
	7	17.0	✓			
	8	18.5	✓			
	9	15.0	✓			
	10	18.5	✓			
	11	16.0	✓			
	12	17.0	✓			
	13	18.0	✓			
	14	16.0	✓			
	15	15.5	✓			
	16	15.0	✓			
	17	17.0	✓			
	18	13.0			✓	Bent tail / shorten tail fin
	19	16.0			✓	Bent tail, shorten tail fin
	20	16.0			✓	lordosis ^{body} jaw deformity, pale color
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 1.74 g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 3/3

Initials: YHL/SS/EC

Reviewed by: Jau

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
Wounded H	1	19.0	✓		
	2	21.0	✓		
	3	20.0	✓		
	4	20.0	✓		
	5	19.5	✓		
	6	20.5	✓		
	7	20.0	✓		
	8	20.0	✓		
	9	20.0	✓		
	10	20.5	✓		
	11	21.0	✓		
	12	18.5	✓		
	13	20.0	✓		
	14	19.5	✓		
	15	20.0	✓		
	16	19.5	✓		
	17	20.0	✓		
	18	20.5	✓		
	19	20.0	✓		
	20	20.0	✓		
	21	19.5	✓		
	22	20.5	✓		
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.79 g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 0/0

Initials: ML/SJEC

Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400mg/L SO ₄ A	1	18.0	✓			
	2	20.0	✓			
	3	19.0	✓			
	4	20.0	✓			
	5	18.5	✓			
	6	18.0	✓			
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.64 g
 Number of survivors: 6
 Number of deformed/have difficulty swimming: 0/0
 Initials: MLISS/EC
 Reviewed by: Joh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
400mg/L SD4 B	1	20.0	✓		
	2	20.5	✓		
	3	20.5	✓		
	4	19.0	✓		
	5	20.5	✓		
	6	19.0	✓		
	7	18.5	✓		
	8	21.0	✓		
	9	17.5	✓		
	10	19.0	✓		
	11	20.0	✓		
	12	19.0	✓		
	13	19.5	✓		
	14	20.0	✓		
	15	17.0	✓		
	16	17.0	✓		
	17	17.0	✓		
	18	18.5	✓		
	19	18.5	✓		
	20	19.0	✓		
	21	18.5	✓		
	22	20.5	✓		
	23	20.0	✓		
	24	20.0	✓		
	25	19.5	✓		
	26	20.5	✓		
	27	20.0	✓		
	28	20.5	✓		
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 3.08 g

Number of survivors: 28

Number of deformed/have difficulty swimming: 0/0

Initials: YML/SS/EC

Reviewed by: JGA

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: November 29, 2016

Work Order No.: 161123

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400mg/L SA4 C	1	18.5	✓			
	2	17.0	✓			
	3	20.0	✓			
	4	18.5	✓			
	5	17.5	✓			
	6	15.0			✓	Bent tail
	7	18.5	✓			
	8	18.5	✓			
	9	18.5	✓			
	10	17.0	✓			
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.92 g

Number of survivors: 10

Number of deformed/have difficulty swimming: 1/1

Initials: MLSS/EC

Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
400mg/L Se4 D	1	19.5	✓		
	2	20.5	✓		
	3	19.5	✓		
	4	19.0	✓		
	5	19.0	✓		
	6	20.0	✓		
	7	18.5	✓		
	8	18.0	✓		
	9	18.5	✓		
	10	18.0	✓		
	11	18.0	✓		
	12	17.0	✓		
	13	19.0	✓		
	14	19.0	✓		
	15	18.5	✓		
	16	17.0	✓		
	17	18.5	✓		
	18	19.0	✓		
	19	19.0	✓		
	20	19.5	✓		
	21	15.5	✓		
22	14.5			✓	Ky ^{ph} l ^{ph} osis
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.73 g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 1/21
 Initials: YML/SS/EC
 Reviewed by: JGM

Date Reviewed: Feb 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
400mg/kg SQ E	1	18.0	✓			
	2	17.0	✓			
	3	20.0	✓			
	4	18.5	✓			
	5	18.0	✓			
	6	19.0	✓			
	7	20.0	✓			
	8	19.0	✓			
	9	20.0	✓			
	10	17.0	✓			
	11	16.5	✓			
	12	19.0	✓			
	13	18.0	✓			
	14	15.5			✓	Extra growth on spine, ^{that} is ^{was} attached on the ^{the} yolk sac, jaw deformity
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.40 g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 1/5
 Initials: YAL/SS/EC
 Reviewed by: JGW

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
400mg/L SA4 F	1	19.5	/		
	2	20.5	/		
	3	20.0	/		
	4	20.5	/		
	5	18.5	/		
	6	20.5	/		
	7	20.5	/		
	8	19.5	/		
	9	20.0	/		
	10	20.0	/		
	11	19.0	/		
	12	20.5	/		
	13	19.0	/		
	14	20.5	/		
	15	18.0	/		
	16	19.5	/		
	17	20.0	/		
	18	18.5	/		
	19	20.0	/		
	20	19.0	/		
	21	20.0	/		
	22	20.5	/		
	23	20.5	/		
	24	20.5	/		
	25	21.0	/		
	26	18.0		/	
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.90g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 1/1
 Initials: YH/SS/EC

Reviewed by: JGB

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 61183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
400mg/L SO ₄ 6	1	19.5	✓		
	2	19.0	✓		
	3	18.0	✓		
	4	19.0	✓		
	5	19.5	✓		
	6	19.0	✓		
	7	16.0		✓	bent tail
	8	13.0		✓	bent tail, shortened tail fin
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 0.75 g
 Number of survivors: 8
 Number of deformed/have difficulty swimming: 2/2
 Initials: ML/SL/EC
 Reviewed by: JCh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
400mg/L SO ₄ H	1	20.0	✓		
	2	20.0	✓		
	3	19.5	✓		
	4	20.0	✓		
	5	19.0	✓		
	6	19.5	✓		
	7	20.0	✓		
	8	20.5	✓		
	9	19.5	✓		
	10	19.5	✓		
	11	20.0	✓		
	12	20.0	✓		
	13	19.0	✓		
	14	18.0	✓		
	15	20.0	✓		
	16	20.0	✓		
	17	20.0	✓		
	18	18.5	✓		
	19	19.5	✓		
	20	20.0	✓		
	21	20.0	✓		
	22	20.0	✓		
	23	19.5	✓		
	24	20.0	✓		
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.07g
 Number of survivors: 24
 Number of deformed/have difficulty swimming: 0/0
 Initials: YMLSS/EC
 Reviewed by: JOM

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/L SO ₄ A	1	20.0	✓			
	2	18.5	✓			
	3	20.0	✓			
	4	19.5	✓			
	5	20.0	✓			
	6	19.80	✓			
	7	20.5	✓			
	8	19.5	✓			
	9	18.5	✓			
	10	18.0	✓			
	11	18.0	✓			
	12	18.0	✓			
	13	17.5	✓			
	14	17.0	✓			
	15	13.5			✓	Set Scoliosis at
	16	15.75			✓	two bodies attached to the tail
	17	15.0			✓	two bodies attached at the tail
	18	16.0			✓	Extra growth on spine attached in yellow area
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.87 g
 Number of survivors: 18
 Number of deformed/have difficulty swimming: 4/43
 Initials: YUL/JS/EC

Reviewed by: JGK

Date Reviewed: Feb 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16A183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
480mg/L SO ₄ B	1	19.5	✓		
	2	20.0	✓		
	3	20.5	✓		
	4	20.5	✓		
	5	19.5	✓		
	6	18.0	✓		
	7	20.0 18.0	✓		
	8	20.5 20.0	✓		
	9	20.0	✓		
	10	20.5	✓		
	11	20.5	✓		
	12	19.5	✓		
	13	18.0	✓		
	14	20.5	✓		
	15	20.5	✓		
	16	18.0	✓		
	17	20.0	✓		
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.87 g
 Number of survivors: 17
 Number of deformed/have difficulty swimming: 0/0
 Initials: YML/SS/EC
 Reviewed by: Joh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/L SD4 C	1	20.0	✓			
	2	18.5	✓			
	3	19.5	✓			
	4	18.0	✓			
	5	18.5	✓			
	6	17.0	✓			
	7	17.5	✓			
	8	18.5	✓			
	9	18.0	✓			
	10	18.5 18.0	✓			
	11	18.5	✓			
	12	18.5	✓			
	13	19.5	✓			
	14	19.5	✓			
	15	17.0	✓			
	16	13.5			✓	Bent tail
	17	15.0			✓	Bent tail fin
	18	16.0			✓	Bent tail fin
	19	16.0			✓	Bent tail
	20	12.5			✓	Small fin body, facial def Jaw deformity
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.79 g

Number of survivors: 20

Number of deformed/have difficulty swimming: 5/5

Initials: ML/SL/ea

Reviewed by: JCh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 16183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
480mg/L SO ₄ D	1	20.0	✓		
	2	19.5	✓		
	3	19.0	✓		
	4	20.0	✓		
	5	18.5	✓		
	6	18.5	✓		
	7	18.0	✓		
	8	19.0	✓		
	9	19.0	✓		
	10	18.5	✓		
	11	20.0	✓		
	12	20.0	✓		
	13	19.5	✓		
	14	16.0	✓		
	15	18.5	✓		
	16	19.0	✓		
	17	19.0	✓		
	18	18.0	✓		
	19	20.5	✓		
	20	19.5	✓		
	21	19.0	✓		
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 1.65 g
Number of survivors: 21
Number of deformed/have difficulty swimming: 0/0
Initials: YHL/SS/EC
Reviewed by: Joh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/L SO ₄ E	1	18.0	✓			
	2	17.5	✓			
	3	19.5	✓			
	4	17.0	✓			
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.34g

Number of survivors: 4

Number of deformed/have difficulty swimming: 0/0

Initials: MLSS/ka

Reviewed by: JGM

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
480mg/L SO ₄ F	1	20.0	✓		
	2	20.5	✓		
	3	20.0	✓		
	4	20.75	✓		
	5	21.0	✓		
	6	19.0	✓		
	7	20.5	✓		
	8	20.0	✓		
	9	20.5	✓		
	10	19.5	✓		
	11	18.5	✓		
	12	20.5	✓		
	13	18.5	✓		
	14	20.0	✓		
	15	21.0	✓		
	16	20.0	✓		
	17	18.0	✓		
	18	20.5	✓		
	19	21.0	✓		
	20	20.0	✓		
	21	19.0	✓		
	22	20.0	✓		
	23	20.0	✓		
	24	18.0	✓		
	25	20.0	✓		
	26	19.0	✓		
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.90 g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 0/0
 Initials: YML/STK
 Reviewed by: JKH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161083

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
480mg/L SO4 G	1	18.5	✓		
	2	17.0	✓		
	3	20.0	✓		
	4	19.5	✓		
	5	18.5	✓		
	6	19.5	✓		
	7	18.0	✓		
	8	19.0	✓		
	9	18.0	✓		
	10	18.0	✓		
	11	20.0	✓		
	12	19.0	✓		
	13	16.0	✓		
	14	17.5	✓		
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.31 g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 0/0
 Initials: YML/SS/EA
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
480mg/kg SO ₄ H	1	19.0	✓			
	2	19.5	✓			
	3	18.5	✓			
	4	19.0	✓			
	5	19.0	✓			
	6	19.0	✓			
	7	20.0	✓			
	8	20.0	✓			
	9	ca 219.5	✓			
	10	20.5	✓			
	11	17.5	✓			
	12	20.0	✓			
	13	17.5	✓			
	14	19.0	✓			
	15	20.0	✓			
	16	18.0	✓			
	17	18.0	✓			
	18	18.0	✓			
	19	13.5			✓	Shorten tail
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.52 g
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 1/0
 Initials: ML/SJ/KE
 Reviewed by: Joh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
576mg/L SO ₄ A	1	16.0	✓			
	2	18.5	✓			
	3	19.0	✓			
	4	17.5	✓			
	5	18 17.5	✓			
	6	15.0		✓	two bodies attached to the yolk sac	
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.50 g
 Number of survivors: 6
 Number of deformed/have difficulty swimming: 1/1
 Initials: MMIS/EE

Reviewed by: Joh

Date Reviewed: Feb. 7/17

1914
PJ 96/123

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
STBorg 11.504 B	1	19.0	✓		
	2	19.5	✓		
	3	19.0	✓		
	4	19.0	✓		
	5	18.5	✓		
	6	19.0	✓		
	7	17.0	✓		
	8	19.0	✓		
	9	19.0	✓		
	10	18.0	✓		
	11	18.0	✓		
	12	19.0	✓		
	13	20.0	✓		
	14	18.5	✓		
	15	20.0	✓		
	16	19.0	✓		
	17	20.0	✓		
	18	19.0	✓		
	19	18.5	✓		
	20	19.0	✓		
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.05g

Number of survivors: 20

Number of deformed/have difficulty swimming: 0/0

Initials: MLSS/ea

Reviewed by: Joh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
576mg/L SO ₂ C	1	18.0	✓		
	2	17.0	✓		
	3	18.0	✓		
	4	15.5	✓		
	5	17.0	✓		
	6	19.5	✓		
	7	17.0	✓		
	8	18.5	✓		
	9	15.5	✓		
	10	19.0	✓		
	11	16.0	✓		
	12	15.5	✓		
	13	17.0	✓		
	14	17.0	✓		
	15	17.5	✓		
	16	18.0	✓		
	17	17.0	✓		
	18	18.0	✓		
	19	17.0	✓		
	20	15.5	✓		
	21	17.0	✓		
	22	16.0	✓		
	23	17.5	✓		
	24	18.0	✓		
	25	15.0			✓
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.21 g
Number of survivors: 25
Number of deformed/have difficulty swimming: 1/1
Initials: YML/SSIC
Reviewed by: JOU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
576mg/L SO ₄ D	1	17.0	✓		
	2	17.0	✓		
	3	17.5	✓		
	4	17.5	✓		
	5	16.5	✓		
	6	18.0	✓		
	7	18.0	✓		
	8	19.0	✓		
	9	17.5	✓		
	10	19.0	✓		
	11	15.0	✓		
	12	13.0	✓		
	13	17.0	✓		
	14	15.0	✓		
	15	15.0	✓		
	16	17.0	✓		
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.13 g
 Number of survivors: 16
 Number of deformed/have difficulty swimming: 0/0
 Initials: MUSSEE
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
S76wylL504 E	1	18.0	✓			
	2	18.5	✓			
	3	18.5	✓			
	4	18.0	✓			
	5	16.5	✓			
	6	17.0	✓			
	7	18.5	✓			
	8	18.0	✓			
	9	17.0	✓			
	10	16.5	✓			
	11	17.0	✓			
	12	13.5			✓	Two bodies attached at the tail
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.22 g
 Number of survivors: 12
 Number of deformed/have difficulty swimming: 1/1
 Initials: MLTS/EC
 Reviewed by: JCM

Date Reviewed: Feb 7/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: November 29, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
ST6wgl1L504 F	1	20.0	✓		
	2	21.0	✓		
	3	20.0	✓		
	4	20.0	✓		
	5	20.0	✓		
	6	17.5	✓		
	7	18.0	✓		
	8	20.0	✓		
	9	20.0	✓		
	10	18.5	✓		
	11	18.0	✓		
	12	20.0	✓		
	13	18.5	✓		
	14	19.0	✓		
	15	19.5	✓		
	16	18.0	✓		
	17	19.0	✓		
	18	20.0	✓		
	19	16.5	✓		
	20	17.0	✓		
	21	20.0	✓		
	22	17.0	✓		
	23	19.0	✓		
24					
25					
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 3.57 g

Number of survivors: 23

Number of deformed/have difficulty swimming: 0/0

Initials: YML/SS/EC

Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
576mg/L 504 G	1	18.5	✓			
	2	16.0	✓			
	3	17.0	✓			
	4	17.0	✓			
	5	18.0	✓			
	6	19.0	✓			
	7	18.5	✓			
	8	18.0	✓			
	9	19.5	✓			
	10	19.0	✓			
	11	18.0	✓			
	12	19.0	✓			
	13	19.0	✓			
	14	15.0			✓	Bent tail
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.31 g

Number of survivors: 14

Number of deformed/have difficulty swimming: 1/1

Initials: YML/SS/EC

Reviewed by: JGH

Date Reviewed: Feb. 1/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
576mg/L SO4 H	1	20.0	✓		
	2	19.0	✓		
	3	19.0	✓		
	4	19.0	✓		
	5	19.5	✓		
	6	19.5	✓		
	7	19.0	✓		
	8	20.0	✓		
	9	20.0	✓		
	10	18.0	✓		
	11	20.0	✓		
	12	18.0	✓		
	13	18.0	✓		
	14	17.0	✓		
	15	20.0	✓		
	16	19.5	✓		
	17	19.5	✓		
	18	19.0	✓		
	19	19.0	✓		
	20	20.0	✓		
	21	19.0	✓		
	22	19.0	✓		
	23	19.0	✓		
	24	18.5	✓		
	25	19.0	✓		
	26	20.0	✓		
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.11 g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 0/0
 Initials: YHL/SS/EL
 Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
691mg/L SO ₄ A	1	18.0	✓			
	2	19.0	✓			
	3	18.5	✓			
	4	18.0	✓			
	5	20.0	✓			
	6	18.5	✓			
	7	18.0	✓			
	8	18.5	✓			
	9	17.0	✓			
	10	18.0	✓			
	11	18.0	✓			
	12	16.0	✓			
	13	17.0	✓			
	14	17.0	✓			
	15	16.05	✓			
	16	13.0	X ^{el}	✓	✓	Two bodies ^{attached} attached to the tail
	17	15.0			✓	extra growth (remnant of twins)
	18	12.0			✓	scoliosis
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.76g
Number of survivors: 18
Number of deformed/have difficulty swimming: 3/3
Initials: YML/SS/EL

Reviewed by: JGK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 16183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
691mg/L SQ B	1	17.0	✓		
	2	19.5	✓		
	3	18.0	✓		
	4	19.0	✓		
	5	18.0	✓		
	6	18.0	✓		
	7	20.5	✓		
	8	18.5	✓		
	9	18.5	✓		
	10	19.5	✓		
	11	19.0	✓		
	12	18.0	✓		
	13	18.0	✓		
	14	18.5	✓		
	15	18.0	✓		
	16	18.5	✓		
	17	19.0	✓		
	18	19.5	✓		
	19	18.0	✓		
	20	18.0	✓		
	21	18.0	✓		
	22	19.0	✓		
	23	18.0 18.0	✓		
	24	17.5	✓		
	25	18.0 18.0	✓		
	26	18.0	✓		
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 277 g
Number of survivors: 26
Number of deformed/have difficulty swimming: 0/0
Initials: MLSS/EC
Reviewed by: JGw

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
601mg/L SO ₄ C	1	17.5	✓			
	2	18.0	✓			
	3	17.0	✓			
	4	17.0	✓			
	5	16.5	✓			
	6	21.0	✓			
	7	18.5	✓			
	8	17.0	✓			
	9	16.5	✓			
	10	15.5	✓			
	11	15.0			✓	Bent tail
	12	14.5			✓	Bent tail
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.17 g
 Number of survivors: 12
 Number of deformed/have difficulty swimming: 2/2
 Initials: MLSS/EC
 Reviewed by: JBN

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
E911mg/kg SO ₄ D	1	19.0	✓		
	2	18.0	✓		
	3	17.0	✓		
	4	18.0	✓		
	5	19.0	✓		
	6	20.0	✓		
	7	17.0	✓		
	8	18.0	✓		
	9	18.5	✓		
	10	17.0	✓		
	11	17.0	✓		
	12	18.5	✓		
	13	16.5	✓		
	14	14.5	✓		
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.04 g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 0/0
 Initials: YML/SS/EC
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 16183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
691 mg/L SO ₂ E	1	20.0	✓			
	2	17.0	✓			
	3	18.0	✓			
	4	19.0	✓			
	5	18.0	✓			
	6	18.0	✓			
	7	18.5	✓			
	8	18.0	✓			
	9	17.5	✓			
	10	18.5	✓			
	11	16.0			✓	Two bodies attached to the tail
	12	14.0			✓	Two ab bodies attached to the tail
	13	11.0			✓	Two bodies
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 333 g^h 1.33g
Number of survivors: 13
Number of deformed/have difficulty swimming: 3/3
Initials: ML/SS/EC
Reviewed by: JOK

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
691mg/L SO ₄ F	1	20.0	✓		
	2	20.5	✓		
	3	19.0	✓		
	4	20.5	✓		
	5	20.0	✓		
	6	19.0	✓		
	7	20.0	✓		
	8	19.5	✓		
	9	20.0	✓		
	10	20.5	✓		
	11	20.5	✓		
	12	18.0	✓		
	13	20.5	✓		
	14	20.5	✓		
	15	20.5	✓		
	16	20.0	✓		
	17	19.0	✓		
	18	20.0	✓		
	19	15.0	✓		
	20	17.5	✓		
	21	20.5	✓		
	22	19.5	✓		
	23	20.5	✓		
	24	18.0	✓		
	25	20.0	✓		
26	18.0	X _{EX}	✓	Jaw deformity	
27					
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.87g

Number of survivors: 26

Number of deformed/have difficulty swimming: 1/1

Initials: MLJ/SLG

Reviewed by: JCH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
691mg/L SO ₄ 6	1	17.5	✓		
	2	18.0	✓		
	3	17.0	✓		
	4	18.5	✓		
	5	17.0	✓		
	6	17.0	✓		
	7	16.5	✓		
	8	15.5	✓		
	9	16.0	✓		
	10	15.0	✓		
	11	16.0	✓		
	12	16.0	✓		
	13	16.5	✓		
	14	16.0	✓		
	15	17.0	✓		
	16	15.0	✓		
	17	16.0	✓		
	18	16.0	✓		
	19	19.0	✓		
	20	15.0	✓		
	21		Yes		
	22		Yes		
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.73 g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 0/0
 Initials: YUL/SS/EC
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
64 mg/L SO ₄ H	1	17.0	✓		
	2	18.5	✓		
	3	18.5	✓		
	4	17.5	✓		
	5	20.0	✓		
	6	19.0	✓		
	7	20.0	✓		
	8	20.0	✓		
	9	20.0	✓		
	10	19.0	✓		
	11	19.0	✓		
	12	18.5	✓		
	13	18.0	✓		
	14	19.0	✓		
	15	19.5	✓		
	16	20.0	✓		
	17	19.0	✓		
	18	19.0	✓		
	19	19.0	✓		
	20	18.5	✓		
	21	18.0	✓		
	22	19.0	✓		
	23	18.0	✓		
	24	18.5	✓		
	25	19.0	✓		
	26	19.0	✓		
	27	18.5	✓		
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.17 g
 Number of survivors: 27
 Number of deformed/have difficulty swimming: 0/0
 Initials: MYL/SS/EC
 Reviewed by: JGU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
82mg/L SO4 B	1	18.0	✓		
	2	20.5	✓		
	3	19.0	✓		
	4	20.0	✓		
	5	17.0	✓		
	6	16.0	✓		
	7	18.0	✓		
	8	20.0	✓		
	9	19.5	✓		
	10	18.5	✓		
	11	19.0	✓		
	12	18.0	✓		
	13	20.0	✓		
	14	20.0 18.5	✓		
	15	20.5	✓		
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.54 g

Number of survivors: 15

Number of deformed/have difficulty swimming: 0/0

Initials: YML/STL

Reviewed by: Joh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
829mg/KSQ D	1	20.0	✓		
	2	18.5	✓		
	3	20.0	✓		
	4	18.5	✓		
	5	18.5	✓		
	6	18.0	✓		
	7	17.0	✓		
	8	19.0	✓		
	9	17.0	✓		
	10	19.0	✓		
	11	19.0	✓		
	12	18.0	✓		
	13	18.5	✓		
	14	20.0	✓		
	15	18.0	✓		
	16	20.0	✓		
	17	18.0	✓		
	18	18.0	✓		
	19	18.0	✓		
	20	18.0	✓		
	21	17.5	✓		
	22	17.0	✓		
	23	18.0	✓		
	24	18.5	✓		
	25	20.0	✓		
	26	18.0	✓		
	27	18.0	✓		
28					
29					
30					
31					
32					
33					
34					
35					

Total Weight (pooled): 2.22 g
Number of survivors: 27
Number of deformed/have difficulty swimming: 0/0
Initials: VML/JSIEK
Reviewed by: JCH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
829mg/L SO ₄ F	1	18.0	✓		
	2	19.0	✓		
	3	21.0	✓		
	4	18.0	✓		
	5	17.0	✓		
	6	17.0	✓		
	7	18.0	✓		
	8	18.0	✓		
	9	18.0	✓		
	10	17.5	✓		
	11	18.5	✓		
	12	18.5	✓		
	13	19.5	✓		
	14	17.0	✓		
	15	18.0	✓		
	16	18.0	✓		
	17	17.5	✓		
	18	19.0	✓		
	19	19.0	✓		
	20	16.5	✓		
	21	20.0	✓		
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.22 g
 Number of survivors: 21
 Number of deformed/have difficulty swimming: 0/0
 Initials: YLI/SLC
 Reviewed by: JOU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
B24 mg/L SO4 6	1	18.0	✓			
	2	18.0	✓			
	3	18.5	✓			
	4	17.0	✓			
	5	16.5	✓			
	6	16.0	✓			
	7	15.0	✓			
	8	16.5	✓			
	9	15.5	✓			
	10	16.0	✓			
	11	12.0			✓	Shorten
	12	14.0			✓	Bent tail fin
	13	15.0	✓			
	14	16.0	✓			
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.24 g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 2/2
 Initials: MLSS/EC
 Reviewed by: JGH

Date Reviewed: Feb 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
824mg/L SO4 H	1	17.0	✓		
	2	18.5	✓		
	3	18.0	✓		
	4	18.5	✓		
	5	16.0	✓		
	6	16.5	✓		
	7	17.0	✓		
	8	20.0	✓		
	9	16.5	✓		
	10	16.0	✓		
	11	18.0	✓		
	12	18.5	✓		
	13	18.5	✓		
	14	17.0	✓		
	15	22.5 18.0	✓		
	16	18.0	✓		
	17	17.0	✓		
	18	18.5	✓		
	19	16.5	✓		
	20	16.5	✓		
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 1.42 g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 0/0
 Initials: YML/SS/EC
 Reviewed by: JGA

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
995mg/L SQ A	1	17.5	✓		
	2	19.0	✓		
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 0.22 g

Number of survivors: 2

Number of deformed/have difficulty swimming: 0/0

Initials: MLJS/EA

Reviewed by: JOU

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
995mg/L SO ₄ B	1	20.0	✓		
	2	20.0	✓		
	3	19.5	✓		
	4	20.0	✓		
	5	20.5	✓		
	6	19.0	✓		
	7	20.0 21.0	✓		
	8	20.0	✓		
	9	20.5	✓		
	10	17.0	✓		
	11	20.75	✓		
	12	18.0	✓		
	13	18.5	✓		
	14	20.5	✓		
	15	20.0	✓		
	16	20.0 21.5	✓		
	17	19.5	✓		
	18	20.0	✓		
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.02g
 Number of survivors: 18
 Number of deformed/have difficulty swimming: 0/0
 Initials: MLJ/SLC
 Reviewed by: JGh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
995 Single Spq C	1	17.5	✓			
	2	17.0	✓			
	3	15.5	✓			
	4	17.5	✓			
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.37 g
 Number of survivors: 4
 Number of deformed/have difficulty swimming: 0/0
 Initials: ML/SS/EC
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
99 Single Silly D	1	18.5	✓			
	2	18.0	✓			
	3	18.0	✓			
	4	17.0	✓			
	5	17.5	✓			
	6	18.0	✓			
	7	16.5	✓			
	8	18.5	✓			
	9	15.5	✓			
	10	20.0	✓			
	11	15.0	✓			
	12	18.0	✓			
	13	19.0	✓			
	14	18.5	✓			
	15	18.0	✓			
	16	17.5	✓			
	17	18.0	✓			
	18	15.0			✓	Shorten Body
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.33g
Number of survivors: 18
Number of deformed/have difficulty swimming: 1/0
Initials: YUJ/EC

Reviewed by: Jo

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
995mg/L SD4 E	1	18.0	✓		
	2	16.0	✓		
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 0.15 g
Number of survivors: 2
Number of deformed/have difficulty swimming: 0/0
Initials: YML/STEC
Reviewed by: JCh

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
099 Single SQ F	1	17.5	✓		
	2	16.0	✓		
	3	16.0	✓		
	4	17.5	✓		
	5	16.0	✓		
	6	16.0	✓		
	7	17.0	✓		
	8	18.0	✓		
	9	18.0	✓		
	10	17.0	✓		
	11	16.0	✓		
	12	18.0	✓		
	13	17.0	✓		
	14	17.5	✓		
	15	16.0	✓		
	16	16.0	✓		
	17	18.0	✓		
	18	15.0	✓		
	19	18.0	✓		
	20	16.0	✓		
	21	15.0	✓		
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 2.05 g
 Number of survivors: 21
 Number of deformed/have difficulty swimming: 0/0
 Initials: MULTS/EC
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 61183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments
99 Single SDP 6	1	14.0		✓	Shorten tail
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
	28				
	29				
	30				
	31				
	32				
	33				
	34				
	35				

Total Weight (pooled): 0.14g
 Number of survivors: 1
 Number of deformed/have difficulty swimming: 1/1
 Initials: MUS/EC
 Reviewed by: JGH

Date Reviewed: Feb. 7/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 16183

Start Date: November 1, 2016
 Termination Date: November 29, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Comments	
995 single sex H	1	16.0	✓			
	2	17.0	✓			
	3	17.5	✓			
	4	17.5	✓			
	5	17.0	✓			
	6	18.0	✓			
	7	18.0	✓			
	8	15.5	✓			
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.59 g
 Number of survivors: 8
 Number of deformed/have difficulty swimming: 0/0
 Initials: MLJ/EC
 Reviewed by: JBL

Date Reviewed: Feb. 7/17

Rainbow Trout Embryo-Alevin Toxicity Test

Client: Teck
WO#: 161183

Test Initiation Date: November 1, 2016
Test Termination Date: November 29, 2016

Lab Control	Test Conc. (mg/L SO4)	Rep	Mortality Counts			Total Dead	Abnormal Alevins	Normal Alevins	Total No. Alevins	Total No. Exposed	Survival	Normal Alevins				
			Day 1 - 12	Day 13 - 24	Day 25 - 28							Mean	SD	Mean	SD	
Lab Control	Control	1	2	2	4	8	3	19	22	30	73.3			63.3		
		2	0	0	2	2	0	28	28	30	93.3			93.3		
		3	3	4	1	8	4	15	19	27	70.4			55.6		
		4	0	2	2	4	2	24	26	30	86.7			80.0		
		5	1	2	2	5	5	18	23	28	82.1			64.3		
		6	0	0	3	3	0	28	28	31	90.3			90.3		
		7	1	1	8	10	3	15	18	28	64.3	Mean	SD	53.6	Mean	SD
		8	0	3	6	9	0	23	23	32	71.9	79.0	10.5	71.9	71.5	15.1
GH_ER2	Unamended	1	1	14	3	18	1	12	13	31	41.9			38.7		
		2	1	0	1	2	3	25	28	30	93.3			83.3		
		3	1	12	1	14	4	9	13	27	48.1			33.3		
		4	1	1	0	2	2	25	27	29	93.1			86.2		
		5	2	12	0	14	4	13	17	31	54.8			41.9		
		6	1	8	0	9	1	20	21	30	70.0			66.7		
		7	0	7	2	9	3	19	22	31	71.0	Mean	SD	61.3	Mean	SD
		8	1	5	0	6	0	24	24	30	80.0	69.0	19.5	80.0	61.4	21.2

JGU
Feb 7/17

092-13

Rainbow Trout Embryo-Alevin Toxicity Test

Client: Teck
WO#: 161183

Test Initiation Date: November 1, 2016
Test Termination Date: November 29, 2016

Test Conc. (mg/L SO4)	Rep	Mortality Counts			Total Dead	Abnormal Alevins	Normal Alevins	Total No. Alevins	Total No. Exposed	Survival	Normal Alevins				
		Day 1-12	Day 13-24	Day 25-28							Mean	SD	Mean	SD	
Unamended	1	2	7	0	9	4	17	21	30	70.0			56.7		
	2	0	7	0	7	1	22	23	30	76.7			73.3		
	3	1	7	0	8	1	22	23	31	74.2			71.0		
	4	0	2	0	2	0	26	26	28	92.9			92.9		
	5	4	5	2	11	4	15	19	30	63.3			50.0		
	6	0	0	0	0	1	29	30	30	100.0			96.7		
	7	1	8	1	10	5	14	19	29	65.5	Mean	SD	48.3	Mean	SD
	8	0	3	0	3	0	26	26	29	89.7	79.0	13.5	89.7	72.3	19.4
400	1	1	12	0	13	4	12	16	29	55.2			41.4		
	2	0	1	0	1	0	29	29	30	96.7			96.7		
	3	0	6	2	8	3	19	22	30	73.3			63.3		
	4	0	7	0	7	1	22	23	30	76.7			73.3		
	5	1	8	2	11	4	15	19	30	63.3			50.0		
	6	0	0	1	1	1	28	29	30	96.7			93.3		
	7	1	2	3	6	4	18	22	28	78.6	Mean	SD	64.3	Mean	SD
	8	0	4	1	5	2	21	23	28	82.1	77.8	14.5	75.0	69.7	19.2
480	1	1	10	1	12	3	15	18	30	60.0			50.0		
	2	0	3	0	3	0	27	27	30	90.0			90.0		
	3	0	13	0	13	2	15	17	30	56.7			50.0		
	4	0	5	0	5	0	27	27	32	84.4			84.4		
	5	1	12	2	15	4	10	14	29	48.3			34.5		
	6	1	0	0	1	0	25	25	26	96.2			96.2		
	7	0	1	1	2	6	22	28	30	93.3	Mean	SD	73.3	Mean	SD
	8	0	2	1	3	0	27	27	30	90.0	77.4	19.1	90.0	71.0	23.2
576	1	3	17	0	20	1	9	10	30	33.3			30.0		
	2	0	1	0	1	0	25	25	26	96.2			96.2		
	3	0	7	0	7	2	21	23	30	76.7			70.0		
	4	0	7	0	7	1	22	23	30	76.7			73.3		
	5	8	17	0	25	1	4	5	30	16.7			13.3		
	6	0	1	0	1	0	29	29	30	96.7			96.7		
	7	0	13	1	14	3	16	19	33	57.6	Mean	SD	48.5	Mean	SD
	8	0	10	0	10	0	19	19	29	65.5	64.9	28.4	65.5	61.7	29.6
691	1	4	14	4	22	2	6	8	30	26.7			20.0		
	2	0	2	0	2	2	24	26	28	92.9			85.7		
	3	1	12	11	24	2	3	5	29	17.2			10.3		
	4	1	3	0	4	0	27	27	31	87.1			87.1		
	5	6	6	0	12	2	13	15	27	55.6			48.1		
	6	0	6	0	6	0	22	22	28	78.6			78.6		
	7	1	13	0	14	3	10	13	27	48.1	Mean	SD	37.0	Mean	SD
	8	1	3	0	4	0	27	27	31	87.1	61.7	29.2	87.1	56.8	31.9
829	1	2	23	3	28	0	0	0	28	0.0			0.0		
	2	0	6	0	6	0	23	23	29	79.3			79.3		
	3	3	9	0	12	2	19	21	33	63.6			57.6		
	4	0	2	1	3	0	27	27	30	90.0			90.0		
	5	8	19	0	27	0	0	0	27	0.0			0.0		
	6	0	4	0	4	0	26	26	30	86.7			86.7		
	7	0	10	4	14	5	10	15	29	51.7	Mean	SD	34.5	Mean	SD
	8	1	4	0	5	0	26	26	31	83.9	56.9	37.3	83.9	54.0	38.0
995	1	6	21	0	27	1	2	3	30	10.0			6.7		
	2	2	8	0	10	0	21	21	31	67.7			67.7		
	3	2	16	0	18	3	12	15	33	45.5			36.4		
	4	0	10	2	12	1	20	21	33	63.6			60.6		
	5	2	17	0	19	3	6	9	28	32.1			21.4		
	6	0	12	0	12	0	17	17	29	58.6			58.6		
	7	0	5	2	7	2	17	19	26	73.1	Mean	SD	65.4	Mean	SD
	8	2	3	0	5	1	27	28	33	84.8	54.4	24.2	81.8	49.8	25.7

JGH
Feb. 2/17

Rainbow Trout Embryo-Alevin Toxicity Test

Client: Teck
WO#: 161183

Test Initiation Date: November 1, 2016
Test Termination Date: November 29, 2016

Test Conc. (mg/L SO4)	Rep	Mortality Counts			Total Dead	Abnormal Alevins	Normal Alevins	Total No. Alevins	Total No. Exposed	Survival	Normal Alevins			
		Day 1-12	Day 13-24	Day 25-28							Mean	SD		
Unamended	1	4	12	0	16	2	13	15	31	48.4		41.9		
	2	0	1	0	1	2	27	29	30	96.7		90.0		
	3	1	12	2	15	2	15	17	32	53.1		46.9		
	4	5	4	0	9	0	21	21	30	70.0		70.0		
	5	3	17	0	20	1	8	9	29	31.0		27.6		
	6	1	8	2	11	0	19	19	30	63.3		63.3		
	7	0	7	1	8	3	17	20	28	71.4	Mean	60.7	Mean	58.4
	8	0	9	2	11	0	22	22	33	66.7	SD	19.3	SD	19.2
400	1	4	20	0	24	0	6	6	30	20.0		20.0		
	2	0	2	0	2	0	28	28	30	93.3		93.3		
	3	1	18	0	19	1	9	10	29	34.5		31.0		
	4	6	4	0	10	1	21	22	32	68.8		65.6		
	5	3	13	0	16	1	13	14	30	46.7		43.3		
	6	0	3	1	4	1	25	26	30	86.7		83.3		
	7	0	22	0	22	2	6	8	30	26.7	Mean	20.0	Mean	54.6
	8	3	3	0	6	0	24	24	30	80.0	SD	28.7	SD	29.7
480	1	3	9	0	12	4	14	18	30	60.0		46.7		
	2	1	11	1	13	0	17	17	30	56.7		56.7		
	3	1	8	1	10	5	15	20	30	66.7		50.0		
	4	4	5	0	9	0	21	21	30	70.0		70.0		
	5	7	19	0	26	0	4	4	30	13.3		13.3		
	6	1	3	0	4	0	26	26	30	86.7		86.7		
	7	0	15	0	15	0	14	14	29	48.3	Mean	48.3	Mean	54.2
	8	3	7	0	10	1	18	19	29	65.5	SD	21.4	SD	21.2
576	1	2	21	1	24	1	5	6	30	20.0		16.7		
	2	0	10	0	10	0	20	20	30	66.7		66.7		
	3	1	4	0	5	1	24	25	30	83.3		80.0		
	4	4	11	0	15	0	16	16	31	51.6		51.6		
	5	2	15	0	17	1	11	12	29	41.4		37.9		
	6	1	5	1	7	0	23	23	30	76.7		76.7		
	7	0	14	1	15	1	13	14	29	48.3	Mean	44.8	Mean	57.3
	8	0	5	0	5	0	26	26	31	83.9	SD	22.6	SD	23.6
691	1	1	8	2	11	3	15	18	29	62.1		51.7		
	2	0	2	3	5	0	26	26	31	83.9		83.9		
	3	0	17	1	18	2	10	12	30	40.0		33.3		
	4	0	14	1	15	0	14	14	29	48.3		48.3		
	5	1	12	1	14	3	10	13	27	48.1		37.0		
	6	0	6	0	6	1	25	26	32	81.3		78.1		
	7	0	11	0	11	0	20	20	31	64.5	Mean	64.5	Mean	61.2
	8	0	0	2	2	0	27	27	29	93.1	SD	19.3	SD	22.2
829	1	7	23	0	30	0	0	0	30	0.0		0.0		
	2	0	9	6	15	0	15	15	30	50.0		50.0		
	3	0	27	1	28	0	0	0	28	0.0		0.0		
	4	0	3	1	4	0	27	27	31	87.1		87.1		
	5	3	26	0	29	0	0	0	29	0.0		0.0		
	6	0	7	1	8	0	21	21	29	72.4		72.4		
	7	0	11	3	14	2	12	14	28	50.0	Mean	42.9	Mean	39.6
	8	0	10	1	11	0	20	20	31	64.5	SD	35.6	SD	35.4
995	1	1	27	0	28	0	2	2	30	6.7		6.7		
	2	1	8	0	9	0	18	18	27	66.7		66.7		
	3	2	21	3	26	0	4	4	30	13.3		13.3		
	4	1	11	2	14	1	17	18	32	56.3		53.1		
	5	6	22	0	28	0	2	2	30	6.7		6.7		
	6	2	5	0	7	0	21	21	28	75.0		75.0		
	7	15	11	1	27	1	0	1	28	3.6	Mean	0.0	Mean	30.9
	8	4	16	3	23	0	8	8	31	25.8	SD	29.6	SD	29.7

JGL
Feb. 15/17

CETIS Summary Report

Report Date: 16 Jan-17 11:28 (p 1 of 1)
 Test Code: 161183SO4a1 | 01-1816-8662

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Batch ID: 20-4550-9778 Test Type: Survival-Development Analyst: Kania Lywe
 Start Date: 01 Nov-16 16:20 Protocol: EC/EPS 1/RM/28 Diluent: Dechlorinated Tap Water
 Ending Date: 29 Nov-16 10:30 Species: Oncorhynchus mykiss Brine:
 Duration: 27d 18h Source: Vancouver Island Trout Hatchery Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		

Proportion Normal Summary (stability)

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	8	0.7153	0.589	0.8417	0.5357	0.9333	0.05341	0.1511	21.12%	0.0%
GH_ER2	8	0.6143	0.437	0.7917	0.3333	0.8621	0.07502	0.2122	34.54%	14.12%
EV_ER4	8	0.723	0.5607	0.8854	0.4828	0.9667	0.06865	0.1942	26.86%	-1.07%
GH_FR1	8	0.5839	0.4232	0.7445	0.2759	0.9	0.06794	0.1922	32.91%	18.38%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	8	0.7904	0.7024	0.8784	0.6429	0.9333	0.03723	0.1053	13.32%	0.0%
GH_ER2	8	0.6904	0.5272	0.8536	0.4194	0.9333	0.06901	0.1952	28.27%	12.65%
EV_ER4	8	0.7903	0.6771	0.9035	0.6333	1	0.04787	0.1354	17.13%	0.02%
GH_FR1	8	0.6258	0.4647	0.7869	0.3103	0.9667	0.06812	0.1927	30.79%	20.83%

Proportion Normal Detail (stability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	0.6333	0.9333	0.5556	0.8	0.6429	0.9032	0.5357	0.7188
GH_ER2	0.3871	0.8333	0.3333	0.8621	0.4194	0.6667	0.6129	0.8
EV_ER4	0.5667	0.7333	0.7097	0.9286	0.5	0.9667	0.4828	0.8966
GH_FR1	0.4194	0.9	0.4688	0.7	0.2759	0.6333	0.6071	0.6667

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	0.7333	0.9333	0.7037	0.8667	0.8214	0.9032	0.6429	0.7188
GH_ER2	0.4194	0.9333	0.4815	0.931	0.5484	0.7	0.7097	0.8
EV_ER4	0.7	0.7667	0.7419	0.9286	0.6333	1	0.6552	0.8966
GH_FR1	0.4839	0.9667	0.5313	0.7	0.3103	0.6333	0.7143	0.6667

Proportion Normal Binomials (stability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	19/30	28/30	15/27	24/30	18/28	28/31	15/28	23/32
GH_ER2	12/31	25/30	9/27	25/29	13/31	20/30	19/31	24/30
EV_ER4	17/30	22/30	22/31	26/28	15/30	29/30	14/29	26/29
GH_FR1	13/31	27/30	15/32	21/30	8/29	19/30	17/28	22/33

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	22/30	28/30	19/27	26/30	23/28	28/31	18/28	23/32
GH_ER2	13/31	28/30	13/27	27/29	17/31	21/30	22/31	24/30
EV_ER4	21/30	23/30	23/31	26/28	19/30	30/30	19/29	26/29
GH_FR1	15/31	29/30	17/32	21/30	9/29	19/30	20/28	22/33

CETIS Summary Report

Report Date: 16 Jan-17 11:30 (p 1 of 1)
Test Code: 161183SO4aa1 | 07-6745-7301

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Batch ID: 08-2295-5651 **Test Type:** Survival-Development-Growth **Analyst:** Kania Lywe
Start Date: 01 Nov-16 16:20 **Protocol:** EC/EPS 1/RM/28 **Diluent:** Dechlorinated Tap Water
Ending Date: 29 Nov-16 10:30 **Species:** Oncorhynchus mykiss **Brine:**
Duration: 27d 18h **Source:** Vancouver Island Trout Hatchery **Age:**

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	8	17.95	16.86	19.05	16.65	20.21	0.4641	1.313	7.31%	0.0%
GH_ER2	8	16.91	15.97	17.84	15.27	18.05	0.3947	1.116	6.6%	5.83%
EV_ER4	8	17.72	16.7	18.74	15.87	19.97	0.4324	1.223	6.9%	1.29%
GH_FR1	8	18.34	17.1	19.58	16.38	19.98	0.523	1.479	8.07%	-2.14%

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	8	98.13	87.11	109.1	79.57	118.6	4.659	13.18	13.43%	0.0%
GH_ER2	8	96.59	88.86	104.3	83.75	111.4	3.267	9.241	9.57%	1.57%
EV_ER4	8	100.5	88.93	112.1	79.62	123	4.892	13.84	13.77%	-2.41%
GH_FR1	8	94.37	85.33	103.4	81.36	108.4	3.824	10.82	11.46%	3.83%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	17.95	19.71	17.32	17.69	16.65	20.21	17.25	16.85
GH_ER2	15.27	17.57	15.58	17.85	16.29	18.05	16.64	18
EV_ER4	17.67	18.02	17.33	18.63	16.79	19.97	15.87	17.5
GH_FR1	17.73	19.21	17.06	19.57	16.89	19.89	16.38	19.98

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	100.9	111.1	90.53	84	102.6	118.6	97.78	79.57
GH_ER2	94.62	111.4	100.8	87.41	91.76	105.7	97.27	83.75
EV_ER4	105.7	115.2	99.57	91.92	96.32	123	92.63	79.62
GH_FR1	104	107.6	90.59	83.81	92.22	108.4	87	81.36

CETIS Analytical Report

Report Date: 16 Jan-17 11:28 (p 1 of 2)
 Test Code: 161183SO4a1 | 01-1816-8662

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 13-3604-0254	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 20 Dec-16 13:03	Analysis: STP 2x2 Contingency Tables	Official Results: Yes
Batch ID: 20-4550-9778	Test Type: Survival-Development	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Dechlorinated Tap Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:
Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		GH_ER2	0.00739	0.0148	Exact	Significant Effect
Control		EV_ER4	0.5095	0.5095	Exact	Non-Significant Effect
Control		GH_FR1	4.155E-05	0.0001	Exact	Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect	
Control	Negative Contr	187	49	236	0.7924	0.2076	0.0%
GH_ER2		165	74	239	0.6904	0.3096	12.87%
EV_ER4		187	50	237	0.789	0.211	0.42%
GH_FR1		152	91	243	0.6255	0.3745	21.06%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	0.7333	0.9333	0.7037	0.8667	0.8214	0.9032	0.6429	0.7188
GH_ER2	0.4194	0.9333	0.4815	0.931	0.5484	0.7	0.7097	0.8
EV_ER4	0.7	0.7667	0.7419	0.9286	0.6333	1	0.6552	0.8966
GH_FR1	0.4839	0.9667	0.5313	0.7	0.3103	0.6333	0.7143	0.6667

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	22/30	28/30	19/27	26/30	23/28	28/31	18/28	23/32
GH_ER2	13/31	28/30	13/27	27/29	17/31	21/30	22/31	24/30
EV_ER4	21/30	23/30	23/31	26/28	19/30	30/30	19/29	26/29
GH_FR1	15/31	29/30	17/32	21/30	9/29	19/30	20/28	22/33

CETIS Analytical Report

Report Date: 16 Jan-17 11:28 (p 2 of 2)
Test Code: 161183SO4a1 | 01-1816-8662

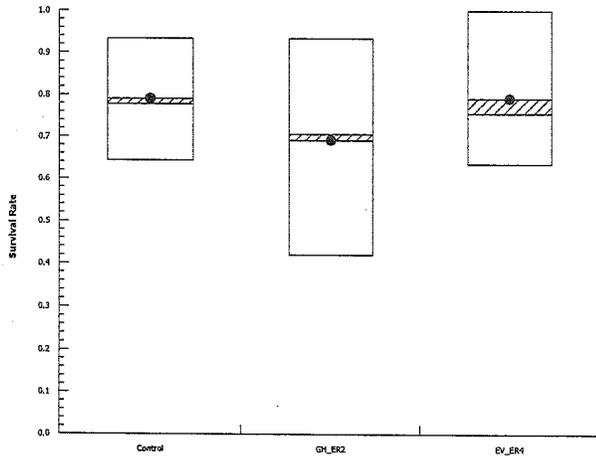
Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 13-3604-0254 Endpoint: Survival Rate
Analyzed: 20 Dec-16 13:03 Analysis: STP 2x2 Contingency Tables

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 11:28 (p 1 of 2)
 Test Code: 161183SO4a1 | 01-1816-8662

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 16-4327-1099	Endpoint: Proportion Normal (viability)	CETIS Version: CETISv1.8.7
Analyzed: 20 Dec-16 13:03	Analysis: STP 2x2 Contingency Tables	Official Results: Yes
Batch ID: 20-4550-9778	Test Type: Survival-Development	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Dechlorinated Tap Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:
Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		GH_ER2	0.009628	0.0193	Exact	Significant Effect
Control		EV_ER4	1	1.0000	Exact	Non-Significant Effect
Control		GH_FR1	0.001208	0.0036	Exact	Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect	
Control	Negative Contr	170	66	236	0.7203	0.2797	0.0%
GH_ER2		147	92	239	0.6151	0.3849	14.61%
EV_ER4		171	66	237	0.7215	0.2785	-0.16%
GH_FR1		142	101	243	0.5844	0.4156	18.88%

Proportion Normal Detail (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	0.6333	0.9333	0.5556	0.8	0.6429	0.9032	0.5357	0.7188
GH_ER2	0.3871	0.8333	0.3333	0.8621	0.4194	0.6667	0.6129	0.8
EV_ER4	0.5667	0.7333	0.7097	0.9286	0.5	0.9667	0.4828	0.8966
GH_FR1	0.4194	0.9	0.4688	0.7	0.2759	0.6333	0.6071	0.6667

Proportion Normal Binomials (viability)

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	19/30	28/30	15/27	24/30	18/28	28/31	15/28	23/32
GH_ER2	12/31	25/30	9/27	25/29	13/31	20/30	19/31	24/30
EV_ER4	17/30	22/30	22/31	26/28	15/30	29/30	14/29	26/29
GH_FR1	13/31	27/30	15/32	21/30	8/29	19/30	17/28	22/33

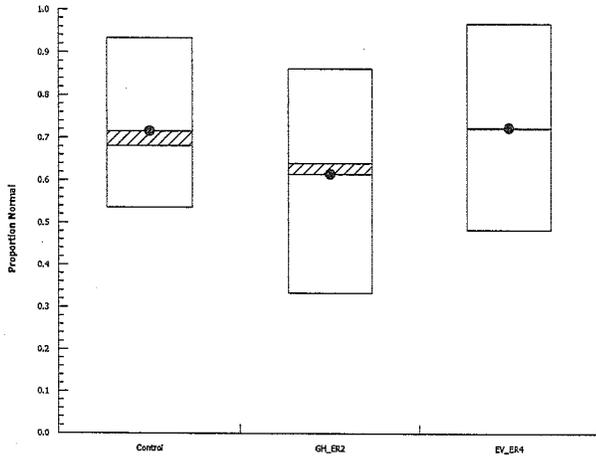
Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 16-4327-1099 Endpoint: Proportion Normal (Viability)
Analyzed: 20 Dec-16 13:03 Analysis: STP 2x2 Contingency Tables

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 11:29 (p 1 of 2)
 Test Code: 161183SO4aa1 | 07-6745-7301

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 09-9222-3764	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 20 Dec-16 13:16	Analysis: Parametric-Control vs Treatments	Official Results: Yes
Batch ID: 08-2295-5651	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Dechlorinated Tap Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:
Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.73%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		GH_ER2	1.624	2.154	1.389	14	0.1330	CDF	Non-Significant Effect
		EV_ER4	0.3586	2.154	1.389	14	0.6057	CDF	Non-Significant Effect
		GH_FR1	-0.5971	2.154	1.389	14	0.9114	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	8.794078	2.93136	3	1.762	0.1772	Non-Significant Effect
Error	46.5696	1.6632	28			
Total	55.36368		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	0.5636	11.34	0.9047	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9563	0.9081	0.2172	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	8	17.95	16.86	19.05	17.51	16.65	20.21	0.4641	7.31%	0.0%
GH_ER2	8	16.91	15.97	17.84	17.1	15.27	18.05	0.3947	6.6%	5.83%
EV_ER4	8	17.72	16.7	18.74	17.58	15.87	19.97	0.4324	6.9%	1.29%
GH_FR1	8	18.34	17.1	19.58	18.47	16.38	19.98	0.523	8.07%	-2.14%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	17.95	19.71	17.32	17.69	16.65	20.21	17.25	16.85
GH_ER2	15.27	17.57	15.58	17.85	16.29	18.05	16.64	18
EV_ER4	17.67	18.02	17.33	18.63	16.79	19.97	15.87	17.5
GH_FR1	17.73	19.21	17.06	19.57	16.89	19.89	16.38	19.98

CETIS Analytical Report

Report Date: 16 Jan-17 11:29 (p 2 of 2)
Test Code: 161183SO4aa1 | 07-6745-7301

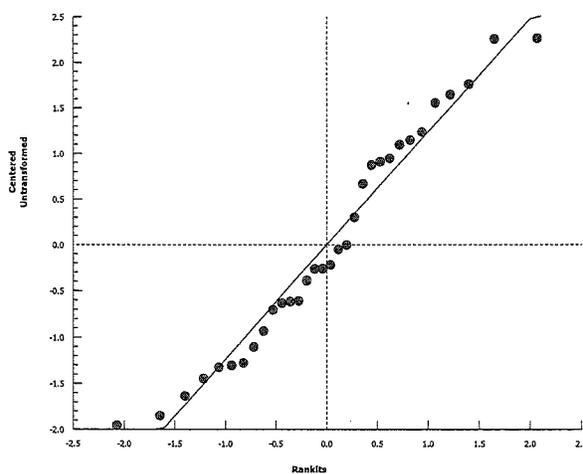
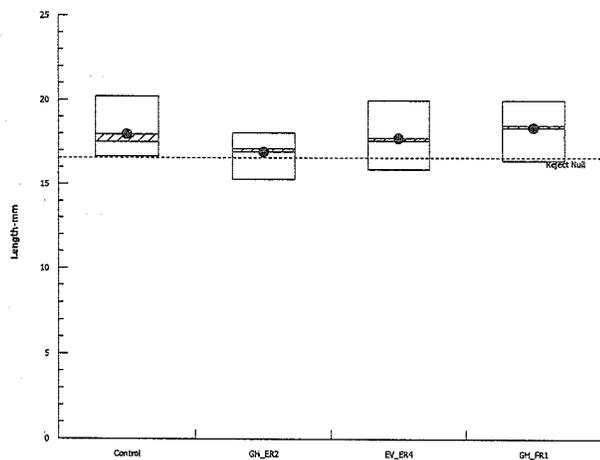
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 09-9222-3764 Endpoint: Length-mm
Analyzed: 20 Dec-16 13:16 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 11:30 (p 1 of 2)
 Test Code: 161183SO4aa1 | 07-6745-7301

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 17-8072-7244 **Endpoint:** Mean ^{Wet} Dry Weight-mg **CETIS Version:** CETISv1.8.7
 Analyzed: 20 Dec-16 13:16 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Batch ID: 08-2295-5651 **Test Type:** Survival-Development-Growth **Analyst:** Kania Lywe
 Start Date: 01 Nov-16 16:20 **Protocol:** EC/EPS 1/RM/28 **Diluent:** Dechlorinated Tap Water
 Ending Date: 29 Nov-16 10:30 **Species:** Oncorhynchus mykiss **Brine:**
 Duration: 27d 18h **Source:** Vancouver Island Trout Hatchery **Age:**

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	13.1%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		GH_ER2	0.2583	2.154	12.83	14	0.6486	CDF	Non-Significant Effect
		EV_ER4	-0.3978	2.154	12.83	14	0.8698	CDF	Non-Significant Effect
		GH_FR1	0.6305	2.154	12.83	14	0.4851	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	159.5266	53.17552	3	0.3749	0.7718	Non-Significant Effect
Error	3971.921	141.8543	28			
Total	4131.447		31			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	1.312	11.34	0.7262	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9751	0.9081	0.6496	Normal Distribution

Mean ^{Wet} Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	8	98.13	87.11	109.1	99.34	79.57	118.6	4.659	13.43%	0.0%
GH_ER2	8	96.59	88.86	104.3	95.94	83.75	111.4	3.267	9.57%	1.57%
EV_ER4	8	100.5	88.93	112.1	97.94	79.62	123	4.892	13.77%	-2.41%
GH_FR1	8	94.37	85.33	103.4	91.41	81.36	108.4	3.824	11.46%	3.83%

Mean ^{Wet} Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
Control	100.9	111.1	90.53	84	102.6	118.6	97.78	79.57
GH_ER2	94.62	111.4	100.8	87.41	91.76	105.7	97.27	83.75
EV_ER4	105.7	115.2	99.57	91.92	96.32	123	92.63	79.62
GH_FR1	104	107.6	90.59	83.81	92.22	108.4	87	81.36

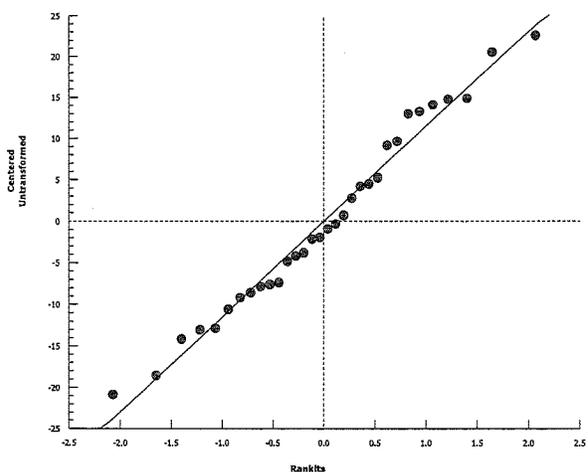
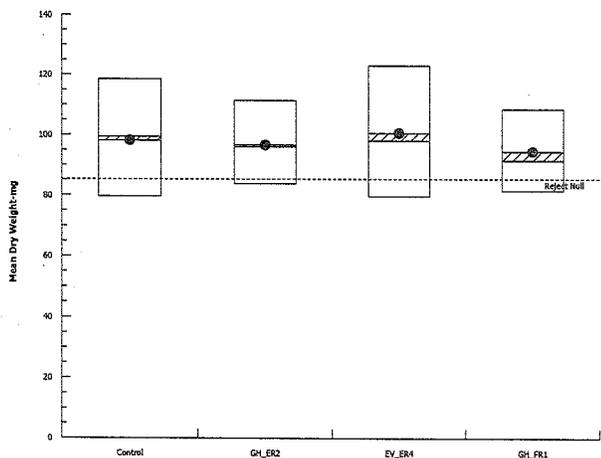
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 17-8072-7244 Endpoint: Mean Dry Weight-mg
Analyzed: 20 Dec-16 13:16 Analysis: Parametric-Control vs Treatments

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 1 of 2)
 Test Code: 161183SO4b1 | 16-1064-4756

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 15-3426-7593 Endpoint: Survival Rate CETIS Version: CETISv1.8.7
 Analyzed: 16 Jan-17 14:54 Analysis: Linear Interpolation (ICPIN) Official Results: Yes

Batch ID: 04-4091-8506 Test Type: Survival-Development Analyst: Kania Lywe
 Start Date: 01 Nov-16 16:20 Protocol: EC/EPS 1/RM/28 Diluent: Site Water
 Ending Date: 29 Nov-16 10:30 Species: Oncorhynchus mykiss Brine:
 Duration: 27d 18h Source: Vancouver Island Trout Hatchery Age:

Sample ID: 06-6901-7584 Code: EV_ER4 Client: Teck Coal
 Sample Date: 25 Oct-16 08:35 Material: Water Sample (SO₄) Project:
 Receive Date: 26 Oct-16 08:44 Source: Teck Coal (TECK COAL)
 Sample Age: 7d 8h (4.2 °C) Station: EV_ER4_WS_2016-10-25_N

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1255118	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L SO ₄	95% LCL	95% UCL
EC5	496.6	155.2	626.2
EC10	525.6	313.7	747.3
EC15	556.4	461.9	871.4
EC20	635.4	508.4	981.1
EC25	792.1	543.7	N/A
EC40	>1008	N/A	N/A
EC50	>1008	N/A	N/A

EV_ER4 is dilution water (site water)

Survival Rate Summary

C-mg/L SO ₄	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
76.53	Dilution Water	8	0.7903	0.6333	1	0.04787	0.1354	17.13%	0.0%	187	237
406.33		8	0.7782	0.5517	0.9667	0.0513	0.1451	18.65%	1.53%	183	235
480.67		8	0.7735	0.4828	0.9615	0.06751	0.191	24.69%	2.12%	183	237
579.17		8	0.6491	0.1667	0.9667	0.1004	0.2838	43.73%	17.87%	153	238
700.17		8	0.6165	0.1724	0.9286	0.1033	0.2921	47.37%	21.98%	143	231
826.83		8	0.569	0	0.9	0.132	0.3734	65.62%	28.0%	137	237
1008.17		8	0.5444	0.1	0.8485	0.08561	0.2421	44.48%	31.11%	133	243

Survival Rate Detail

C-mg/L SO ₄	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
76.53	Dilution Water	0.7	0.7667	0.7419	0.9286	0.6333	1	0.6552	0.8966
406.33		0.5517	0.9667	0.7333	0.7667	0.6333	0.9667	0.7857	0.8214
480.67		0.6	0.9	0.5667	0.8438	0.4828	0.9615	0.9333	0.9
579.17		0.3333	0.9615	0.7667	0.7667	0.1667	0.9667	0.5758	0.6552
700.17		0.2667	0.9286	0.1724	0.871	0.5556	0.7857	0.4815	0.871
826.83		0	0.7931	0.6364	0.9	0	0.8667	0.5172	0.8387
1008.17		0.1	0.6774	0.4545	0.6364	0.3214	0.5862	0.7308	0.8485

Survival Rate Binomials

C-mg/L SO ₄	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
76.53	Dilution Water	21/30	23/30	23/31	26/28	19/30	30/30	19/29	26/29
406.33		16/29	29/30	22/30	23/30	19/30	29/30	22/28	23/28
480.67		18/30	27/30	17/30	27/32	14/29	25/26	28/30	27/30
579.17		10/30	25/26	23/30	23/30	5/30	29/30	19/33	19/29
700.17		8/30	26/28	5/29	27/31	15/27	22/28	13/27	27/31
826.83		0/28	23/29	21/33	27/30	0/27	26/30	15/29	26/31
1008.17		3/30	21/31	15/33	21/33	9/28	17/29	19/26	28/33

CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 2 of 2)
Test Code: 161183SO4b1 | 16-1064-4756

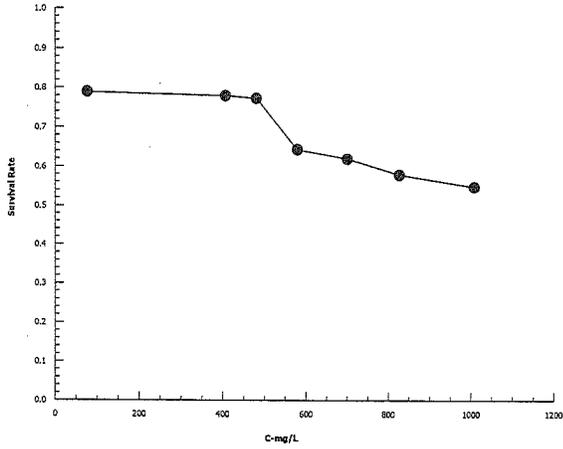
Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 15-3426-7593 Endpoint: Survival Rate
Analyzed: 16 Jan-17 14:54 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 1 of 2)
 Test Code: 161183SO4b1 | 16-1064-4756

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 14-2861-4473	Endpoint: Proportion Normal (Viability)	CETIS Version: CETISv1.8.7
Analyzed: 16 Jan-17 14:55	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 04-4091-8506	Test Type: Survival-Development	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:
Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample (SO ₄)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 8h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	617506	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L SO ₄	95% LCL	95% UCL
EC5	498	117.5	829.5
EC10	534.9	180.2	869.3
EC15	574.5	276.1	983.9
EC20	680.1	442.2	N/A
EC25	865.2	519.8	N/A
EC40	>1008	N/A	N/A
EC50	>1008	N/A	N/A

EV ER4 is dilution water (Site water)

Proportion Normal Summary (Viability)

Calculated Variate(A/B)

C-mg/L SO ₄	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
76.53	Dilution Water	8	0.723	0.4828	0.9667	0.06865	0.1942	26.86%	0.0%	171	237
406.33		8	0.6967	0.4138	0.9667	0.06797	0.1922	27.59%	3.65%	164	235
480.67		8	0.7104	0.3448	0.9615	0.08188	0.2316	32.6%	1.74%	168	237
579.17		8	0.6169	0.1333	0.9667	0.1048	0.2963	48.04%	14.68%	145	238
700.17		8	0.5675	0.1034	0.871	0.1128	0.319	56.21%	21.51%	132	231
826.83		8	0.5399	0	0.9	0.1344	0.3803	70.43%	25.33%	131	237
1008.17		8	0.4983	0.06667	0.8182	0.09093	0.2572	51.62%	31.08%	122	243

Proportion Normal Detail (Viability)

C-mg/L SO ₄	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
76.53	Dilution Water	0.5667	0.7333	0.7097	0.9286	0.5	0.9667	0.4828	0.8966
406.33		0.4138	0.9667	0.6333	0.7333	0.5	0.9333	0.6429	0.75
480.67		0.5	0.9	0.5	0.8438	0.3448	0.9615	0.7333	0.9
579.17		0.3	0.9615	0.7	0.7333	0.1333	0.9667	0.4848	0.6552
700.17		0.2	0.8571	0.1034	0.871	0.4815	0.7857	0.3704	0.871
826.83		0	0.7931	0.5758	0.9	0	0.8667	0.3448	0.8387
1008.17		0.06667	0.6774	0.3636	0.6061	0.2143	0.5862	0.6538	0.8182

Proportion Normal Binomials (Viability)

C-mg/L SO ₄	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
76.53	Dilution Water	17/30	22/30	22/31	26/28	15/30	29/30	14/29	26/29
406.33		12/29	29/30	19/30	22/30	15/30	28/30	18/28	21/28
480.67		15/30	27/30	15/30	27/32	10/29	25/26	22/30	27/30
579.17		9/30	25/26	21/30	22/30	4/30	29/30	16/33	19/29
700.17		6/30	24/28	3/29	27/31	13/27	22/28	10/27	27/31
826.83		0/28	23/29	19/33	27/30	0/27	26/30	10/29	26/31
1008.17		2/30	21/31	12/33	20/33	6/28	17/29	17/26	27/33

CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 2 of 2)
Test Code: 161183SO4b1 | 16-1064-4756

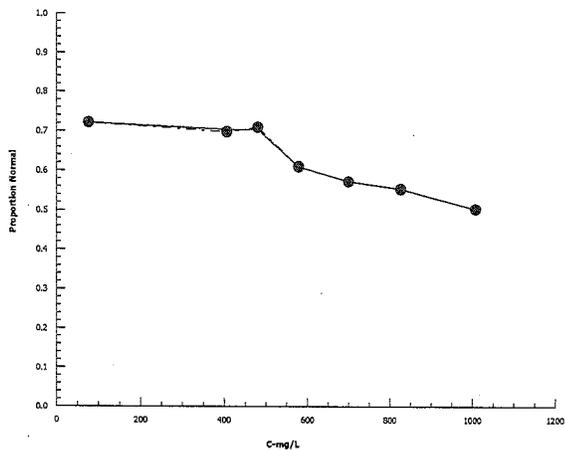
Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 14-2861-4473 Endpoint: Proportion Normal (w/abilt)
Analyzed: 16 Jan-17 14:55 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 1 of 2)
 Test Code: 161183SO4bb1 | 11-2293-6911

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 01-2190-0462	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 16 Jan-17 11:21	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 21-4327-7357	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:
Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample (SO ₄)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 8h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	798919	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L SO ₄	95% LCL	95% UCL
IC5	897.3	255.3	N/A
IC10	>1008	N/A	N/A
IC15	>1008	N/A	N/A
IC20	>1008	N/A	N/A
IC25	>1008	N/A	N/A
IC40	>1008	N/A	N/A
IC50	>1008	N/A	N/A

EV-ER4 is dilution water (site water)

Length-mm Summary

C-mg/L SO ₄	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
76.53	Dilution Water	8	17.72	15.87	19.97	0.4324	1.223	6.9%	0.0%
406.33		8	16.89	15.56	18.84	0.4134	1.169	6.92%	4.71%
480.67		8	17.35	16.08	19.66	0.4361	1.234	7.11%	2.1%
579.17		8	17.16	15.11	19.78	0.6269	1.773	10.33%	3.17%
700.17		8	17.28	14.2	18.91	0.5615	1.588	9.19%	2.47%
826.83		6	17.02	14.97	18.63	0.612	1.499	8.81%	3.95%
1008.17		8	16.57	14.83	17.95	0.3665	1.037	6.26%	6.49%

Length-mm Detail

C-mg/L SO ₄	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
76.53	Dilution Water	17.67	18.02	17.33	18.63	16.79	19.97	15.87	17.5
406.33		15.56	17.14	15.84	18.17	16.08	18.84	17.23	16.24
480.67		16.08	17.46	16.71	18.69	16.79	19.66	16.29	17.13
579.17		16.05	19.6	15.28	17.46	16.8	19.78	15.11	17.21
700.17		15.75	18.52	14.2	18.35	17.07	18.91	17.85	17.63
826.83		17.28	15.38	18.63	17.87	14.97	18		
1008.17		14.83	17.64	16.03	17.24	16.72	16.41	15.76	17.95

*conc 826.83 mg/L SO₄ Rep A & E
 are removed from analysis.*

CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 2 of 2)
Test Code: 161183SO4bb1 | 11-2293-6911

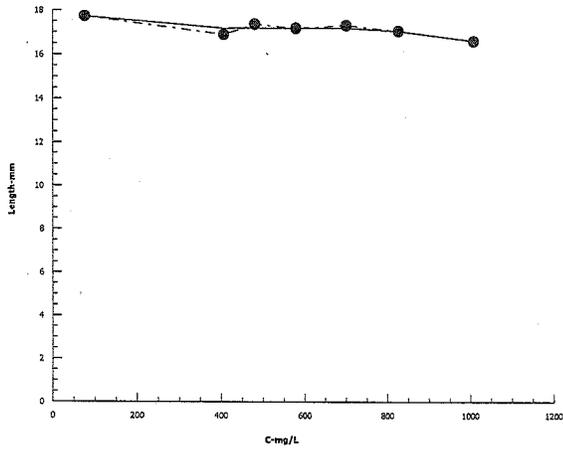
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 01-2190-0462 Endpoint: Length-mm
Analyzed: 16 Jan-17 11:21 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 1 of 2)
 Test Code: 161183SO4bb1 | 11-2293-6911

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 12-6392-1879	Endpoint: Mean ⁱⁿ Dry Weight-mg	CETIS Version: CETISv1.8.7
Analyzed: 16 Jan-17 11:21	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes

Batch ID: 21-4327-7357	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:
Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample (007)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 8h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	490427	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L SO ₄	95% LCL	95% UCL
IC5	742.2	152.2	N/A
IC10	>1008	N/A	N/A
IC15	>1008	N/A	N/A
IC20	>1008	N/A	N/A
IC25	>1008	N/A	N/A
IC40	>1008	N/A	N/A
IC50	>1008	N/A	N/A

Conc. 826.83 mg/L SO₄ Rep A & E
 are removed from analysis.
 EV_ER4 is dilution water (site water)

Mean Dry Weight-mg Summary

C-mg/L SO ₄	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
76.53	Dilution Water	8	100.5	79.62	123	4.892	13.84	13.77%	0.0%
406.33		8	97.86	74.35	116.9	5.025	14.21	14.52%	2.62%
480.67		8	95.28	81.11	116.4	4.174	11.81	12.39%	5.19%
579.17		8	96.46	78.42	125.2	5.809	16.43	17.03%	4.02%
700.17		8	95.99	80.37	113.2	4.185	11.84	12.33%	4.49%
826.83		6	93.53	82.69	108.8	4.399	10.77	11.52%	6.93%
1008.17		8	95.8	82.38	110.6	3.758	10.63	11.1%	4.68%

Mean Dry Weight-mg Detail

C-mg/L SO ₄	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
76.53	Dilution Water	105.7	115.2	99.57	91.92	96.32	123	92.63	79.62
406.33		97.5	111.7	90	84.78	102.6	116.9	105	74.35
480.67		86.67	107.4	92.94	85.56	97.86	116.4	94.29	81.11
579.17		97	115.2	90	80	98	125.2	87.89	78.42
700.17		95	111.5	88	85.19	100	113.2	94.62	80.37
826.83		104.3	90.95	83.7	108.8	90.67	82.69		
1008.17		93.33	108.1	93.33	82.38	103.3	110.6	92.11	83.21

CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 2 of 2)
Test Code: 161183SO4bb1 | 11-2293-6911

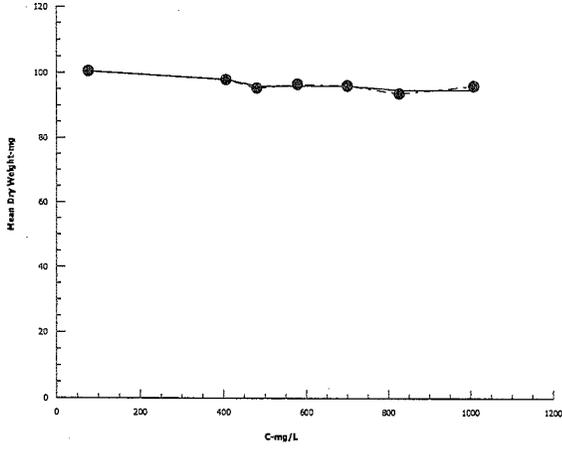
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 12-6392-1879 Endpoint: Mean Dry Weight-mg
Analyzed: 16 Jan-17 11:21 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 1 of 3)
 Test Code: 161183SO4c1 | 19-7232-6995

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 02-6983-6422	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 16 Jan-17 14:49	Analysis: Linear Regression (MLE)	Official Results: Yes
Batch ID: 19-1415-2965	Test Type: Survival-Development	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:
Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (SD)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Linear Regression Options

Model Function	Threshold Option	Threshold	Optimized	Pooled	Het Corr	Weighted
Log-Normal [NED=A+B*log(X)]	Control Threshold	0.3744856	Yes	No	Yes	Yes

Regression Summary

Iters	LL	AICc	BIC	Mu	Sigma	Adj R2	F Stat	Critical	P-Value	Decision(α:5%)
37	-1115	2237	2243	2.997	0.09996	0.08346	0.347	2.561	0.8449	Non-Significant Lack of Fit

Point Estimates

Level	mg/L _{dry}	95% LCL	95% UCL
EC5	680.3	N/A	N/A
EC10	739.6	N/A	N/A
EC15	782.5	N/A	N/A
EC20	818.4	N/A	N/A
EC25	850.5	N/A	N/A
EC40	937.1	N/A	N/A
EC50	993.4	N/A	N/A

GH FR1 is dilution water (site water)

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
Threshold	0.3947	0.04627	0.3019	0.4875	8.531	<0.0001	Significant Parameter
Slope	10	6.668	-3.37	23.38	1.5	0.1395	Non-Significant Parameter
Intercept	-29.98	19.8	-69.7	9.729	-1.514	0.1359	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	55.99459	55.99459	1	7.008	0.0107	Significant
Lack of Fit	11.66317	2.915792	4	0.347	0.8449	Non-Significant
Pure Error	411.7885	8.403846	49			
Residual	423.4516	7.989653	53			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Goodness-of-Fit	Pearson Chi-Sq GOF	423.5	70.99	<0.0001	Significant Heterogeneity
	Likelihood Ratio GOF	481.7	70.99	<0.0001	Significant Heterogeneity
Variances	Bartlett Equality of Variance	4.683	12.59	0.5851	Equal Variances
	Mod Levene Equality of Variance	1.239	2.29	0.3029	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9721	0.9582	0.2178	Normal Distribution
	Anderson-Darling A2 Normality	0.388	2.492	0.3912	Normal Distribution

CETIS Analytical Report

Report Date: 16 Jan-17 15:54 (p 2 of 3)
 Test Code: 161183SO4c1 | 19-7232-6995

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 02-6983-6422 Endpoint: Survival Rate CETIS Version: CETISv1.8.7
 Analyzed: 16 Jan-17 14:49 Analysis: Linear Regression (MLE) Official Results: Yes

Survival Rate Summary

Calculated Variate(A/B)

C-mg/L ^{50µ}	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
220.17	Dilution Water	8	0.6258	0.3103	0.9667	0.06812	0.1927	30.79%	0.0%	152	243
399		8	0.5707	0.2	0.9333	0.1015	0.2871	50.31%	8.8%	138	241
478.5		8	0.5839	0.1333	0.8667	0.07549	0.2135	36.57%	6.69%	139	238
570.67		8	0.5898	0.2	0.8387	0.07998	0.2262	38.36%	5.76%	142	240
684.67		8	0.6515	0.4	0.931	0.06823	0.193	29.62%	-4.11%	156	238
832.5		8	0.405	0	0.871	0.1258	0.3559	87.88%	35.28%	97	236
1001		8	0.3175	0.03571	0.75	0.1045	0.2956	93.12%	49.27%	74	236

Survival Rate Detail

C-mg/L ^{50µ}	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
220.17	Dilution Water	0.4839	0.9667	0.5313	0.7	0.3103	0.6333	0.7143	0.6667
399		0.2	0.9333	0.3448	0.6875	0.4667	0.8667	0.2667	0.8
478.5		0.6	0.5667	0.6667	0.7	0.1333	0.8667	0.4828	0.6552
570.67		0.2	0.6667	0.8333	0.5161	0.4138	0.7667	0.4828	0.8387
684.67		0.6207	0.8387	0.4	0.4828	0.4815	0.8125	0.6452	0.931
832.5		0	0.5	0	0.871	0	0.7241	0.5	0.6452
1001		0.06667	0.6667	0.1333	0.5625	0.06667	0.75	0.03571	0.2581

Survival Rate Binomials

C-mg/L ^{50µ}	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
220.17	Dilution Water	15/31	29/30	17/32	21/30	9/29	19/30	20/28	22/33
399		6/30	28/30	10/29	22/32	14/30	26/30	8/30	24/30
478.5		18/30	17/30	20/30	21/30	4/30	26/30	14/29	19/29
570.67		6/30	20/30	25/30	16/31	12/29	23/30	14/29	26/31
684.67		18/29	26/31	12/30	14/29	13/27	26/32	20/31	27/29
832.5		0/30	15/30	0/28	27/31	0/29	21/29	14/28	20/31
1001		2/30	18/27	4/30	18/32	2/30	21/28	1/28	8/31

GH-FPI is dilution water (site water)

Salmonid Embryo-Alevin Survival and Development Test

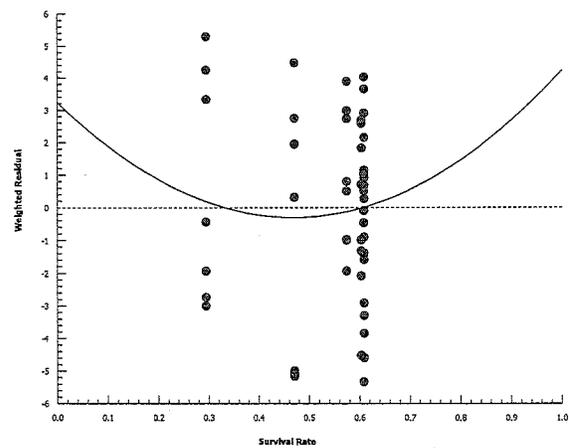
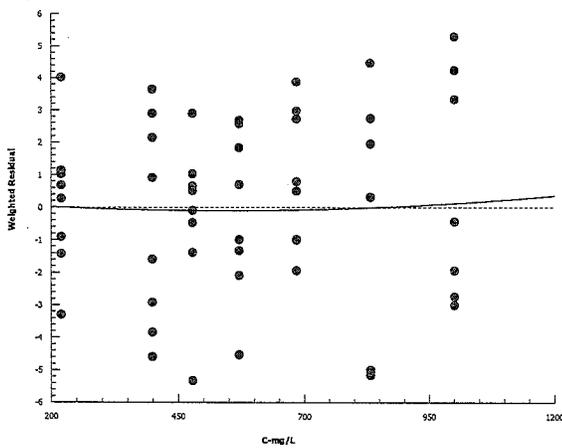
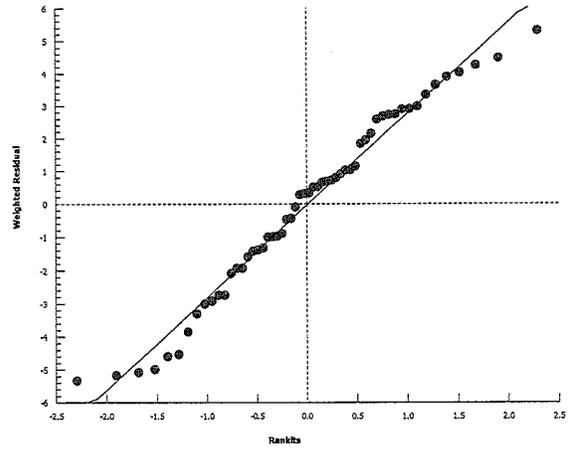
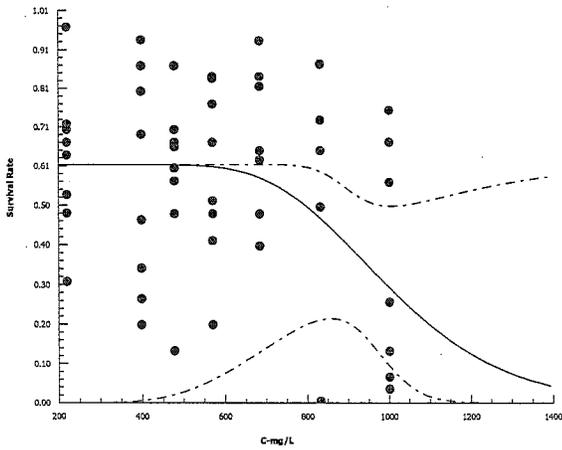
Nautilus Environmental

Analysis ID: 02-6983-6422 Endpoint: Survival Rate
Analyzed: 16 Jan-17 14:49 Analysis: Linear Regression (MLE)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics

Log-Normal [NED=A+B*log(X)]



CETIS Analytical Report

Report Date: 16 Jan-17 15:55 (p 1 of 3)
 Test Code: 161183SO4c1 | 19-7232-6995

Salmonid Embryo-Alevin Survival and Development Test			Nautilus Environmental		
Analysis ID: 04-0155-4149	Endpoint: Proportion Normal (stability)	CETIS Version: CETISv1.8.7	Batch ID: 19-1415-2965	Test Type: Survival-Development	Analyst: Kania Lywe
Analyzed: 16 Jan-17 14:49	Analysis: Linear Regression (MLE)	Official Results: Yes	Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 29 Nov-16 10:30	Species: Oncorhynchus mykiss	Brine:	Duration: 27d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal	Sample Date: 25 Oct-16 10:30	Material: Water Sample (SO4)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)		Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Linear Regression Options

Model Function	Threshold Option	Threshold	Optimized	Pooled	Het Corr	Weighted
Log-Normal [NED=A+B*log(X)]	Control Threshold	0.4156379	Yes	No	Yes	Yes

Regression Summary

Iters	LL	AICc	BIC	Mu	Sigma	Adj R2	F Stat	Critical	P-Value	Decision(α:5%)
54	-1126	2259	2264	3.002	0.09929	0.05691	0.2253	2.561	0.9230	Non-Significant Lack of Fit

Point Estimates

Level	mg/L ^{SO4}	95% LCL	95% UCL
EC5	689.3	N/A	N/A
EC10	749	N/A	N/A
EC15	792.2	N/A	N/A
EC20	828.3	N/A	N/A
EC25	860.5	N/A	N/A
EC40	947.5 ^{KE}	N/A	N/A
EC50	1004 ¹⁰⁰¹	N/A	N/A

GH FR1 is dilution water (site water)

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
Threshold	0.4275	0.04704	0.3331	0.5218	9.088	<0.0001	Significant Parameter
Slope	10.07	7.503	-4.977	25.12	1.342	0.1852	Non-Significant Parameter
Intercept	-30.23	22.3	-74.96	14.49	-1.356	0.1809	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	43.637	43.637	1	5.319	0.0250	Significant
Lack of Fit	7.852804	1.963201	4	0.2253	0.9230	Non-Significant
Pure Error	426.9434	8.713131	49			
Residual	434.7962	8.203703	53			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Goodness-of-Fit	Pearson Chi-Sq GOF	434.8	70.99	<0.0001	Significant Heterogeneity
	Likelihood Ratio GOF	496.7	70.99	<0.0001	Significant Heterogeneity
Variances	Bartlett Equality of Variance	4.165	12.59	0.6543	Equal Variances
	Mod Levene Equality of Variance	1.305	2.29	0.2729	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9701	0.9582	0.1777	Normal Distribution
	Anderson-Darling A2 Normality	0.3993	2.492	0.3686	Normal Distribution

CETIS Analytical Report

Report Date: 16 Jan-17 15:55 (p 2 of 3)
 Test Code: 161183SO4c1 | 19-7232-6995

Salmonid Embryo-Alevin Survival and Development Test

Nautilus Environmental

Analysis ID: 04-0155-4149 Endpoint: Proportion Normal (viability)
 Analyzed: 16 Jan-17 14:49 Analysis: Linear Regression (MLE) CETIS Version: CETISv1.8.7
 Official Results: Yes

Proportion Normal Summary (viability)			Calculated Variate(A/B)								
C-mg/L <i>SL</i>	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
220.17	Dilution Water	8	0.5839	0.2759	0.9	0.06794	0.1922	32.91%	0.0%	142	243
399		8	0.5458	0.2	0.9333	0.105	0.2969	54.39%	6.52%	132	241
478.5		8	0.5421	0.1333	0.8667	0.07502	0.2122	39.14%	7.16%	129	238
570.67		8	0.5728	0.1667	0.8387	0.08343	0.236	41.2%	1.9%	138	240
684.67		8	0.6125	0.3333	0.931	0.07845	0.2219	36.23%	-4.9%	146	238
832.5		8	0.3961	0	0.871	0.1252	0.3541	89.39%	32.16%	95	236
1001		8	0.3091	0	0.75	0.1051	0.2972	96.15%	47.07%	72	236

Proportion Normal Detail (viability)		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
C-mg/L <i>SL</i>	Control Type								
220.17	Dilution Water	0.4194	0.9	0.4688	0.7	0.2759	0.6333	0.6071	0.6667
399		0.2	0.9333	0.3103	0.6563	0.4333	0.8333	0.2	0.8
478.5		0.4667	0.5667	0.5	0.7	0.1333	0.8667	0.4828	0.6207
570.67		0.1667	0.6667	0.8	0.5161	0.3793	0.7667	0.4483	0.8387
684.67		0.5172	0.8387	0.3333	0.4828	0.3704	0.7813	0.6452	0.931
832.5		0	0.5	0	0.871	0	0.7241	0.4286	0.6452
1001		0.06667	0.6667	0.1333	0.5313	0.06667	0.75	0	0.2581

Proportion Normal Binomials (viability)		Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
C-mg/L <i>SL</i>	Control Type								
220.17	Dilution Water	13/31	27/30	15/32	21/30	8/29	19/30	17/28	22/33
399		6/30	28/30	9/29	21/32	13/30	25/30	6/30	24/30
478.5		14/30	17/30	15/30	21/30	4/30	26/30	14/29	18/29
570.67		5/30	20/30	24/30	16/31	11/29	23/30	13/29	26/31
684.67		15/29	26/31	10/30	14/29	10/27	25/32	20/31	27/29
832.5		0/30	15/30	0/28	27/31	0/29	21/29	12/28	20/31
1001		2/30	18/27	4/30	17/32	2/30	21/28	0/28	8/31

GH FPI is dilution water (safe water)

Salmonid Embryo-Alevin Survival and Development Test

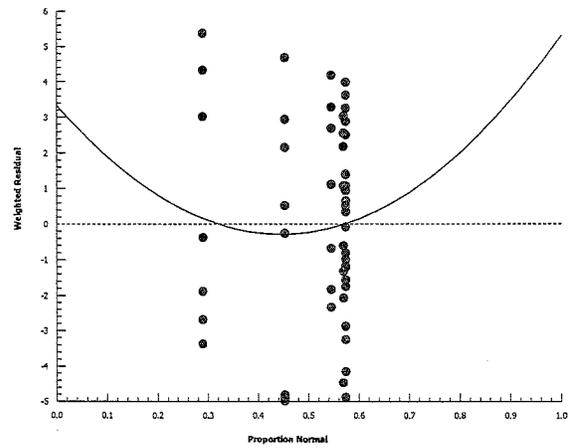
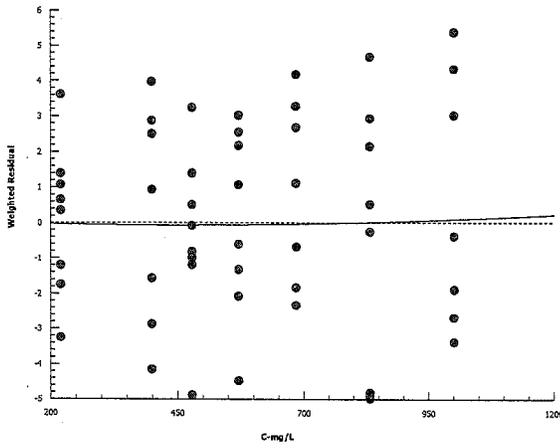
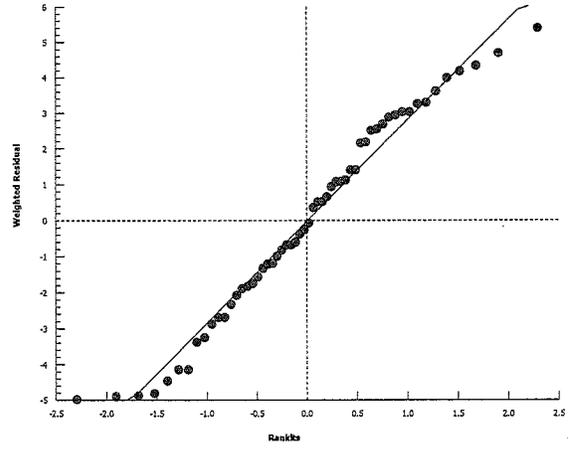
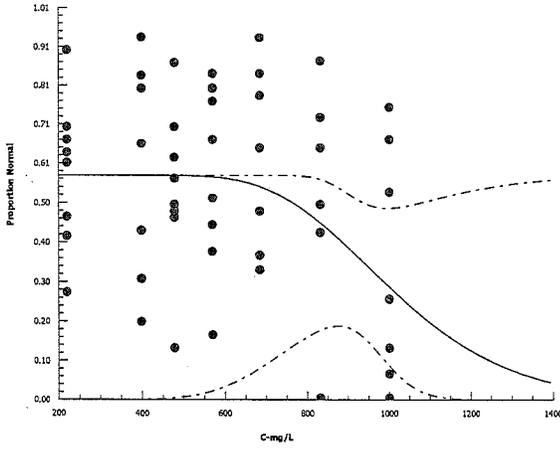
Nautilus Environmental

Analysis ID: 04-0155-4149 Endpoint: Proportion Normal (Survival)
Analyzed: 16 Jan-17 14:49 Analysis: Linear Regression (MLE)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics

Log-Normal [NED=A+B*log(X)]



CETIS Analytical Report

Report Date: 09 Feb-17 16:40 (p 1 of 2)
 Test Code: 161183SO4cc1 | 04-8323-3824

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 10-1760-5964 Endpoint: Length-mm CETIS Version: CETISv1.8.7
 Analyzed: 09 Feb-17 16:39 Analysis: Linear Interpolation (ICPIN) Official Results: Yes

Batch ID: 13-0432-3209 Test Type: Survival-Development-Growth Analyst: Kania Lywe
 Start Date: 01 Nov-16 16:20 Protocol: EC/EPS 1/RM/28 Diluent: Site Water
 Ending Date: 29 Nov-16 10:30 Species: Oncorhynchus mykiss Brine:
 Duration: 27d 18h Source: Vancouver Island Trout Hatchery Age:

Sample ID: 02-0044-4943 Code: GH_FR1 Client: Teck Coal
 Sample Date: 25 Oct-16 10:30 Material: Water Sample (Sew) Project:
 Receive Date: 26 Oct-16 08:44 Source: Teck Coal (TECK COAL)
 Sample Age: 7d 6h (4.2 °C) Station: GH_FR1_WS_2016-10-25_N

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	179312	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L ⁹⁰⁴	95% LCL	95% UCL
IC5	869.4	494.4	N/A
IC10	>1001	N/A	N/A
IC15	>1001	N/A	N/A
IC20	>1001	N/A	N/A
IC25	>1001	N/A	N/A
IC40	>1001	N/A	N/A
IC50	>1001	N/A	N/A

GH_FR1 is dilution water (site water)

Length-mm Summary

Calculated Variate

C-mg/L ⁹⁰⁴	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
220.17	Dilution Water	8	18.34	16.38	19.98	0.523	1.479	8.07%	0.0%
399		8	18.75	17.88	19.77	0.267	0.7551	4.03%	-2.26%
478.5		8	18.64	17.48	19.79	0.2864	0.8099	4.35%	-1.66%
570.67		8	17.96	17.06	19.13	0.3294	0.9318	5.19%	2.05%
684.67		8	17.79	16.53	19.5	0.3662	1.036	5.82%	2.99%
832.5		5	17.81	16	18.83	0.4988	1.115	6.26%	2.89%
1001		8	17.16	14	19.78	0.5748	1.626	9.47%	6.42%

Length-mm Detail

C-mg/L ⁹⁰⁴	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
220.17	Dilution Water	17.73	19.21	17.06	19.57	16.89	19.89	16.38	19.98
399		18.92	19.23	17.9	18.41	18.25	19.77	17.88	19.67
478.5		18	19.62	17.48	19	18	19.79	18.54	18.71
570.67		17.25	18.9	17.08	17.06	17.25	19.07	17.96	19.13
684.67		17.11	18.44	17	17.71	17.19	19.5	16.53	18.85
832.5		18.83	18.44	18.24	16	17.53			
1001		18.25	19.78	16.88	17.58	17	16.74	14	17.06

conc. 832.5 Rep A, C & E are removed from analysis

CETIS Analytical Report

Report Date: 09 Feb-17 16:40 (p 2 of 2)
Test Code: 161183SO4cc1 | 04-8323-3824

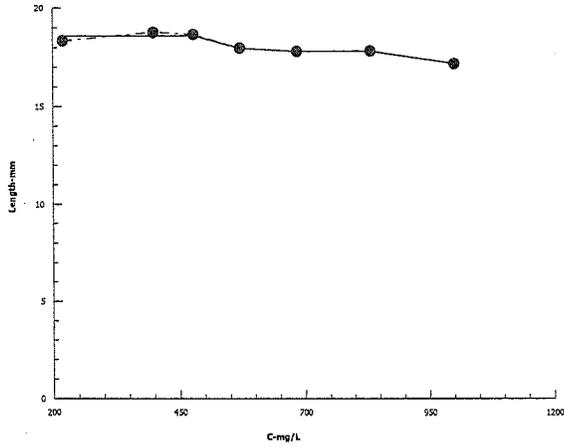
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 10-1760-5964 Endpoint: Length-mm
Analyzed: 09 Feb-17 16:39 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 16 Jan-17 15:55 (p 1 of 2)
 Test Code: 161183SO4cc1 | 04-8323-3824

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 06-1385-3327 Endpoint: Mean Dry Weight-mg CETIS Version: CETISv1.8.7
 Analyzed: 16 Jan-17 15:13 Analysis: Linear Interpolation (ICPIN) Official Results: Yes

Batch ID: 13-0432-3209 Test Type: Survival-Development-Growth Analyst: Kania Lywe
 Start Date: 01 Nov-16 16:20 Protocol: EC/EPS 1/RM/28 Diluent: Site Water
 Ending Date: 29 Nov-16 10:30 Species: Oncorhynchus mykiss Brine:
 Duration: 27d 18h Source: Vancouver Island Trout Hatchery Age:

Sample ID: 02-0044-4943 Code: GH_FR1 Client: Teck Coal
 Sample Date: 25 Oct-16 10:30 Material: Water Sample (804) Project:
 Receive Date: 26 Oct-16 08:44 Source: Teck Coal (TECK COAL)
 Sample Age: 7d 6h (4.2 °C) Station: GH_FR1_WS_2016-10-25_N

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1666513	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L ⁸⁰⁴	95% LCL	95% UCL
IC5	>1001	N/A	N/A
IC10	>1001	N/A	N/A
IC15	>1001	N/A	N/A
IC20	>1001	N/A	N/A
IC25	>1001	N/A	N/A
IC40	>1001	N/A	N/A
IC50	>1001	N/A	N/A

GH_FR1 is dilution water (site water)

Mean Dry Weight-mg Summary

Calculated Variate

C-mg/L ⁸⁰⁴	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
220.17	Dilution Water	8	94.37	81.36	108.4	3.824	10.82	11.46%	0.0%
399		8	97.36	78.64	111.5	4.162	11.77	12.09%	-3.16%
478.5		8	94.01	78.57	111.5	4.623	13.08	13.91%	0.39%
570.67		8	96.84	70.63	153.5	8.925	25.24	26.07%	-2.61%
684.67		8	94.46	74.29	110.4	4.532	12.82	13.57%	-0.09%
832.5		5	90.03	71	105.7	6.446	14.41	16.01%	4.6%
1001		8	96.87	73.75	140	8.269	23.39	24.14%	-2.65%

Mean Dry Weight-mg Detail

C-mg/L ⁸⁰⁴	Control Type	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8
220.17	Dilution Water	104	107.6	90.59	83.81	92.22	108.4	87	81.36
399		106.7	110	92	78.64	100	111.5	93.75	86.25
478.5		103.9	110	89.5	78.57	85	111.5	93.57	80
570.67		83.33	102.5	88.4	70.63	101.7	153.5	93.57	81.15
684.67		97.78	106.5	97.5	74.29	102.3	110.4	86.5	80.37
832.5		102.7	82.22	105.7	88.57	71			
1001		110	112.2	92.5	73.89	75	97.62	140	73.75

conc. 832 Sample 804 Rep A, C & E are removed from analysis -

CETIS Analytical Report

Report Date: 16 Jan-17 15:55 (p 2 of 2)
Test Code: 161183SO4cc1 | 04-8323-3824

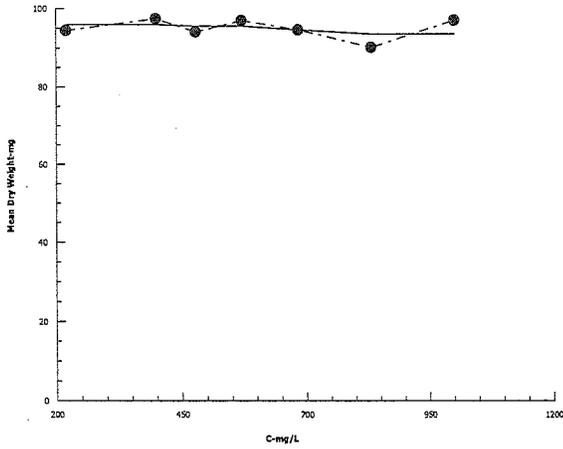
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 06-1385-3327 Endpoint: Mean Dry Weight-mg
Analyzed: 16 Jan-17 15:13 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



Embryo-Alevin-Swimup Test Summary Sheet

Client: Teck (NO3 testing) Test Date: November 1 - December 9, 2016
 Work Order No.: 161183 Test Species: Oncorhynchus mykiss

Sample Information:

Sample ID: Various - see table below
 Sample Date: October 25, November 1, November 8, November 15, November 22 & November 29, 2016
 Date Received: October 26, November 2, November 9, November 16, November 23 & November 30, 2016
 Sample Volume: (1 - 4) x 200 L per refresh

Dilution Water:

Type: Dechlorinated Tap Water
 Hardness (mg/L CaCO3): 7 - 9
 Alkalinity (mg/L CaCO3): 2 - 5

Test Organism Information:

Batch No: 110116
 Source: Vancouver Island Trout Hatchery, Duncan, BC Number male broodstock used: 3
 Loading Density: 1.22 g / L Number female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE90
 Stock Solution ID: 16SO2 (1000 mg/L SDS)
 Date Initiated: November 1, 2016
 7-d EC50 (95% CL): 7.5 (7.4 - 7.5) mg/L SDS

Reference Toxicant Mean and Range: 4.0 (2.1 - 7.6) mg/L SDS
 Reference Toxicant CV (%): 38

Test Results:

Sample ID	Survival (%) (Mean ± SD)	Swimup (%) (Mean ± SD)	Length (mm) (Mean ± SD)	Wet weight (mg) (Mean ± SD)
Control	66.86 ± 27.94	92.11 ± 11.16	21.82 ± 1.39	117.20 ± 22.12
GH_ER2	80.49 ± 10.93	74.50 ± 15.11	23.08 ± 1.13	115.60 ± 8.26
EV_ER4	61.02 ± 28.49	92.48 ± 8.70	23.99 ± 0.68	127.90 ± 15.31
GH_FR1	63.09 ± 15.96	88.11 ± 9.62	21.95 ± 0.71	109.30 ± 10.00
GH_ER_HH (GH_FR1_HH)	32.75 ± 16.91 *	65.83 ± 28.28	21.72 ± 0.35	117.00 ± 11.92

* Indicates results that were significantly lower relative to laboratory control

	Sample ID - GH_ER2_WS_2016-10-25_N			
	Survival	Percent Swimup	Length	Wet weight
EC25 (mg/L NO3) (95% CL)	17.22 (8.03 - 22.98)	>45.05	-	-
EC50 (mg/L NO3) (95% CL)	25.19 (16.68 - 31.71)	>45.05	-	-
IC25 (mg/L NO3) (95% CL)	-	-	>45.05	>45.05
IC50 (mg/L NO3) (95% CL)	-	-	>45.05	>45.05

Reviewed by: JCH

Date reviewed: 04/30/17

Embryo-Alevin-Swimup Test Summary Sheet

Client: Teck (NO3 testing)
Work Order No.: 161183

Test Date: November 1 - December 9, 2016
Test Species: Oncorhynchus mykiss

Sample Information:

Sample ID: Various - see table below
Sample Date: October 25, November 1, November 8, November 15, November 22 & November 29, 2016
Date Received: October 26, November 2, November 9, November 16, November 23 & November 30, 2016
Sample Volume: (1 - 4) x 200 L per refresh

Dilution Water:

Type: Dechlorinated Tap Water
Hardness (mg/L CaCO3): 7 - 9
Alkalinity (mg/L CaCO3): 2 - 5

Test Organism Information:

Batch No: 110116
Source: Vancouver Island Trout Hatchery, Duncan, BC Number male broodstock used: 3
Loading Density: 1.22 g / L Number female broodstock used: 4

SDS Reference Toxicant Results:

Reference Toxicant ID: RTE90
Stock Solution ID: 16SO2 (1000 mg/L SDS)
Date Initiated: November 1, 2016
7-d EC50 (95% CL): 7.5 (7.4 - 7.5) mg/L SDS

Reference Toxicant Mean and Range: 4.0 (2.1 - 7.6) mg/L SDS
Reference Toxicant CV (%): 38

Test Results:

Sample ID - EV_ER4_WS_2016-10-25_N				
	Survival	Percent Swimup	Length	Wet weight
EC25 (mg/L NO3) (95% CL)	>69.29	>69.29	-	-
EC50 (mg/L NO3) (95% CL)	>69.29	>69.29	-	-
IC25 (mg/L NO3) (95% CL)	-	-	>69.29	>69.29
IC50 (mg/L NO3) (95% CL)	-	-	>69.29	>69.29

Sample ID - GH_FR1_WS_2016-10-25_N				
	Survival	Percent Swimup	Length	Wet weight
EC25 (mg/L NO3) (95% CL)	63.96 (1.93 - N/A)	39.06 (6.06 - 67.62)	-	-
EC50 (mg/L NO3) (95% CL)	>74.50	>74.50	-	-
IC25 (mg/L NO3) (95% CL)	-	-	>74.50	>74.50
IC50 (mg/L NO3) (95% CL)	-	-	>74.50	>74.50

Sample ID - GH_FR1-HH_WS_2016-10-25_N				
	Survival	Percent Swimup	Length	Wet weight
EC25 (mg/L NO3) (95% CL)	67.21 (N/A)	23.64 (5.69 - N/A)	-	-
EC50 (mg/L NO3) (95% CL)	103.40 (N/A)	>110.60	-	-
IC25 (mg/L NO3) (95% CL)	-	-	>110.60	>110.60
IC50 (mg/L NO3) (95% CL)	-	-	>110.60	>110.60

Reviewed by: Jon

Date reviewed: Oct. 30/17

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: Lab Control
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1600h
 Test Species: Oncorhynchus mykiss

Lab Control Concentration	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	15.0	/	15.0	/	14.5	15.0	14.5	/	14.5	/	14.5	15.0	14.5
DO (mg/L)	10.0	/	9.4	/	9.7	9.8	10.0	/	9.8	/	9.8	9.9	9.8
pH	6.6	/	6.9	/	7.1	6.8	6.9	/	7.1	/	6.8	7.0	7.0
Cond. (µS/cm)	29		32		32		28		29		31		28
Initials	KLP		K		K		K		K		K		K

Concentration	Days												
	init.	new	old										
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Concentration	Days												
	init.	new	old										
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Concentration	Days												
	init.	new	old										
Temperature (°C)													
DO (mg/L)													
pH													
Cond. (µS/cm)													
Initials													

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control			
Hardness*	9	/		
Alkalinity*	4	/		

* mg/L as CaCO₃

Analysts: KLP, KL, AWP

Reviewed by: JGU

Date reviewed: Feb 8/17

Sample Description: clear, colorless, odorless, no particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

GH-ER2 Concentration (unamended)	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.5		15.0		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.1		9.4		9.7	10.0	10.0		9.8		9.8	9.8	9.7	
pH	7.9		8.2		8.2	8.2	8.2		8.2		8.2	8.0	8.0	
Cond. (µS/cm)	313		314		313	314	314		313		313	312	312	
Initials	KLP		K		K	K	K		A		K	K	K	

3 Concentration mg/L NO ₃ -N	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.5		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.1		9.4		9.7	10.0	10.0		9.7		9.8	9.7	9.7	
pH	7.9		8.2		8.2	8.1	8.2		8.3		8.2	8.2	8.0	
Cond. (µS/cm)	336		339		338	336	336		336		338	337	337	
Initials	KLP		K		K	K	K		A		K	K	K	

5 Concentration mg/L NO ₃ -N	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.5		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.1		9.4		9.8	10.0	10.0		9.8		9.8	9.7	9.7	
pH	7.9		8.2		8.2	8.1	8.2		8.2		8.2	8.2	8.0	
Cond. (µS/cm)	352		354		354	351	351		351		353	353	353	
Initials	KLP		K		K	K	K		A		K	K	K	

9 Concentration mg/L NO ₃ -N	Days													
	0	1		2		3		4		5		6		
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.5		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.2		9.4		9.8	10.0	10.0		9.7		9.8	9.7	9.7	
pH	7.9		8.2		8.2	8.1	8.2		8.3		8.2	8.2	8.0	
Cond. (µS/cm)	383		386		385	383	383		384		386	382	382	
Initials	KLP		K		K	K	K		A		K	K	K	

Thermometer: CER-10 DO meter: DO-213 pH meter: PH-113 Conductivity meter: C-213

	Control	GH-ER2 (unamended)	
Hardness*	9	167	
Alkalinity*	4	147	

* mg/L as CaCO₃

Analysts: KLP, AWD, K

Reviewed by: Jbb

Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, no particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9 16 @ 1600h
 Test Species: Oncorhynchus mykiss

Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.5		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.2		9.4		9.8	10.0	10.0		9.8		9.8	9.7	9.7
pH	7.9		8.2		8.2	8.1	8.2		8.3		8.2	8.1	8.0
Cond. (µS/cm)	430	434		432		426		430		435		429	
Initials	KL	KL		KL		KL		KL		KL		KL	

Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.5		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.1		9.4		9.8	10.0	9.9		9.8		9.8	9.7	9.7
pH	7.9		8.2		8.2	8.1	8.2		8.3		8.2	8.1	8.0
Cond. (µS/cm)	513	519		517		510		509		510		523	
Initials	KL	KL		KL		KL		KL		KL		KL	

Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.5		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.1		9.4		9.8	10.0	9.9		9.8		9.8	9.7	9.7
pH	7.9		8.2		8.2	8.1	8.2		8.3		8.2	8.1	8.0
Cond. (µS/cm)	657	666		661		660		661		667		666	
Initials	KL	KL		KL		KL		KL		KL		KL	

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

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-ER2 (unamended)	KL
Hardness*	9	167	
Alkalinity*	4	147	

* mg/L as CaCO₃

Analysts: KL, AWS, KL

Reviewed by: John

Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, no particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EVER4
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9 116 @ 1000h
 Test Species: Oncorhynchus mykiss

EVER4 Concentration (unamended)	Days												
	0	1		2		3		4		5		6	
	init	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.5		9.7	9.9	10.0		9.7		9.8	9.9	9.7
pH	8.0		8.2		8.2	8.3	8.2		8.2		8.3	8.2	8.1
Cond. (µS/cm)	470		475		473		466		470		473		473
Initials	KLP		K		K		K		K		K		K

S Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.5		9.7	9.9	9.9		9.7		9.7	9.7	9.7
pH	8.0		8.2		8.2	8.2	8.2		8.2		8.3	8.1	8.1
Cond. (µS/cm)	490		492		489		485		485		489		491
Initials	KLP		K		K		K		K		K		K

9 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.5		9.8	9.9	9.9		9.8		9.7	9.7	9.7
pH	8.0		8.2		8.2	8.2	8.2		8.3		8.3	8.1	8.1
Cond. (µS/cm)	519		526		522		525		524		522		524
Initials	KLP		K		K		K		K		K		K

15 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.5		9.8	9.9	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.2		8.2	8.2	8.2		8.3		8.3	8.1	8.1
Cond. (µS/cm)	560		578		573		580		578		568		575
Initials	KLP		K		K		K		K		K		K

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	EVER4 (unamended)	K
Hardness*	9	249	/
Alkalinity*	4	63	/

* mg/L as CaCO₃

Analysts: KLP, AWD, K

Reviewed by: JGL

Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.5		9.8	9.5	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.2		8.3	8.2	8.3		8.3		8.3	8.1	8.1
Cond. (µS/cm)	653		661		655	658		659		662		660	
Initials	WP		W		W	W		A		W		W	

Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.5		9.8	9.9	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.2		8.2	8.2	8.3		8.3		8.3	8.1	8.1
Cond. (µS/cm)	797		807		800	801		796		775		803	
Initials	WP		W		W	W		A		W		W	

Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.5		9.9	9.9	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.2		8.2	8.2	8.3		8.2		8.3	8.1	8.1
Cond. (µS/cm)	1023		1025		1029	1029		1031		1038		1045	
Initials	WP		W		W	W		A		W		W	

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

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	EV-ER4 (unamended)	W
Hardness*	9	249	
Alkalinity*	4	163	

Analysts: KP, AWP, RL

Reviewed by: JGL
 Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FRI
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

GH-FRI Concentration (unamended)	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.3		9.4		9.7	10.0	10.0		9.8		9.8	9.6	9.7
pH	8.0		8.3		8.3	8.3	8.3		8.2		8.4	8.1	8.2
Cond. (µS/cm)	804		816		807	799	805		805		810	813	
Initials	KL		K		K	K	K		A		K	K	

14 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.6		14.5	15.0	14.5
DO (mg/L)	10.3		9.4		9.8	10.0	9.9		9.7		9.8	9.7	9.7
pH	8.0		8.3		8.3	8.2	8.3		8.3		8.4	8.2	8.2
Cond. (µS/cm)	837		848		838	842	842		841		842	840	840
Initials	KL		K		K	K	K		A		K	K	

20 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.6		14.5	15.0	14.5
DO (mg/L)	10.3		9.4		9.8	10.2	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.3		8.3	8.2	8.3		8.3		8.4	8.2	8.2
Cond. (µS/cm)	883		888		882	890	890		890		886	886	886
Initials	KL		K		K	K	K		A		K	K	

27 Concentration mg/L NO ₂ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.6		14.5	15.0	14.5
DO (mg/L)	10.3		9.4		9.8	10.0	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.3		8.3	8.2	8.3		8.3		8.4	8.2	8.2
Cond. (µS/cm)	952		951		955	950	950		950		958	950	950
Initials	KL		K		K	K	K		A		K	K	

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FRI (unamended)	
Hardness*	9	147.5	148
Alkalinity*	4	193	

Analysts: KL, AWD, K
 Reviewed by: JGh
 Date reviewed: Feb. 3/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

38 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.6		14.5	15.0	14.5
DO (mg/L)	10.3		9.4		9.8	10.0	9.9		9.9		9.8	9.7	9.7
pH	8.0		8.3		8.3	8.2	8.3		8.2		8.4	8.2	8.2
Cond. (µS/cm)	1038		1038		1041	1040	1040		1044		1035	1035	1035
Initials	KLP		K		K	K	K		A		K	K	K

54 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.6		14.5	15.0	14.5
DO (mg/L)	10.3		9.4		9.9	10.0	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.3		8.3	8.2	8.3		8.2		8.4	8.2	8.2
Cond. (µS/cm)	1140		1140		1141	1145	1145		1142		1133	1170	1170
Initials	KLP		K		K	K	K		A		K	K	K

75 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	14.0		14.5		14.5	15.0	14.5		14.8		14.5	15.0	14.5
DO (mg/L)	10.3		9.4		9.9	10.0	9.9		9.8		9.8	9.7	9.7
pH	8.0		8.2		8.3	8.2	8.3		8.3		8.4	8.2	8.2
Cond. (µS/cm)	1312		1317		1314	1315	1315		1300		1262	1337	1337
Initials	KLP		K		K	K	K		A		K	K	K

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

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FR1 (unamended)	
Hardness*	9	447 448	K
Alkalinity*	4	193	

Analysts: KLP, HWD, K

Reviewed by: JGK

Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Start Date & Time: November 1, 2016 @ 1620h
 Sample ID: GH-FRI-HH (700mg/L CaCO₃) Stop Date & Time: Dec 9/16 @ 1000h
 Work Order #: 161183 Test Species: Oncorhynchus mykiss

GH-FRI-HH Concentration (unamended)	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.3		9.4		9.8	10.0	10.0		9.8		9.8	9.7	9.7	
pH	8.1		8.2		8.3	8.3	8.3		8.2		8.4	8.2	8.2	
Cond. (µS/cm)	1190		1190		1193		1181		1184		1192		1181	
Initials	YHP		K		K		K		K		K		K	

15 Concentration mg/L NO ₃ -N	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.3		9.4		9.8	10.0	10.0		9.9		9.8	9.7	9.8	
pH	8.1		8.7		8.3	8.2	8.3		8.2		8.4	8.2	8.2	
Cond. (µS/cm)	1230		1231		1231		1225		1230		1233		1229	
Initials	YHP		K		K		K		K		K		K	

23 Concentration mg/L NO ₃ -N	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.4		9.4		9.8	10.0	10.0		9.8		9.8	9.7	9.8	
pH	8.1		8.2		8.3	8.2	8.3		8.3		8.4	8.2	8.2	
Cond. (µS/cm)	1294		1297		1296		1285		1283		1283		1284	
Initials	YHP		K		K		K		K		K		K	

34 Concentration mg/L NO ₃ -N	Days													
	0		1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old	
Temperature (°C)	13.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5	
DO (mg/L)	10.4		9.4		9.8	10.0	10.0		9.8		9.8	9.7	9.8	
pH	8.1		8.2		8.3	8.2	8.3		8.3		8.4	8.2	8.2	
Cond. (µS/cm)	1374		1378		1377		1373		1379		1394		1391	
Initials	YHP		K		K		K		K		K		K	

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FRI-HH (unamended)	K
Hardness*	9	709	
Alkalinity*	4	192	

Analysts: YHP, AWE, K

Reviewed by: JGK
Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: GH-FRI-HH is GH-FRI w/ hardness adjusted in-house to ~700mg/L CaCO₃

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FRI-HH (700 mg/L CaCO₃)
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

51 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.4		9.4		9.9	10.0	10.0		9.8		9.8	9.7	9.8
pH	8.1		8.2		8.3	8.2	8.3		8.2		8.3	8.2	8.2
Cond. (µS/cm)	1512		1516		1511	1500	1505		1505		1516	1520	
Initials	KLP		K		K	K	K		K		K	K	

76 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.4		9.4		9.9	10.0	10.0		9.9		9.8	9.7	9.8
pH	8.1		8.2		8.3	8.2	8.3		8.3		8.4	8.2	8.2
Cond. (µS/cm)	1696		1703		1697	1680	1689		1689		1711	1708	
Initials	KLP		K		K	K	K		K		K	K	

114 Concentration mg/L NO ₃ -N	Days												
	0	1		2		3		4		5		6	
	init.	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	13.0		14.5		14.5	15.0	14.5		14.5		14.5	15.0	14.5
DO (mg/L)	10.4		9.4		9.9	10.0	10.0		9.8		9.8	9.7	9.8
pH	8.1		8.2		8.3	8.2	8.3		8.3		8.4	8.2	8.2
Cond. (µS/cm)	1942		1953		1945	1915	1902		1902		1893	1956	
Initials	KLP		K		K	K	K		K		K	K	

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

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FRI-HH (unhardened)	
Hardness*	9	709	/
Alkalinity*	4	192	

Analysts: KLP, KL, AWD
 Reviewed by: JGB
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: Clear, colourless, odourless, some particulates

Comments: GH-FRI-HH is GH-FRI w/ hardness adjusted inhouse to ~700mg/L CaCO₃

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tecta
 Sample ID: Lab control
 Work Order #: 161183

Start Date & Time: Nov 11/16 C 1620h
 Stop Date & Time: Dec 9/16 C 1000h
 Test Species: Oncorhynchus mykiss

Lab Control Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	15.0	15.0		15.0	15.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.7	9.9	9.9		10.0	9.8	9.8		10.0		10.1	10.2	9.9
pH		6.9	7.0	7.0		7.0	7.0	7.1		7.2		6.8	7.1	6.9
Cond. (µS/cm)		30	30	30		31	28	28		27		31	27	
Initials		K	M	M		UML	UML	UML		A		A	UML	

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0												
DO (mg/L)		9.7												
pH		8.1												
Cond. (µS/cm)														
Initials														

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CEP-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control			
Hardness*	7			
Alkalinity*	5			

Analysts: UML, AWD, K
 Reviewed by: Joh
 Date reviewed: Feb 8/17

* mg/L as CaCO3

Sample Description: Clear colourless, odourless, no particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-ER2
 Work Order #: 16183

Start Date & Time: Nov 1/16 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

GH-ER2 Concentration (unamended)	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.7	10.3	9.8		9.9	10.2	9.9		10.0		10.0	10.1	10.1
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.1	8.3	8.2
Cond. (µS/cm)		312	307	314		311	311	311		317		316	311	311
Initials		KL	YML	YML		YML	YML	YML		A		A	YML	YML

3 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.9		9.7	10.2	9.8		10.1		10.1	10.2	10.0
pH		8.1	8.1	8.2		8.0	8.1	8.1		8.1		8.1	8.3	8.2
Cond. (µS/cm)		339	333	339		339	339	339		352		342	345	345
Initials		KL	YML	YML		YML	YML	YML		A		A	YML	YML

5 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.7		9.9	10.2	9.9		10.0		10.1	10.2	10.0
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.1	8.3	8.2
Cond. (µS/cm)		354	349	349		349	353	353		388		367	359	359
Initials		KL	YML	YML		YML	YML	YML		A		A	YML	YML

9 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.9		9.6	10.2	9.8		10.0		10.0	10.2	10.0
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.1	8.3	8.2
Cond. (µS/cm)		385	392	394		394	384	384		408		395	386	386
Initials		KL	YML	YML		YML	YML	YML		A		A	YML	YML

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/B

	Control	GH-ER2 (unamended)	
Hardness*	7	179	/
Alkalinity*	5	146	

Analysts: YML, AND, KL

Reviewed by: JGH
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: QH-ER2
 Work Order #: 161183

Start Date & Time: Nov 11/16 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.6	10.2	9.9		10.0		10.1	10.2	10.0
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.1	8.3	8.2
Cond. (µS/cm)		434	434		441		432		435		439		430	
Initials		ML	YML		YML		YML		A		A		YML	

Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.7		9.5	10.2	9.9		10.0		10.1	10.1	10.0
pH		8.1	8.1	8.2		8.1	8.1	8.1		8.2		8.1	8.3	8.2
Cond. (µS/cm)		517	529		532		545		531		540		523	
Initials		ML	YML		YML		YML		A		A		YML	

Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.9		9.7	10.2	9.7		10.0		10.1	10.1	10.1
pH		8.1	8.1	8.1		8.1	8.1	8.1		8.1		8.1	8.3	8.2
Cond. (µS/cm)		666	676		682		695		685		694		679	
Initials		ML	YML		YML		YML		A		A		YML	

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	QH-ER2 (unamended)	
Hardness*	7	179	
Alkalinity*	5	146	

Analysts: YML, AWD, ML

Reviewed by: YML

Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Telco
 Sample ID: EV-EP4
 Work Order #: 161183

Start Date & Time: Nov 11/16 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

EV-EP4 Concentration (unamended)	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.9		9.9	10.2	9.6		10.0		10.0	10.1	9.9
pH		8.2	8.1	8.2		8.1	8.2	8.2		8.1		8.1	8.2	8.2
Cond. (µS/cm)		470		488		474		471		469		477		469
Initials		W		YCL		WML		WML		A		A		WML

5 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.7	10.2	9.9		10.0		10.0	10.1	10.0
pH		8.2	8.1	8.2		8.1	8.2	8.2		8.2		8.1	8.2	8.2
Cond. (µS/cm)		489		488 488		494		490		485		493		488
Initials		W		YCL		WML		WML		A		A		WML

9 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.5	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.9		9.8	10.2	9.9		10.1		10.1	10.0	9.9
pH		8.2	8.1	8.2		8.1	8.2	8.2		8.1		8.1	8.3	8.2
Cond. (µS/cm)		522		520 520		527		523		527		527		519
Initials		W		YCL		WML		WML		A		A		WML

15 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.5	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.2	9.8		10.0		10.0	10.0	10.0
pH		8.2	8.1	8.2		8.1	8.2	8.2		8.1		8.1	8.3	8.2
Cond. (µS/cm)		571		568		572		570		564		573		569
Initials		W		YCL		WML		WML		A		A		WML

Thermometer: GR-10 DO meter: DO-2/3 pH meter: PH-1/33 Conductivity meter: C-2/B

	Control	EV-EP4 (unamended)	
Hardness*	7	257	/
Alkalinity*	5	162	

Analysts: WML, AWO, W
 Reviewed by: JGK
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tek
 Sample ID: EV-EP4
 Work Order #: 16183

Start Date & Time: Nov 1/16 C 1620h
 Stop Date & Time: Dec 9/16 P 1000h
 Test Species: Oncorhynchus mykiss

25 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.2	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.7	10.3	9.8		9.6	10.2	9.9		9.9		10.1	10.1	9.9
pH		8.2	8.1	8.2		8.1	8.2	8.2		8.1		8.1	8.3	8.2
Cond. (µS/cm)		662	648	655		655	655	649		656		660	660	
Initials		ML	YML	YML		YML	YML	A		A		YML	YML	

43 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.7	10.3	10.0		9.7	10.2	10.0		9.8		10.0	10.1	9.8
pH		8.2	8.1	8.2		8.1	8.2	8.2		8.2		8.1	8.3	8.2
Cond. (µS/cm)		787	811	812		800	791	809		806		806	806	
Initials		ML	YML	YML		YML	A	A		YML		YML	YML	

72 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.7	10.3	9.8		9.9	10.2	10.0		10.2		10.1	10.1	9.8
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.3	8.2
Cond. (µS/cm)		1043	1071	1050		1060	1026	1031		1019		1019	1019	
Initials		ML	YML	YML		YML	A	A		YML		YML	YML	

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CEL-60 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-EP4 (unamended)	ML
Hardness*	7	257	
Alkalinity*	5	162	

Analysts: YML, AWO, ML

Reviewed by: JOB
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: CH-FR3
 Work Order #: 161183

Start Date & Time: Nov 11/16 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration (unamended)	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.7	10.3	9.9		9.7	10.2	9.6		10.0		10.0	9.8	9.9
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.1		8.1	8.2	8.2
Cond. (µS/cm)		806		796		807		812		802		815		812
Initials		KL		YCL		YML		YML		A		A		YML

Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.9		10.0	10.2	9.9		10.0		10.1	9.9	10.0
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.1		8.1	8.2	8.2
Cond. (µS/cm)		839		847		854		848		836		845		847
Initials		KL		YCL		YML		YML		A		A		YML

Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		10.0	10.2	9.9		9.9		10.0	9.9	10.0
pH		8.2	8.1	8.2		8.1	8.2	8.1		8.2		8.1	8.2	8.2
Cond. (µS/cm)		891		883		890		901		892		894		887
Initials		KL		YCL		YML		YML		A		A		YML

Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.8	10.2	9.9		9.8		10.0	10.0	10.0
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.2	8.2
Cond. (µS/cm)		954	948		950		951	951		946		949		949
Initials		KL		YCL		YML		YML		A		A		YML

Thermometer: CR-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: G-2/3

	Control	CH-FR3 (unamended)	
Hardness*	3	465	/
Alkalinity*	3	192	/

Analysts: YML, AND KL

Reviewed by: JOB

Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: Clear, odourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tek
 Sample ID: GH-PE^m P1
 Work Order #: 161183

Start Date & Time: Nov 1/16 P 1620h
 Stop Date & Time: Dec 9/16 P 1000h
 Test Species: Oncorhynchus mykiss

38 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.2	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.2	10.0		10.0		10.1	10.0	9.9
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.2	8.2
Cond. (µS/cm)		1035		989		1015		1022		1027		1031		1036
Initials		W		YLC		YML		YML		A		A		YML

54 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.2	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.7	10.2	10.0		9.9		10.0	10.0	9.9
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.2	8.2
Cond. (µS/cm)		1153		1113		1168		1149		1148		1156		1158
Initials		W		YLC		YML		YML		A		A		YML

75 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.2	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.6	10.2	10.0		10.0		10.0	10.0	9.8
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.2	8.3
Cond. (µS/cm)		1295		1276		1301		1255		1300		1322		1306
Initials		W		YLC		YML		YML		A		A		YML

Concentration	Days													
	7		8		9		10		11		12		13	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: ESP-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/B

	Control	GH-PE1 (unamended)	W
Hardness*	2	465	
Alkalinity*	5	192	

Analysts: YML, W, AWO

Reviewed by: John
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colorless, odorless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH_FP1-AH (700 mg/L CaCO₃)
 Work Order #: 10183

Start Date & Time: Nov 11/6 p 1620h
 Stop Date & Time: Dec 9/16 p 1000h
 Test Species: Oncorhynchus mykiss

GH_FP1-AH Concentration (unamended)	Days													
	7		8		9		10		11		12		13	
	new	old												
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.3	10.0		10.0		9.9	10.0	9.7
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.1		8.1	8.3	8.2
Cond. (µS/cm)		1192	1181		1184		1186		1185		1195		1190	
Initials		W	W		W		W		A		A		W	

15 Concentration mg/L NO ₂ -N	Days													
	7		8		9		10		11		12		13	
	new	old												
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.3	10.0		10.0		10.1	10.0	9.8
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.3	8.2
Cond. (µS/cm)		1232	1222		1236		1226		1230		1243		1229	
Initials		W	W		W		W		A		A		W	

23 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old												
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.8	10.3	10.1		9.9		10.0	10.0	9.9
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.3	8.2
Cond. (µS/cm)		1285	1269		1290		1285		1283		1296		1277	
Initials		W	W		W		W		A		A		W	

34 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old												
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.3	10.0		10.0		10.1	10.1	9.9
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.3	8.2
Cond. (µS/cm)		1387	1380		1395		1385		1382		1395		1384	
Initials		W	W		W		W		A		A		W	

Thermometer: 02-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	GH_FP1-AH (unamended)	W
Hardness*	7	717	
Alkalinity*	5	195	

Analysts: W, A, W, W
 Reviewed by: JGU
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: Clear, colourless, odourless, some particulates

Comments: GH_FP1-AH is GH_FP1 w/ hardness adjusted in-house to ~700mg/L CaCO₃.

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tekt
 Sample ID: AH-FR1-HH (with 700mg/L CaCO₃)
 Work Order #: 161183

Start Date & Time: NOV 11/16 @ 1620h
 Stop Date & Time: DEC 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

SI Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old												
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.3	10.0		10.1		10.2	10.1	10.0
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.2		8.1	8.3	8.2
Cond. (µS/cm)		1520	1496		1517		1509		1502		1519		1507	
Initials		RL	YML		YML		YML		M		M		YML	

76 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old												
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.8		9.9	10.3	10.0		10.0		10.1	10.1	10.1
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.1		8.1	8.3	8.2
Cond. (µS/cm)		1707	1670		1697		1701		1689		1702		1689	
Initials		RL	YML		YML		YML		M		M		YML	

114 Concentration mg/L NO ₃ -N	Days													
	7		8		9		10		11		12		13	
	new	old												
Temperature (°C)		15.0	13.0	15.0		15.0	14.0	15.0		15.0		15.0	15.0	14.5
DO (mg/L)		9.8	10.3	9.9		9.8	10.3	9.9		10.0		10.1	10.0	10.1
pH		8.2	8.1	8.2		8.2	8.2	8.2		8.1		8.1	8.3	8.2
Cond. (µS/cm)		1929	1853		1894		1862		1864		1875		1861	
Initials		RL	YML		YML		YML		M		M		YML	

Concentration	Days													
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	AH-FR1-HH (unamended)	
Hardness*	7	717	
Alkalinity*	5	195	

Analysts: YML, AWO, RL

Reviewed by: JGL
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: AH-FR1-HH-B AH-FR1 w/ hardness adjusted to ~ 700 mg/L CaCO₃

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: Lab Control
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Lab Control Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.9	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		10.0	10.1	10.1		9.6	9.9	9.8		9.7		9.8	10.0	9.8
pH		6.7	7.0	6.9		6.7	7.0	6.8		6.9		7.1	6.5	7.1
Cond. (µS/cm)		28		28		28		28		29		32		27
Initials		YML		EL		W		YML		A		A		W

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control		
Hardness*	7		
Alkalinity*	2		

Analysts: YML, EL, AWO, W

Reviewed by: JBL
 Date reviewed: Feb 8/17

Sample Description: Clear, colorless, odourless, no particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-ER2
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

GH-ER2 Concentration (unamended)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	13.0	15.0	/	15.0	14.5	15.0	/	14.5	/	14.5	15.0	14.0
DO (mg/L)	/	10.0	10.2	10.1	/	9.6	10.1	9.8	/	9.7	/	9.8	9.75	9.8
pH	/	8.0	7.7	8.0	/	7.7	7.8	7.9	/	8.0	/	8.1	7.8	7.7
Cond. (µS/cm)		309		310		313		306		311		315		324
Initials		ML		ML		K		ML		A		A		K

3 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.0	15.0	/	15.0	14.5	15.0	/	14.5	/	14.5	15.0	14.0
DO (mg/L)	/	9.9	10.2	10.1	/	9.6	10.1	9.9	/	9.8	/	9.8	9.5	9.8
pH	/	8.0	7.8	8.0	/	7.7	7.8	7.9	/	8.1	/	8.2	7.8	7.8
Cond. (µS/cm)		337		335		339		334		338		339		336
Initials		ML		EC		K		ML		A		A		K

5 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.0	15.0	/	15.0	14.5	15.0	/	14.5	/	14.5	15.0	14.0
DO (mg/L)	/	10.1	10.2	10.0	/	9.6	10.1	9.9	/	9.7	/	9.8	9.5	9.8
pH	/	8.0	7.8	8.0	/	7.7	7.8	7.9	/	8.0	/	8.1	7.8	7.8
Cond. (µS/cm)		350		356		356		356		349		350		350
Initials		ML		EC		K		ML		A		A		K

9 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.0	15.0	/	15.0	14.5	15.0	/	14.5	/	14.5	15.0	14.0
DO (mg/L)	/	10.1	10.2	10.0	/	9.6	10.2	9.9	/	9.6	/	9.7	9.5	9.8
pH	/	8.0	7.8	8.0	/	7.7	7.9	7.9	/	8.1	/	8.2	7.8	7.8
Cond. (µS/cm)		390		379		386		380		381		385		379
Initials		ML		EC		K		ML		A		A		K

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-ER2 (unamended)	EC
Hardness*	7	182	/
Alkalinity*	2	149	/

Analysts: ML, EC, PWD, K

Reviewed by: JG

Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GHI-ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.1	10.2	10.1		9.6	10.2	9.8		9.6		9.7	9.5	9.8
pH		8.0	7.8	8.0		7.7	7.9	8.0		8.1		8.2	7.8	7.8
Cond. (µS/cm)		436		428		432		420		425		427		423
Initials		YML		EL		KL		YML		A		A		KL

Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		9.9	10.2	10.0		9.6	10.1	9.9		9.7		9.8	9.5	9.8
pH		8.0	7.8	8.0		7.8	7.9	8.0		8.1		8.2	7.8	7.8
Cond. (µS/cm)		532		512		517		517		519		521		440 522
Initials		YML		EL		KL		YML		A		A		KL

Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.0	10.2	10.0		9.7	10.1	9.9		9.6		9.7	9.5	9.8
pH		8.0	7.8	8.0		7.8	7.9	8.0		8.1		8.1	7.8	7.8
Cond. (µS/cm)		688		677		682		662		670		673		658
Initials		YML		EL		KL		YML		A		A		KL

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GHI-ER2 (unamended)	
Hardness*	7	182	
Alkalinity*	2	149	

Analysts: YML, EL, TWD, KL

Reviewed by: JGU
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

EV-ER4 Concentration (unamended)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.8	10.3	10.1		9.6	9.9	9.8		9.7		9.8	9.6	9.8
pH		8.0	7.9	8.0		7.8	7.9	7.9		8.0		8.1	7.9	7.89
Cond. (µS/cm)		476		470		476		468		477		475		467
Initials		YML		EL		K		YML		A		A		K

5 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.8	10.3	10.1		9.6	9.9	9.8		9.7		9.8	9.6	9.8
pH		8.0	7.9	8.0		7.8	7.9	7.9		8.1		8.1	8.0	7.9
Cond. (µS/cm)		494		489		491		486		489		491		485
Initials		YML		EL		K		YML		A		A		K

9 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.9	10.3	10.1		9.6	9.9	9.8		9.6		9.7	9.6	9.8
pH		8.0	7.8	8.0		7.8	7.9	7.9		8.0		8.1	8.0	7.9
Cond. (µS/cm)		526		519		549		518		522		528		516
Initials		YML		EL		K		YML		A		A		K

15 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.9	10.3	10.2		9.6	9.9	9.9		9.7		9.8	9.6	9.8
pH		8.0	7.9	8.0		7.9	7.9	7.9		8.0		8.1	8.0	7.9
Cond. (µS/cm)		574		569		541		564		556		560		561
Initials		YML		EL		K		YML		A		A		K

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	EV-ER4 (unamended)	K
Hardness*	7	253	
Alkalinity*	2	167	

Analysts: YML, EL, AWD, K
 Reviewed by: JGH
 Date reviewed: Feb. 8/17

Sample Description: clear, colorless, odorless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TECK
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

25 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.9	10.3	10.1		9.6	9.9	10.0		9.8		9.5	9.6	9.8
pH		8.0	7.9	8.0		7.9	7.9	7.9		8.0		8.1	8.0	7.9
Cond. (µS/cm)		670	649		655		648		651		654		643	
Initials		YML	EC		K		YML		A		A		K	

43 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.9	10.3	10.2		9.7	9.9	10.0		9.7		9.7	9.6	9.8
pH		8.0	7.9	8.0 ⁰		7.9	7.9	7.9		8.0		8.1	8.0	7.9
Cond. (µS/cm)		813	802		801		795		799		804		808	795
Initials		YML	EC		K		YML		A		A		K	

72 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.9	10.3	10.2		9.7	9.9	9.9		9.8		9.8	9.6	9.8
pH		8.1	7.9	8.0 ⁰		7.9	7.9	7.9		8.0		8.1	8.0	7.9
Cond. (µS/cm)		1018	1024		1025		1026		1025		1033		1015	
Initials		YML	EC		K		YML		A		A		K	

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	EV-ER4 (unamended)	K
Hardness*	7	23	
Alkalinity*	2	167	

Analysts: YML, EC, AND, K

Reviewed by: JBL
 Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FRI
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

GH-FRI Concentration (unamended)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		10.1	10.3	10.2		9.7	9.9	10.0		9.8		9.7	9.5	9.8
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.0		8.1	8.0	8.1
Cond. (µS/cm)		819	809			837	806		809		814		801	
Initials		YML	EC			K	YML		A		A		K	

14 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		10.1	10.3	10.1		9.7	9.9	10.0		9.8		9.8	9.6	9.9
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		852	842			870	875		881		883		837	
Initials		YML	EC			K	YML		A		A		K	

20 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		10.0	10.3	10.0		9.7	9.9	10.0		9.8		9.7	9.6	9.9
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		893	887			899	931		934		938		890	
Initials		YML	EC			K	YML		A		A		K	

27 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		10.1	10.3	10.1		9.7	9.8	9.9		9.6		9.8	9.6	9.9
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		956	909			962	952		961		960		955	
Initials		YML	EC			K	YML		A		A		K	

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FRI (unamended)	
Hardness*	7	460	K
Alkalinity*	2	204	

Analysts: YML, EC, AWD, K

Reviewed by: JOH

Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1800h
 Test Species: Oncorhynchus mykiss

38 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.130	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		9.9	10.3	10.0		9.7	9.6	10.0		9.6		9.7	9.5	9.9
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.1		8.0	8.0	8.1
Cond. (µS/cm)		1042	1036			1044	1044			1024		1037	1043	1032
Initials			EV			K		YUL		A		A		K

54 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		10.0	10.3	10.0		9.7	10.0	10.0		9.9		9.8	9.6	9.7
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		1167	1164			1168	1150			1159		1163	1142	
Initials		YUL	EV			K				A		A		K

75 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	14.5	14.0
DO (mg/L)		10.1	10.3	9.9		9.7	9.9	9.9		9.6		9.8	9.7	9.7
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		1316	1341			1331	1351			1341		1343	1317	
Initials		YUL	EV			K	YUL			A		A		K

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FR1 (unamended)	
Hardness*	7	460	
Alkalinity*	2	204	

* mg/L as CaCO₃

Analysts: YUL, EC, AWO, K

Reviewed by: JGH

Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck Start Date & Time: November 1, 2016 @ 1620h
 Sample ID: GH-FRI-HH (700 mg/L CaCO₃) Stop Date & Time: Dec 9/16 @ 1000h
 Work Order #: 161183 Test Species: Oncorhynchus mykiss

GH-FRI-HH Concentration (unamended)	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.0	10.3	10.1		9.7	10.1	9.9		9.7		9.8	9.8	9.7
pH		8.1	7.9	8.1		7.9	8.0	8.0		8.0		8.1	8.0	8.1
Cond. (µS/cm)		1195		1188		1191		1179		1178		1181		1182
Initials		YUL		EL		K		YUL		A		A		K

15 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.0	10.3	10.0		9.7	10.1	9.9		9.6		9.7	9.6	9.7
pH		8.1	8.0	8.1		7.9	8.1	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		1238		1227		1233		1219		1224		1231		1222
Initials		YUL		EL		K		YUL		A		A		K

23 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.1	10.3	10.0		9.7	10.0	9.8		9.6		9.7	9.7	9.7
pH		8.1	8.0	8.1		7.9	8.0	8.0		8.1		8.2	8.0	8.1
Cond. (µS/cm)		1292		1286		1290		1277		1282		1288		1280
Initials		YUL		EL		K		YUL		A		A		K

34 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.1	10.3	10.0		9.7	10.0	9.9		9.7		9.8	9.7	9.7
pH		8.1	8.0	8.1		7.9	8.0	8.1		8.1		8.2	8.0	8.1
Cond. (µS/cm)		1394		1365		1383		1380		1378		1382		1375
Initials		YUL		EL		K		YUL		A		A		K

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FRI-HH (unamended)	in
Hardness*	7	684	/
Alkalinity*	2	196	/

Analysts: YUL, EL, AND, JK
 Reviewed by: JK
 Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: GH-FRI-HH is GH-FRI w/ hardness adjusted in-house to ~700mg/L CaCO₃.

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FR1-HH (700 mg/L CaCO₃)
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

51 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old												
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.0	10.3	10.1		9.7	10.0	9.9		9.7		9.7	9.7	9.7
pH		8.1	8.0	8.1		7.9	8.0	8.1		8.1		8.2	8.0	8.1
Cond. (µS/cm)		1525	1496		1502		1499		1500		1505		1501	
Initials		YML	EL		K		YML		A		A		K	

76 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old												
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.0	10.3	10.1		9.7	10.0	9.9		9.6		9.6	9.7	9.7
pH		8.1	8.0	8.1		7.9	8.0	8.1		8.1		8.2	8.0	8.1
Cond. (µS/cm)		1708	1686		1688	1694	1714		1701		1704		1683	
Initials		YML	EL		K		YML		A		A		K	

114 Concentration mg/L NO ₃ -N	Days													
	14		15		16		17		18		19		20	
	new	old												
Temperature (°C)		14.5	13.0	15.0		15.0	14.5	15.0		14.5		14.5	15.0	14.0
DO (mg/L)		10.1	10.3	10.0		9.7	10.0	9.9		9.7		9.7	9.7	9.7
pH		8.1	8.0	8.1		7.9	8.0	8.1		8.1		8.2	8.1	8.1
Cond. (µS/cm)		1891	1973		1931		1889		1900		1897		1986	1968
Initials		YML	EL		K		YML		A		A		K	

Concentration	Days													
	14		15		16		17		18		19		20	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-213 pH meter: pH-113 Conductivity meter: C-213

	Control	GH-FR1-HH (unhardened)	K
Hardness*	7	684	
Alkalinity*	2	196	

Analysts: YML, AWD, EC, K

Reviewed by: JOB
 Date reviewed: Feb-8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: GH-FR1-HH is GH-FR1 w/ hardness adjusted in-house to ~700mg/L CaCO₃.

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tecb
 Sample ID: Lab Control
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Lab control Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.6	13.0		14.0	14.2	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.6	10.0	9.8		9.9	10.1	9.9		9.8		10.0	10.0	9.8
pH		6.5	6.9	7.2		6.9	6.8	6.9		7.1		6.9	6.8	7.1
Cond. (µS/cm)		28		28		31		27		29		30		27
Initials		KC		A		A		A		A		A		KC

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control		
Hardness*	8		
Alkalinity*	5		

* mg/L as CaCO₃

Analysts: AWD/KC

Reviewed by: JKU

Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, no particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-EP2
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

GH EP2 Concentration (unamended)	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.4	9.8		9.9	10.1	9.9		10.0		9.9	10.0	9.9
pH		8.0	8.1	8.0		8.0	8.1	8.1		8.0		7.9	8.0	8.1
Cond. (µS/cm)		315	303			312	309			310		318	308	
Initials		W	A			A	A			A		A	KL	

3 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.3	9.8		9.8	10.1	9.8		10.1		9.8	10.0	9.9
pH		8.6	8.1	8.0		8.1	8.1	8.0		8.1		8.0	8.0	8.1
Cond. (µS/cm)		341	322			337	331			338		341	332	
Initials		W	A			A	A			A		A	KL	

5 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.3	9.8		9.9	10.1	10.0		10.0		9.9	10.0	10.0
pH		8.0	8.1	8.0		8.1	8.1	8.0		8.1		8.0	8.0	8.1
Cond. (µS/cm)		357	340			349	347			355		359	347	
Initials		W	A			A	A			A		A	KL	

9 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.3	10.0		9.8	10.1	9.8		10.0		9.9	10.1	10.0
pH		8.0	8.1	8.0		8.1	8.1	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		385	370			378	376			364		366	378	
Initials		W	A			A	A			A		A	KL	

Thermometer: CER-60 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH EP2 (unamended)	W
Hardness*	8	173	
Alkalinity*	5	144	

Analysts: AWD, KL

Reviewed by: 166
 Date reviewed: Feb. 8/17

Sample Description: clear, colorless, odorless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TecE
 Sample ID: Att-ER2
 Work Order #: 10183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

15 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.3	9.8		9.9	10.1	9.8		10.1		9.8	10.0	10.1
pH		8.0	8.1	8.0		8.1	8.1	8.0		8.0		8.1	8.0	8.1
Cond. (µS/cm)		431		421		419		421		423		433		424
Initials		K		A		A		A		A		A		KL

25 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.3	10.0		9.9	10.1	9.9		10.0		9.9	10.0	10.0
pH		8.0	8.1	8.1		8.1	8.1	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		530		514		523		505		515		530		515
Initials		K		A		A		A		A		A		KL

43 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.3	9.8		9.9	10.1	9.8		10.0		9.9	10.0	10.1
pH		8.0	8.1	8.0		8.1	8.1	8.0		8.1		8.1	8.0	8.1
Cond. (µS/cm)		669		656		664		656		664		670		658
Initials		K		A		A		A		A		A		KL

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	Att-ER2 (unamended)	
Hardness*	8	173	
Alkalinity*	5	144	

Analysts: AWD, K

Reviewed by: John
 Date reviewed: Feb. 8/17

Sample Description: clear, colorless, odorless, some faintⁱⁿ particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 16:00h
 Stop Date & Time: Dec 9/16 @ 10:00h
 Test Species: Oncorhynchus mykiss

EV-ER4 Concentration (unamended)	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.2	9.9		9.9	10.1	9.9		10.0		9.8	9.9	10.0
pH		8.1	8.0	8.0		8.0	8.1	8.0		8.1		8.2	8.1	8.1
Cond. (µS/cm)		475	460		470	461		470		476		461		
Initials		K	A		A	A		A		A		A		KL

5 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.2	10.0		9.8	10.1	9.8		10.1		9.8	9.8	10.1
pH		8.1	8.0	8.0		8.1	8.1	8.0		8.1		8.2	8.1	8.1
Cond. (µS/cm)		492	480		485	477		482		485		477		
Initials		K	A		A	A		A		A		A		KL

9 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.2	9.9		9.8	10.1	9.9		9.9		9.9	9.9	10.1
pH		8.1	8.0	8.0		8.1	8.1	8.0		8.1		8.2	8.1	8.1
Cond. (µS/cm)		527	517		517	509		517		522		522		
Initials		K	A		A	A		A		A		A		KL

15 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.2	9.9		9.9	10.1	9.8		9.9		9.8	9.9	10.1
pH		8.1	8.0	8.0		8.0	8.1	8.0		8.1		8.1	8.1	8.1
Cond. (µS/cm)		561	558		560	564		555		564		567	557	
Initials		K	A		A	A		A		A		A		KL

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-ER4 (unamended)	
Hardness*	8	53	
Alkalinity*	5	162	

Analysts: AWD, KL

Reviewed by: JML
 Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TECK
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1600h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

25 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.2	9.9		9.8	10.1	9.8		10.0		9.8	9.9	10.2
pH		8.1	8.0	7.9		8.0	8.1	8.0		8.0		8.1	8.1	8.1
Cond. (µS/cm)		652		648		651		640		644		649		667
Initials		W		A		A		A		A		A		KL

43 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.2	9.9		9.9	10.1	9.9		9.9		9.8	9.9	10.1
pH		8.1	8.0	8.0		8.1	8.1	8.1		8.1		8.1	8.1	8.1
Cond. (µS/cm)		804		777		782		771		776		777		776
Initials		W		A		A		A		A		A		KL

72 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.7	10.2	9.9		9.9	10.1	10.0		9.8		9.9	9.9	10.2
pH		8.1	8.0	8.0		8.1	8.1	8.1		8.1		8.1	8.1	8.1
Cond. (µS/cm)		1029		965		981		975		986		1006		987
Initials		W		A		A		A		A		A		KL

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-ER4 (unamended)	W
Hardness*	8	253 253	
Alkalinity*	5	162	

Analysts: AWD, W

Reviewed by: Joh
 Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH FFI
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 0000h
 Test Species: Oncorhynchus mykiss

GH FFI Concentration (unamended)	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)	14.0	13.0	13.0	13.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.7	10.2	9.8	9.8	9.7	10.2	9.9	9.9	10.0	9.9	9.9	9.9	10.0	10.0
pH	8.1	8.1	8.0	8.0	8.1	8.1	8.1	8.1	8.0	8.1	8.2	8.2	8.3	8.3
Cond. (µS/cm)	811	801	806	802	811	815	800							
Initials	KL	A	A	A	A	A								KL

24 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)	13.5	13.0	13.0	13.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.8	10.2	9.8	9.8	9.8	10.2	9.9	9.9	10.0	9.8	9.9	9.9	10.2	10.2
pH	8.1	8.1	8.0	8.0	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.2
Cond. (µS/cm)	845	837	842	854	856	857	836							
Initials	KL	A	A	A	A	A								KL

20 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)	14.5	13.0	13.0	13.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.8	10.2	9.9	9.9	9.7	10.2	9.9	9.9	10.1	9.9	9.9	9.9	10.2	10.2
pH	8.1	8.1	8.0	8.0	8.1	8.1	8.0	8.0	8.0	8.1	8.2	8.2	8.2	8.2
Cond. (µS/cm)	915	877	882	881	883	890	886							
Initials	KL	A	A	A	A	A								KL

27 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)	14.5	13.0	13.0	13.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0
DO (mg/L)	9.8	10.2	9.8	9.8	9.9	10.2	9.9	9.9	10.0	9.9	9.9	9.9	10.2	10.2
pH	8.1	8.1	8.0	8.0	8.1	8.1	8.0	8.0	8.1	8.1	8.2	8.2	8.2	8.2
Cond. (µS/cm)	967	924	936	931	944	951	951							
Initials	KL	A	A	A	A	A								KL

Thermometer: CER-60 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH FFI (unamended)	u
Hardness*	8	459	
Alkalinity*	5	197	

Analysts: AWD, KL

Reviewed by: JOB

Date reviewed: Feb 27/17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH-FP1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

38 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)		11.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.9		9.9	10.2	9.9		10.0		9.8	9.9	10.1
pH		8.1	8.1	8.0		8.1	8.1	8.1		8.1		8.1	8.2	8.2
Cond. (µS/cm)		1042	1022		1032		1004		1031		1039		1025	
Initials		KL	A		A		A		A		A		KL	

54 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)		11.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.8		9.8	10.2	9.9		10.1		10.0	9.9	10.1
pH		8.1	8.1	8.0		8.0	8.1	8.1		8.2		8.0	8.2	8.2
Cond. (µS/cm)		1161	1151		1167		1142		1156		1162		1159	
Initials		KL	A		A		A		A		A		KL	

75 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old												
Temperature (°C)		13.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.9		9.7	10.2	9.9		10.0		9.9	9.9	10.2
pH		8.1	8.1	8.0		8.1	8.1	8.1		8.2		8.1	8.2	8.2
Cond. (µS/cm)		1353	1315		1325		1315		1305		1313		1302	
Initials		KL	A		A		A		A		A		KL	

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH-FP1 (unamended)	
Hardness*	8	459	
Alkalinity*	5	197	

Analysts: AWD KL

Reviewed by: JGK

Date reviewed: Feb 8/17

Sample Description: clear, colorless, odorless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: CH FFI-HH (700 mg/L CaCO₃)
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

CH FFI-HH Concentration (unamended)	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	13.0		13.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.9		9.9	10.3	9.9		9.9		9.9	9.9	10.1
pH		8.2	8.0	8.1		8.0	8.0	8.0		8.1		8.0	8.2	8.2
Cond. (µS/cm)		1191		1157		1176		1156		1170		1183		1167
Initials		K		A		A		A		A		A		KL

15 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.9		9.8	10.3	10.1		10.0		9.8	9.9	10.2
pH		8.2	8.0	8.0		8.1	8.0	8.1		8.1		8.0	8.2	8.2
Cond. (µS/cm)		1230		1199		1219		1196		1209		1220		1209
Initials		K		A		B		A		A		A		KL

23 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.8		9.9	10.3	10.1		12.1		9.9	9.9	10.2
pH		8.2	8.0	8.0		8.1	8.0	8.1		8.0		8.0	8.2	8.2
Cond. (µS/cm)		1292		1251		1262		1258		1272		1276		1269
Initials		K		A		A		A		A		A		KL

34 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.8		9.9	10.3	10.2		10.0		9.8	9.8	10.2
pH		8.2	8.0	8.0		8.0	8.0	8.1		8.1		8.1	8.2	8.2
Cond. (µS/cm)		1389		1351		1365		1344		1361		1370		1365
Initials		K		A		A		A		A		A		KL

Thermometer: TERR-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	CH FFI-HH (unamended)	
Hardness*	8	706	
Alkalinity*	5	189	

Analysts: AWD, H
 Reviewed by: JOK
 Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odorless, some particulates

Comments: (1) 14.0 CH FFI-HH is CH FFI w/ hardness adjusted in-house to ~700mg/L CaCO₃.

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: GH FRI-HH (700mg/L CaCO₃)
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

51 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.8	10.2	9.9		9.7	10.3	10.0		10.1		9.9	10.0	10.2
pH		8.1	8.0	8.1		8.1	8.0	8.1		8.0		8.0	8.2	8.2
Cond. (µS/cm)		1512		1446		1462		1436		1456		1470		1492
Initials		W		A		A		A		A		A		KL

76 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.6	10.2	9.8		9.8	10.3	9.9		10.0		9.8	10.0	10.2
pH		8.2	8.0	8.1		8.1	8.0	8.1		8.1		8.0	8.2	8.2
Cond. (µS/cm)		1711		1671		1676		1660		1676		1688		1683
Initials		W		A		A		A		A		A		KL

114 Concentration mg/L NO ₃ -N	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		13.5	13.0	13.0		14.0	14.0	14.0		14.0		14.0	14.0	14.0
DO (mg/L)		9.6	10.2	9.9		9.7	10.3	10.1		10.0		9.9	9.9	10.2
pH		8.2	8.0	8.1		8.0	8.0	8.1		8.0		8.0	8.2	8.2
Cond. (µS/cm)		1940		1955		1947		1945		1954		1966		1941
Initials		W		A		A		A		A		A		KL

Concentration	Days													
	21		22		23		24		25		26		27	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials		W												

Thermometer: CER-6 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH FRI-HH (unamended)	
Hardness*	8	706	
Alkalinity*	5	189	

Analysts: AWD, KL

Reviewed by: JGL
 Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless - some particulates

Comments: GH FRI-HH is GH FRI w/ hardness adjusted in-house to ~700mg/L CaCO₃.

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TECF
 Sample ID: Lab control
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Lab Control Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.5	15.0		14.0	14.0	14.0	14.0	14.0		14.0	14.5	14.0
DO (mg/L)		10.0	10.2	9.1		10.0	10.1	9.7		9.8		9.8	10.1	9.4
pH		7.1	7.0	7.0		6.8	6.9	7.1		7.2		6.9	6.9	7.0
Cond. (µS/cm)		32		25		25		26		32		37		25
Initials		KL		KL		MLL		KL		KL		KL		KL

Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CCR-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control			
Hardness*	8			
Alkalinity*	2			

Analysts: MLL, AWD, KL

Reviewed by: Joh

Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, no particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TEPC
 Sample ID: AHLERZ
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

AHLERZ Concentration (unamended)	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	9.9	9.6	9.0	/	10.1	10.0	9.8	/	9.9	/	9.8	9.6	9.5
pH	/	8.1	7.9	7.9	/	7.8	8.0	7.9	/	8.0	/	7.9	8.2	8.1
Cond. (µS/cm)		313		307		313		311		314		312		310
Initials		W		WML		WML		A		A		A		W

3 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	9.9	9.6	9.0	/	10.0	10.0	9.8	/	9.8	/	9.8	9.6	9.5
pH	/	8.1	7.9	7.9	/	7.8	8.0	7.9	/	8.1	/	7.9	8.2	8.1
Cond. (µS/cm)		338		334		345		335		342		350		333
Initials		W		WML		WML		A		A		A		W

5 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	9.9	9.7	9.0	/	10.0	10.0	9.7	/	9.9	/	9.8	9.6	9.5
pH	/	8.1	7.9	7.9	/	7.8	8.0	8.0	/	8.0	/	7.9	8.1	8.1
Cond. (µS/cm)		353		351		356		352		352		362		349
Initials		W		WML		WML		A		A		A		W

9 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	9.9	9.7	9.0	/	10.1	10.0	9.8	/	9.8	/	9.8	9.6	9.5
pH	/	8.1	7.9	7.9	/	7.8	8.0	7.9	/	8.0	/	7.9	8.1	8.1
Cond. (µS/cm)		386		380		389		385		390		394		379
Initials		W		WML		WML		A		A		A		W

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	AHLERZ (unamended)	W
Hardness*	8	178	/
Alkalinity*	2	146	/

Analysts: WML, AWP, WML
 Reviewed by: JGh
 Date reviewed: Feb. 3/17

* mg/L as CaCO₃

Sample Description: near colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TRC
 Sample ID: GH-EP2
 Work Order #: 161183

Start Date & Time: November 1, 2016 8:16:20h
 Stop Date & Time: Dec 9 116 8:00:00h
 Test Species: Oncorhynchus mykiss

15 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.7	9.1		10.0	10.0	9.8		9.9		9.9	9.6	9.5
pH		8.1	7.9	7.9		7.8	8.0	8.0		8.0		8.0	8.1	8.1
Cond. (µS/cm)		434	430		435	420	470	470		434		440		427
Initials		KL	VM		VM		A		A		A			KL

25 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.7	9.1		10.0	10.0	9.8		9.8		9.8	9.6	9.5
pH		8.1	7.9	7.9		7.8	8.0	8.1		8.1		8.0	8.1	8.1
Cond. (µS/cm)		519	518		528	520	524	524		524		524		514
Initials		KL	VM		VM		A		A		A			KL

43 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.7	9.0		10.1	10.0	9.7		9.9		9.8	9.6	9.5
pH		8.1	7.9	7.9		7.8	8.0	8.0		8.1		8.0	8.1	8.2
Cond. (µS/cm)		664	678		679	661	670	675		675		675		658
Initials		KL	VM		VM		A		A		A			KL

Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)		9.9												
pH		8.1												
Cond. (µS/cm)														
Initials		KL												

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	GH-EP2 (unamended)	KL
Hardness*	8	178	
Alkalinity*	2	146	

Analysts: VM, AW, KL

Reviewed by: JCH

Date reviewed: Feb 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TEUP
 Sample ID: EV-EP4
 Work Order #: W 16483 16483

Start Date & Time: November 1, 2016 8:16:00h
 Stop Date & Time: Dec 9/16 8:00:00h
 Test Species: Oncorhynchus mykiss

EV-EP4 Concentration (unamended)	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.8	9.0		9.9	10.0	9.8		9.7		9.8	9.7	9.5
pH		8.4	8.0	7.9		7.9	8.0	7.9		8.0		8.0	8.2	8.1
Cond. (µS/cm)		470	468	475		470	475	478		478		478	467	467
Initials		W	MM	MM		A	A	A		A		A	W	W

5 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.8	9.1		9.9	10.1	9.7		9.8		9.8	9.7	9.7
pH		8.1	8.0	8.0		7.9	8.0	7.9		8.0		7.9	8.2	8.2
Cond. (µS/cm)		483	488	491		488	491	492		492		492	485	485
Initials		W	MM	MM		A	A	A		A		A	W	W

9 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.7	9.1		10.0	10.1	9.7		9.9		9.7	9.7	9.5
pH		8.1	8.0	8.0		7.9	8.0	8.0		8.1		7.9	8.2	8.2
Cond. (µS/cm)		521	521	525		521	524	526		524		526	517	517
Initials		W	MM	MM		A	A	A		A		A	W	W

15 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.7	9.1		10.0	10.1	9.8		9.9		9.8	9.7	9.6
pH		8.1	8.0	8.0		7.9	8.0	8.1		8.2		8.0	8.2	8.2
Cond. (µS/cm)		563	567	573		560	566	570		566		570	564	564
Initials		W	MM	MM		A	A	A		A		A	W	W

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-EP4 (unamended)	W
Hardness*	8	265	
Alkalinity*	2	162	

Analysts: YLL, AWO, W

Reviewed by: W

Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TEC
 Sample ID: EV-ER4
 Work Order #: 16118

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

25 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.7	9.0		10.0	10.1	9.6		9.9		9.8	9.7	9.6 ^u
pH		8.1	8.0	8.0		7.9	8.0	8.1		8.1		8.0	8.2	8.1
Cond. (µS/cm)		646	649			661	657			661		662		643
Initials		KL	YML			YML		A		A		A		KL

43 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.7	9.1		9.9	10.1	9.7		9.8		9.7	9.7	9.6
pH		8.1	8.0	8.0		8.0	8.0	8.0		8.1		8.0	8.2	8.2
Cond. (µS/cm)		785	800			801	804			802		811		82 ^u 792
Initials		KL	YML			YML		A		A		A		KL

72 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.5	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		9.9	9.8	9.1		10.0	10.1	9.7		9.8		9.9	9.7	9.6
pH		8.1	8.0	8.0		8.0	8.0	8.1		8.1		8.1	8.3	8.2
Cond. (µS/cm)		996	1001			1020	1039			994		991		999
Initials		KL	YML			YML		A		A		A		KL

Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	EV-ER4 (unamended)	
Hardness*	8	265	
Alkalinity*	2	162	

Analysts: YML, AWD, KL
 Reviewed by: JOB
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TECP
 Sample ID: GH-FR1
 Work Order #: 161183

Start Date & Time: November 1, 2016 8:20h
 Stop Date & Time: Dec 1/16 10:00h
 Test Species: Oncorhynchus mykiss

GH-FR1 Concentration (unamended)	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.5	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	10.0	9.9	9.1	/	10.1	9.9	9.6	/	9.8	/	9.8	9.7	9.6
pH	/	8.2	8.0	8.1	/	8.1	8.1	8.0	/	8.0	/	8.0	8.3	8.3
Cond. (µS/cm)		808	815		823		823		819		826		808	
Initials		KL	VM		VM		A		A		A		KL	

14 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	10.1	9.9	9.1	/	10.1	9.9	9.8	/	9.9	/	9.8	9.7	9.7
pH	/	8.2	8.0	8.1	/	8.1	8.1	8.0	/	8.1	/	8.0	8.3	8.3
Cond. (µS/cm)		844	848		858		849		859		855		839	
Initials		KL	EL		VM		A		A		A		KL	

20 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	10.1	9.9	9.0	/	10.0	9.9	9.7	/	9.8	/	9.9	9.7	9.7
pH	/	8.2	8.0	8.1	/	8.1	8.1	8.0	/	8.0	/	8.0	8.3	8.3
Cond. (µS/cm)		886	895		897		889		894		900		892	
Initials		KL	EL		VM		A		A		A		KL	

27 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	14.0	14.0	15.0	/	14.0	14.0	14.0	/	14.0	/	14.0	14.5	14.0
DO (mg/L)	/	10.1	9.9	9.0	/	9.8	9.9	9.7	/	9.9	/	9.9	9.7	9.7
pH	/	8.2	8.0	8.1	/	8.1	8.1	8.1	/	8.1	/	8.0	8.3	8.3
Cond. (µS/cm)		935	957		960		955		968		971		950	
Initials		KL	EL		VM		A		A		A		KL	

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH-FR1 (unamended)	KL
Hardness*	8	482	/
Alkalinity*	2	195	/

Analysts: KL, VM, EL

Reviewed by: JOL
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TEK
 Sample ID: AHL F21
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 10:00h
 Test Species: Oncorhynchus mykiss

38 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.9	9.8		9.9	9.9	9.7		9.6		9.7	9.7	9.7
pH		8.2	8.0	8.1		8.1	8.1	8.1		8.1		8.0	8.3	8.3
Cond. (µS/cm)		1037		1033		1040		1039		1050		1050		1032
Initials		KL		EL		MM		A		A		A		KL

54 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.9	9.2		10.0	9.9	9.7		9.7		9.8	9.7	9.7
pH		8.2	8.1	8.1		8.0	8.1	8.0		8.2		8.1	8.3	8.2
Cond. (µS/cm)		1162		1145		1179		1141		1155		1156		1141
Initials		KL		EL		MM		A		A		A		KL

75 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.9	9.2		10.0	9.9	9.6		9.7		9.7	9.7	9.7
pH		8.2	8.1	8.1		8.1	8.1	8.0		8.1		8.1	8.3	8.3
Cond. (µS/cm)		1310		1313		1313		1268		1290		1297		1326
Initials		KL		EL		MM		A		A		A		KL

Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	AHL F21 (unamended)	KL
Hardness*	8	482	
Alkalinity*	2	195	

Analysts: KL, MO, YZL, EC

Reviewed by: JGA

Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TEK
 Sample ID: GH-FP1-HH (700 mg/L CaCO₃)
 Work Order #: 161183

Start Date & Time: November 1, 2016 6:20h
 Stop Date & Time: Dec 9/16 10:00h
 Test Species: Oncorhynchus mykiss

GH-FP1-HH Concentration (unamended)	Days													
	28		29		30		31		32		33		34	
	new	old												
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.8	9.2		9.9	10.0	9.7		9.8		9.9	9.7	9.7
pH		8.2	8.1	8.0		8.1	8.1	8.0		8.0		8.0	8.3	8.3
Cond. (µS/cm)		1180	1145		1170		1152		1165		1172		1153	
Initials		KL	EL		YML		A		A		A		KL	

15 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old												
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.8	9.2		9.9	10.0	9.8		9.9		9.8	9.7	9.7
pH		8.2	8.1	8.1		8.1	8.1	8.0		8.1		8.1	8.3	8.2
Cond. (µS/cm)		1200	1199		1211		1202		1197		1203		1189	
Initials		KL	EL		YML		A		A		A		KL	

23 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old												
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.8	9.2		9.9	10.0	9.7		9.8		9.7	9.7	9.7
pH		8.2	8.1	8.1		8.1	8.1	8.0		8.0		8.1	8.3	8.3
Cond. (µS/cm)		1329	1250		1267		1257		1270		1280		1249	
Initials		KL	EL		YML		A		A		A		KL	

34 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old												
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.8	9.2		9.9	10.0	9.8		9.8		9.9	9.7	9.7
pH		8.2	8.1	8.1		8.1	8.1	8.0		8.1		8.1	8.3	8.3
Cond. (µS/cm)		1370	1345		1361		1342		1360		1369		1339	
Initials		KL	EL		YML		A		A		A		KL	

Thermometer: CER-10 DO meter: DO-2/3 pH meter: pH-1/3 Conductivity meter: C-2/3

	Control	GH-FP1-HH (unamended)	KL
Hardness*	8	719	
Alkalinity*	2	198	

Analysts: YML, AWD, EL, KL

Reviewed by: JGL

Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, some particulates

Comments: GH-FP1-HH B GH-FP1 W hardness adjusted ^{KL} in-house to ~700mg/L CaCO₃.

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: TEPC
 Sample ID: GH-FP1-HH (700mg/L CaCO₃)
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 16:20h
 Stop Date & Time: Dec 9/16 @ 10:00h
 Test Species: Oncorhynchus mykiss

S1 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.8	9.2		9.9	10.0	9.8		9.8		9.9	9.7	9.7
pH	8.1	8.1	8.1	8.1		8.1	8.1	8.0		8.1		8.1	8.3	8.3
Cond. (µS/cm)		1495	1454			1474	1449			1461		1471		1469
Initials		W	EV			MM	A			M		A		KL

76 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.8	9.2		9.9	10.0	9.7		9.8		9.7	9.7	9.7
pH	8.1	8.1	8.1	8.1		8.1	8.1	8.0		8.0		8.1	8.3	8.3
Cond. (µS/cm)		1693	1649			1672	1619			1642		1639		1640
Initials		W	EV			MM	A			A		A		KL

114 Concentration mg/L NO ₃ -N	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		14.0	14.0	15.0		14.0	14.0	14.0		14.0		14.0	14.5	14.0
DO (mg/L)		10.1	9.8	9.2		9.9	10.0	9.6		9.9		9.8	9.7	9.7
pH	8.2	8.1	8.1	8.1		8.1	8.1	8.1		8.1		8.1	8.3	8.3
Cond. (µS/cm)		1972	1919			1950	1965			1960		1969		1890
Initials		W	EV			MM	A			A		A		KL

Concentration	Days													
	28		29		30		31		32		33		34	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	GH-FP1-HH (unamended)	W
Hardness*	8	719	
Alkalinity*	2	198	

Analysts: YHL, AWD, EC, KL

Reviewed by: JGL

Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: GH-FP1-HH B GH-FP1 w/ hardness adjusted inhouse to ~700mg/L CaCO₃

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tox
 Sample ID: Lab Control
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1000h
 Test Species: Oncorhynchus mykiss

Lab control Concentration	Days													
	35		36		37		38		39		40		41	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	14.0	14.5		14.5		14.0						
DO (mg/L)		9.7	10.1	9.9		9.8		9.7						
pH		6.9	6.8	6.7		6.6		6.9						
Cond. (µS/cm)		39	26			35		29						
Initials		KL	A			A		YML						

Concentration	Days													
	35		36		37		38		39		40		41	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	35		36		37		38		39		40		41	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Concentration	Days													
	35		36		37		38		39		40		41	
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control			
Hardness*	3			
Alkalinity*	3			

Analysts: AWD, YML, KL
 Reviewed by: JBL
 Date reviewed: Feb. 3/17

* mg/L as CaCO3

Sample Description: clear, colourless, odourless, se^{te} no particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: AH-ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 16:00h
 Stop Date & Time: December 9, 2016 @ 10:00h
 Test Species: Oncorhynchus mykiss

AH-ER2 Concentration (unamended)	Days													
	35		36		37		38 AM							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.7	10.1	9.9		9.7		9.8						
pH		7.8	7.9	7.8		7.7		7.9						
Cond. (µS/cm)		321		311		318		319						
Initials		KL		A		YML		YML						

3 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 PM							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.1	9.8		9.7		9.7						
pH		7.8	7.9	7.8		7.7		7.9						
Cond. (µS/cm)		347		337		349		350						
Initials		KL		A		YML		YML						

5 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 AM							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.1	9.9		9.8		9.7						
pH		7.8	7.9	7.8		7.7		7.9						
Cond. (µS/cm)		359		350		357		363						
Initials		KL		A		YML		YML						

9 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 PM							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.1	9.8		9.8		9.7						
pH		7.8	7.9	7.8		7.7		8.0						
Cond. (µS/cm)		392		379		386		387						
Initials		KL		A		YML		YML						

Thermometer: CE-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	AH-ER2 (unamended)	KL
Hardness*	8	163	
Alkalinity*	3	149	

Analysts: YML, AWD, KL

Reviewed by: JOK

Date reviewed: Feb. 8 / 17

Sample Description: clear, colourless, odourless, some particulates

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tock
 Sample ID: GH-ERZ
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1000h
 Test Species: Oncorhynchus mykiss

K Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.1	9.9		9.7		9.7						
pH		7.8	7.9	7.9		7.7		8.0						
Cond. (µS/cm)		437	420		431		431							
Initials		KL	A		MLL		MLL							

25 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.1	9.8		9.8		9.7						
pH		7.8	7.9	8.0		7.7		8.0						
Cond. (µS/cm)		519	515		524		530							
Initials		KL	A		MLL		A							

43 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.1	9.8		9.7		9.7						
pH		7.8	7.9	8.0		7.7		8.1						
Cond. (µS/cm)		668	672		674		675							
Initials		KL	A		MLL		A							

Concentration	Days													
	35		36											
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH		7.8												
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	GH-ERZ (unamended)	
Hardness*	8	163	
Alkalinity*	3	149	

Analysts: MLL, AWS, KL

Reviewed by: JGB

Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: Clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tock
 Sample ID: EV-EP4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1000h
 Test Species: Oncorhynchus mykiss

EV-EP4 Concentration (unamended)	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	13.0	14.5	/	14.5	/	14.0						
DO (mg/L)	/	9.5	10.2	9.7	/	9.8	/	9.6						
pH	/	7.8	7.9	7.8	/	7.7	/	8.0						
Cond. (µS/cm)		476		473		477		477						
Initials		W		A		MM		A						

5 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	13.0	14.5	/	14.5	/	14.0						
DO (mg/L)	/	9.5	10.2	9.7	/	9.7	/	9.6						
pH	/	7.8	7.9	7.9	/	7.8	/	8.0						
Cond. (µS/cm)		493		490		494		495						
Initials		W		A		MM		A						

9 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	13.0	14.5	/	14.5	/	14.0						
DO (mg/L)	/	9.5	10.2	9.8	/	9.7	/	9.6						
pH	/	7.8	7.9	7.9	/	7.8	/	8.0						
Cond. (µS/cm)		523		522		526		530						
Initials		W		A		MM		A						

15 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)	/	15.0	13.0	14.5	/	14.5	/	14.0						
DO (mg/L)	/	9.5	10.2	9.8	/	9.7	/	9.6						
pH	/	7.8	7.9	7.9	/	7.8	/	8.0						
Cond. (µS/cm)		569		569		574		576						
Initials		W		A		MM		MM						

Thermometer: CER-10 DO meter: DO-2(3) pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	EV-EP4 (unamended)	W
Hardness*	8	248	/
Alkalinity*	3	164	/

Analysts: MM, AW, W

Reviewed by: JOU
 Date reviewed: Feb 8/19

Sample Description: clear, colourless, odourless, some particulates

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Toxik
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1600h
 Test Species: Oncorhynchus mykiss

25 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.2	9.8		9.8		9.6						
pH		7.8	7.9	8.0		7.8		8.0						
Cond. (µS/cm)		660		636		653		656						
Initials		KL		A		UML		A						

43 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.2	9.7		9.8		9.7						
pH		7.8	7.9	8.0		7.8		8.1						
Cond. (µS/cm)		804		785		794		796						
Initials		KL		A		UML		A						

72 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.2	9.7		9.7		9.7						
pH		7.8	7.9	8.0		7.8		8.1						
Cond. (µS/cm)		1029		989		1005		1008						
Initials		KL		A		UML		A						

Concentration	Days													
	35		36											
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2(3) pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	EV-ER4 (uncensored)	
Hardness*	8	248	
Alkalinity*	3	164	

* mg/L as CaCO₃

Analysts: JML, AWD, KL

Reviewed by: JML

Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, some ^{KL}PTT particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Tock
 Sample ID: GH-FB1
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1000h
 Test Species: Oncorhynchus mykiss

GH-FB1 Concentration (unamended)	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.5	10.3	9.9		9.8		9.8						
pH		7.9	7.9	7.9		7.8		8.1						
Cond. (µS/cm)		828		813		822		819						
Initials		W		A		YML		YML						

14 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.7	10.3	9.8		9.7		9.8						
pH		7.9	7.9	7.9		7.8		8.1						
Cond. (µS/cm)		857		836		848		847						
Initials		K		A		YML		YML						

20 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.7	10.3	9.8		9.7		9.9						
pH		7.9	7.9	8.0		7.8		8.1						
Cond. (µS/cm)		904		884		897		896						
Initials		K		A		YML		YML						

27 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.8	10.3	9.6		9.8		10.0						
pH		7.9	7.9	8.0		7.8		8.1						
Cond. (µS/cm)		961		923		949		945						
Initials		K		A		YML		YML						

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	GH-FB1 (unamended)	is
Hardness*	8	437	
Alkalinity*	3	199	

Analysts: YML, ALD, K

Reviewed by: JGh
 Date reviewed: Feb. 8/17

* mg/L as CaCO₃

Sample Description: clear, colourless, odourless, some particulates.

Comments: _____

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: AHL FRI
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1000h
 Test Species: Oncorhynchus mykiss

38 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.8	10.3	9.8		9.8		9.9						
pH		7.9	7.9	8.0		7.8		8.1						
Cond. (µS/cm)		1050		1009		1040		1032						
Initials		KL		AM		VMC		VMC						

54 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.8	10.3	9.8		9.8		9.9						
pH		7.9	7.9	8.1		7.8		8.1						
Cond. (µS/cm)		1170		1123		1140		1141						
Initials		KL		AM		VMC		VMC						

75 Concentration mg/L NO ₃ -N	Days Final													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.8	10.3	9.8		9.7		9.8						
pH		8.0	7.9	8.0		7.8		8.1						
Cond. (µS/cm)		1307		1322		1323		1325						
Initials		KL		AM		VMC		VMC						

Concentration	Days													
	35		36											
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2 (3) pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	AHL FRI (unamended)	KL
Hardness*	8	437	
Alkalinity*	3	199	

* mg/L as CaCO₃

Analysts: YML, AWD, KL

Reviewed by: JOU

Date reviewed: Feb. 8 / 17

Sample Description: clear, colourless, odourless, some particulates.

Comments:

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: AHL-FR1-HH (700mg/L CaCO₃)
 Work Order #: 161883

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1000h
 Test Species: Oncorhynchus mykiss

AHL-FR1-HH Concentration (unamended)	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.8	10.2	9.7		9.8		9.7						
pH		8.0	8.0	8.0		7.8		8.1						
Cond. (µS/cm)		1105	1207			1197		1196						
Initials		KL		AM		YML		YML						

15 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.8	10.2	9.7		9.8		9.7						
pH		8.0	8.0	8.0		7.8		8.2						
Cond. (µS/cm)		1203	1239			1257		1226						
Initials		KL		AM		YML		YML						

23 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	13.5		14.5		14.0						
DO (mg/L)		9.8	10.2	9.7		9.9		9.9						
pH		8.0	8.0	8.0		7.8		8.1						
Cond. (µS/cm)		1264	1290			1302		1296						
Initials		KL		AM		YML		YML						

34 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.9	10.2	9.8		9.7		9.8						
pH		8.0	8.0	8.1		7.8		8.1						
Cond. (µS/cm)		1354	1402			1418		1403						
Initials		KL		AM		YML		YML						

Thermometer: CER-10 DO meter: DO-2(3) pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	AHL-FR1-HH (unamended)	KL
Hardness*	8	672	
Alkalinity*	3	203	

Analysts: MYL, AWD, KL

Reviewed by: JGL
 Date reviewed: Feb. 8/17

Sample Description: Clear, colourless, odourless, some particulates.

Comments: AHL-FR1-HH is AHL-FR1 w/ hardness adjusted in-house to ~700mg/L CaCO₃.

Embryo-Alevin Freshwater Toxicity Test Initial and Final Water Quality Measurements

Client: Teck
 Sample ID: AH-FR1-HH (700mg/L CaCO3)
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9, 2016 @ 1000h
 Test Species: Oncorhynchus mykiss

SI Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.9	10.2	9.7		9.8		9.8						
pH		8.0	8.0	8.0		7.9		8.1						
Cond. (µS/cm)		1492		1504		1497		1494						
Initials		W		A		WML		AS						

76 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.9	10.2	9.6		9.8		9.9						
pH		8.0	8.0	8.1		7.9		8.2						
Cond. (µS/cm)		1648		1668		1663		1665						
Initials		W		AS		WML		WML						

114 Concentration mg/L NO ₃ -N	Days													
	35		36		37		38 Final							
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)		15.0	13.0	14.5		14.5		14.0						
DO (mg/L)		9.9	10.2	9.8		9.8		9.9						
pH		8.0	8.0	8.1		7.9		8.2						
Cond. (µS/cm)		1929		2015		1994		1993						
Initials		W		AS		WML		AS						

Concentration	Days													
	35		36											
	new	old	new	old	new	old	new	old	new	old	new	old	new	old
Temperature (°C)														
DO (mg/L)														
pH														
Cond. (µS/cm)														
Initials														

Thermometer: CER-10 DO meter: DO-2/3 pH meter: PH-1/3 Conductivity meter: C-2/3

	Control	AH-FR1-HH (unhardened)	
Hardness*	8	672	
Alkalinity*	3	203	

Analysts: WML, AWO, W

Reviewed by: JGL
 Date reviewed: Feb. 8/17

Sample Description: clear, colourless, odourless, some particulates

Comments: AH-FR1-HH IS AH-FR1 w/ hardness adjusted in-house to ~ 700 mg/L CaCO₃.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: lab control
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
lab control	1	0	1	0	0	0	0	0	0	0	1	0	0	2 0 2 0
	2	↓	0	↓	↓	↓	↓	0	0	0	0	↓	↓	
	3	↓	0	↓	↓	↓	↓	↓	0	0	0	↓	↓	
	4	↓	0	↓	↓	↓	↓	↓	0	0	0	↓	↓	
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		h	h	h	h	h	h	h	h	h	JW	A	A	h

Comments: _____

Reviewed by: JOB Date reviewed: Feb. 9/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teek
 Sample ID: Lab control
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/Alevins
		B ^①	14	15	16	17	18	19	20	21	22	23	24	
Lab Control	1	0	0	0	0	0	0	0	0	1 ^③	2	3	2	6
	2	↓	↓	↓	↓	↓	↓	↓	4 ^④	0	2	0	0	19
	3	↓	↓	↓	↓	↓	↓	↓	0	0	0	0	0	0
	4	↓	↓	↓	↓	↓	↓	↓	0	0	0	0	1	1
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		MM	MM	MM	KL	KL	KL	AS	KL	KL	KL	AS	KL	KL

Comments: ① at eyed stage (all reps) ② start to hatch ③ >50% hatched ④ developed eggs turned white & nothing unusual noticed in the water column

Reviewed by: JOB Date reviewed: Feb 9/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: TECK
 Sample ID: Lab control
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1020h
 Test Species: Oncorhynchus mykiss

Concentration	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/Alevins
		25	26	27	28	29	30	31	32	33	34	35	36	
Lab control	1	1	0	0 ^①	0	0	0	0	0	0	1 ^②	0 ^②	0	2
	2	0	0	1 ^②	↓	↓	↓	↓	↓	↓	↓	0	0 ^③	1
	3	2 ^①	1	1 ^②	↓	↓	↓	↓	↓	↓	↓	0	0	4
	4	0	0	0	↓	↓	↓	↓	↓	↓	↓	0 ^③	0	0
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
	1													
	2													
	3													
	4													
Tech Initials		AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS	AS

Comments: ① oil sheen present on surface ② white debris in the water column and sticking to bottom of tubs - tubs were changed the previous day during water change ③ 75% swimup.

Reviewed by: JOH Date reviewed: Feb-9/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: TecE
 Sample ID: Lab Control
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9/16 @ 1600h.
 Test Species: Oncorhynchus mykiss

Concentration	Rep	Day of Test - No. of Mortalities							Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		37	38	39	40	41	42	43				
Lab Control	1	0	0						10	1	18	29
	2	1	0						20	0	8	30 28
	3	1	0						6	6	18	30
	4	1	1						20 28	0	28	30 29
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
	1											
	2											
	3											
	4											
Tech Initials		ps	kl						kl	kl	kl	kl

Comments: _____

Reviewed by: _____ Date reviewed: _____

Embryo-Alevin Toxicity Test Daily Mortality

Client: TRCK
 Sample ID: GH-ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
GH-ER2 (unamended)	1	0	0	0	0	1	0	0	0	0	0	0	0	1
	2	↓	↓	↓	↓	0	↓	↓	↓	↓	0	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
3	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	3
5	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	3
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	3
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	14
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
9	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	3
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	2
15	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	2
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
25	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	3
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
43	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	2
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	3
Tech Initials	1	W	W	W	A	W	W	W	W	W	JW	A	A	W
	2	W	W	W	W	W	W	W	W	W	W	W	W	W
	3	W	W	W	W	W	W	W	W	W	W	W	W	W
	4	W	W	W	W	W	W	W	W	W	W	W	W	W

Comments:

Reviewed by: JW

Date reviewed: Feb. 9/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH-ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 16:20h
 Stop Date & Time: Dec 9/16 @ 18:00h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13	14	15	16	17	18	19	20	21	22	23	24	
GH-ER2 (unamended)	1	0	0	0	0	0	0	1	10	3	2	0	0	7
	2	↓	↓	↓	↓	↓	0	0	0	0	0	1	1	2
	3	↓	↓	↓	↓	↓	0	1	0	0	2	1	0	4
	4	↓	↓	↓	↓	↓	0	0	1	0	0	0	1	3
3	1	↓	↓	↓	↓	↓	0	1	1	1	1	0	4	
	2	↓	↓	↓	↓	↓	0	1	0	0	0	0	2	
	3	↓	↓	↓	↓	↓	0	1	0	2	2	0	5	
	4	↓	↓	↓	↓	↓	0	1	0	1	1	0	4	
5	1	1	1	↓	0	↓	↓	0	0	2	0	4	7	
	2	1	0	↓	0	↓	↓	1	0	0	0	0	2	
	3	1	↓	↓	0	0	↓	0	0	0	0	0	2	
	4	2	↓	↓	0	0	↓	0	0	0	0	0	2	
9	1	0	↓	↓	0	↓	↓	1	1	1	0	0	3	
	2	2	↓	↓	0	↓	↓	1	1	0	0	1	5	
	3	1	↓	↓	1	1	↓	5	2	1	0	1	12	
	4	0	↓	↓	0	↓	↓	0	2	0	0	0	2	
15	1	0	↓	↓	↓	↓	2	3	2	1	0	1	9	
	2	0	↓	↓	↓	↓	0	1	0	0	0	1	2	
	3	2	↓	↓	↓	↓	0	1	2	0	0	1	6	
	4	0	↓	↓	↓	↓	↓	2	0	1	0	0	4	
25	1	↓	↓	↓	↓	↓	0	5	0	0	0	4	9	
	2	↓	↓	↓	↓	↓	↓	1	0	1	1	2	5	
	3	↓	↓	↓	↓	↓	↓	1	2	2	1	0	6	
	4	↓	↓	↓	↓	↓	↓	3	1	0	0	2	7	
43	1	↓	↓	↓	↓	↓	0	1	2	1	0	0	4	
	2	↓	↓	↓	↓	↓	0	0	1	0	0	0	1	
	3	↓	↓	↓	↓	↓	0	0	1	0	0	0	3	
	4	0	↓	↓	↓	↓	0	0	0	0	0	0	1	
Tech Initials	1													
	2													
	3													
	4													

Comments: ① at eyed stage (all reps) ② start to hatch ③ 1 fuzzy ④ >50% hatched ⑤ yolk sac edema + small fin
 ⑥ 1 scoliosis and small body ⑦ small body & tail fin ⑧ yolk sac edema + scoliosis ⑨ yolk sac edema
 ⑩ yolk sac almost fully absorbed

Reviewed by: JB Date reviewed: Feb 9/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: TECK
 Sample ID: AH-ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		25	26	27	28	29	30	31	32	33	34	35	36	
AH-ER2 (unamended)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	1	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	3	0	0	0	0	1	0	0	0	1	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	1	0	1	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	1	0	0	0	0	1	1	0	0	0	0
	4	0	0	1	0	0	0	0	0	0	0	0	0	0
5	1	0	2	0	0	0	0	2	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	1	0	0	0	0	0	0	0	0	0
	4	0	1	0	0	0	0	0	0	0	0	0	0	0
9	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	0	0	0	0	0	1	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	1	0	0	0	0	0
	3	0	0	0	1	0	0	0	3	1	0	0	0	0
	4	0	0	0	0	0	0	1	0	0	0	0	0	0
25	1	0	0	0	1	1	0	0	0	0	0	0	0	0
	2	0	0	4	4	2	0	0	1	6	1	3	0	0
	3	0	0	0	2	1	1	1	2	0	1	0	0	0
	4	0	2	0	0	0	0	0	0	0	0	0	0	0
43	1	0	0	1	6	10	0	2	0	2	1	0	0	0
	2	0	0	0	0	0	2	4	2	8	2	4	0	0
	3	0	0	2	0	4	2	3	3	2	1	0	0	0
	4	0	0	2	0	0	0	1	0	2	6	5	1	0
	1													
	2													
	3													
	4													
Tech Initials		A	A	K	K	K	A	MM	A	A	K	K	MM	K

Comments: ^{yolk sac} ① edema ② two-headed ③ lots of debris ⁱⁿ ④ egg yolk edema ⑤ bent tail ⑥ 2 w scoliosis (early), I also w yolk sac edema ⑦ yolk sac edema ⑧ partial 2nd body ⑨ scoliosis
 ⑩ 1 two-headed, 2 lordosis, 4 scoliosis ⑪ single opens ^{early} cloudy ⑫ >50% swim up
 ⑬ deformed jaw, yolk sac edema ⑭ n/100% swim up

Reviewed by: JOU Date reviewed: Feb-9/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: TEC
 Sample ID: GH ER2
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9/16 @ 0000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities							Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		37 35 K	38	39	40	41	42	43				
GH ER2 (unamended)	1	0	0						8	3	19	30
	2								3	0	26	29
	3								9	2	18	29
	4								3	1	26	30
3	1								9	~ 33	16	28
	2								0	1	29	30
	3								14	5	11	30
	4								9	0	22	31
5	1		1						21	0	10	31
	2								2 ^m 4	0	26	~ 2430
	3		0						6	0	25	31
	4		0						12	0	15	27
9	1		0						6	1	24	31
	2		1 ^m 2						8 ^m 8	0	22	30 ^m 28 ^m
	3		0						15	2	12	29
	4		0						4	0	26	30
15	1		0						13	3	14	30
	2		3						6 ^m 9	1	19	~ 2829
	3		0						13	3	13	29
	4	✓	0						8	0	24	32
25	1	5	2						14 ^m 12 ^m	1	11	30 ^m 29 ^m
	2	0	2						29 ^m 27 ^m 24 ^m	0	0	29
	3	0	3						7 ^m 17 ^m	5	7	~ 2629
	4	0	4						~ 1115	0	15	~ 2630
43	1	0	1						~ 2629	0	3	30 ^m 29 ^m
	2	4	1						~ 2429	1	3	~ 2833
	3	0	4						~ 2735	1	0	36
	4	1	~ 15						27	0	7	~ 2834
	1											
	2											
	3											
	4											
Tech Initials		A	K						K	K	K	K

Comments: _____

Reviewed by: Jan Date reviewed: Feb. 14/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
Sample ID: EV-ER4
Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
Stop Date & Time: Dec 9/16 @ 1000h
Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
EV-ER4 (unamended)	1	0	0	0	0	1	0	0	0	0	2	0	0	3
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	0	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	1	↓	2	3
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	0	0
5	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
9	1	↓	↓	↓	↓	↓	2	1	↓	↓	0	↓	↓	3
	2	↓	↓	↓	↓	↓	0	0	↓	↓	0	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	1	↓	↓	0	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	3	↓	↓	0	↓	↓	3
15	1	↓	↓	↓	2	↓	↓	0	1	↓	0	↓	↓	3
	2	↓	↓	↓	0	↓	↓	↓	↓	↓	0	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
25	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	2
43	1	↓	↓	↓	↓	↓	↓	0	0	↓	↓	↓	↓	1
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	1	↓	↓	1
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	1	↓	↓	1
72	1	↓	↓	↓	↓	↓	↓	1	0	↓	↓	↓	↓	1
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	↓	0
	3	↓	↓	↓	↓	↓	↓	0	↓	↓	0	↓	↓	1
	4	↓	↓	↓	↓	↓	↓	0	↓	↓	0	↓	↓	0
Tech Initials	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓

Comments: _____

Reviewed by: JGA

Date reviewed: Feb-9/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 0620h
 Stop Date & Time: Nov 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13 [ⓐ]	14	15	16	17	18	19	20	21	22	23	24	
EV-ER4 (unamended)	1	0	1	0	1	1 [ⓑ]	0	3	0 [ⓐ]	0	0	0	6	
	2	0	0	0	1	2	0	0	1 [ⓐ]	1 [ⓐ]	0	0	4	
	3	6	2	1	2	4	2	1	2 [ⓐ]	1 [ⓐ]	0	0	20	
	4	2	0	0	2	0	0	0	0 [ⓐ]	0 [ⓐ]	2	0	7	
5	1	0	0	0	0	0	1	1 [ⓐ]	2 [ⓐ]	0	0	1 [ⓐ]	5	
	2	0	0	0	1	0	0	0 [ⓐ]	2 [ⓐ]	2 [ⓐ]	0	0	5	
	3	0	0	0	1	0	0	2 [ⓐ]	1 [ⓐ]	1 [ⓐ]	1 [ⓐ]	0	6	
	4	0	2	0	1	0	0	0 [ⓐ]	0 [ⓐ]	0	0	1	3	
9	1	9	2	0	2	1	1	1 [ⓐ]	0	0	0	0	15	
	2	0	0	0	0	0	0	0 [ⓐ]	0 [ⓐ]	0	0	0	0	
	3	0	1	0	0	0	0	0 [ⓐ]	3	3 [ⓐ]	0	2	7	
	4	3	0	1	1	0	2	0 [ⓐ]	1 [ⓐ]	0	1	0	9	
15	1	0	0	0	1	1	0	1 [ⓐ]	0 [ⓐ]	0	0	0	3	
	2	1	0	0	0	0	0	0 [ⓐ]	0 [ⓐ]	0	0	1	1	
	3	1	0	0	0	0	0	0	0 [ⓐ]	0 [ⓐ]	3	1	4	
	4	1	0	1	0	0	0	0 [ⓐ]	0 [ⓐ]	0	0	0	1	
25	1	1	0	1	0	1	3	0 [ⓐ]	1 [ⓐ]	1 [ⓐ]	1	0	8	
	2	1	0	1	0	0	0	1 [ⓐ]	0 [ⓐ]	0	0	0	3	
	3	0	0	1	0	0	0	0 [ⓐ]	1 [ⓐ]	0	1	0	3	
	4	1	1	3	0	0	0	5 [ⓐ]	0 [ⓐ]	0	0	0	10	
43	1	2	0	1	0	1	3	2 [ⓐ]	0 [ⓐ]	1 [ⓐ]	0	0	10	
	2	0	0	0	0	1	0	2 [ⓐ]	0 [ⓐ]	1 [ⓐ]	0	0	2	
	3	1	0	0	1	1	1	0 [ⓐ]	0 [ⓐ]	0	0	0	4	
	4	4	2	1	2	1	0	1 [ⓐ]	0	1 [ⓐ]	0	0	13	
72	1	0	0	0	0	2	0	1 [ⓐ]	5 [ⓐ]	0	0	0	8	
	2	1	1	0	1	0	0	0 [ⓐ]	1 [ⓐ]	0 [ⓐ]	1	0	5	
	3	0	0	0	0	2	1	0 [ⓐ]	1 [ⓐ]	0	0	0	4	
	4	0	0	0	0	0	0	0 [ⓐ]	0 [ⓐ]	0	0	0	0	
	1													
	2													
	3													
	4													
Tech Initials		VM	VM	K	K	K	A	A	K	K	K	A	K	

Comments: not eyed stage (all) ^{rep} 1 furry 3 not hatched 5 to water
2 swollen shelled body 1 to body 1 a thin piece of oil on surface of water 1 fuzzy and scabbed
1 edema + furry 1 half hatched

Reviewed by: JGh
 Version 1.1 Issued October 6, 2015

Date reviewed: Feb 9/17
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: TECK
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016. c 1620h
 Stop Date & Time: Dec 9/16 c 1000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		25	26	27	28	29	30	31	32	33	34	35	36	
EV-ER4 (unamended)	1	0	0	0	0	0	0	0	1	0	0	0	0	1
	2			0	0	0	0	0	0		0	0	0	0
	3			0							0	0	0	0
	4			1							0	0	0	0
5	1			0							0	0	0	0
	2			0				↓			0	0	0	0
	3			1				1			0	0	1	3
	4			0				0	1		0	0	0	0
9	1								1		0	0	0	1
	2		1						0		0	0	0	0
	3		1	↓					0		0	0	0	2
	4		0	1		↓			0		0	0	0	1
15	1	1	1	3		3			1		0	0	0	7
	2	1	1	0	↓	0			0		0	0	0	1
	3	0	1	0	1	0					1	↓	1	3
	4	1	1	1	0	1				1	0	↓	0	3
25	1		0	0		1				1	0	0	0	2
	2		0			0				0	0	0	0	0
	3		0			0				0	0		0	0
	4	1	0			0				0	0		0	0
43	1	1	1		↓	0				0	0		0	3
	2	0	0	↓	1	1				0	0	↓	0	2
	3	0	0	1	1	0				1	1	↓	0	5
	4	0	0	0	0	0	↓			0	0	↓	0	0
72	1	1	2	0	0	2	1			1	1	0	1	18
	2	0	0		0	0	0			0	2	0	0	2
	3	0	0	↓	0	2	0			0	0	0	0	2
	4	0	1	1	0	1	0	↓		0	0	0	0	3
	1							↓		0	0	0	0	
	2													
	3													
	4													
Tech Initials														

Comments: ① oil sheen on surface ② 1 yolk sac, 1 yolk sac edema and 1 two-headed
③ fuzzy ④ edema ⑤ 1 yolk sac edema, 1 undeveloped egg ⑥ 75% swimming ⑦ 100% swimming

Reviewed by: JGh

Date reviewed: Feb 9/17
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Telle
 Sample ID: EV-ER4
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration (µg/L NO ₂ -N)	Rep	Day of Test - No. of Mortalities							Total Dead Embryos/ Alevins	Total Undeveloped/ Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		37	38	39	40	41	42	43				
EV-ER4 (unamended)	1	0	0						10	3	16	29
	2								4	0	28	32
	3								23	0	6	29
	4								8	0	19	27
5	1								5	5	20	30
	2								5	0	25	30
	3								9	1	20	30
	4								3	0	25	28
9	1								19	1	9	29
	2								0	0	29	29
	3								10	1	20	31
	4								13	0	19	32
15	1								13	0	19-20	32-33
	2								2	0	28	30
	3								7	1	20	28
	4								4	0	26	30
25	1								10	4	16	30
	2								3	1	26	30
	3								4	6	20	30
	4								12	0	18	30
43	1		0						14	1	16	31
	2		1						14-15	0	25	30 ^m 29
	3		0						10	1	19	30
	4		0						14	0	15	29
72	1	1	1						26-28 ^m	1	2	30-29 ^m
	2	1	0						29 ^m	0	19	28-29 ^m
	3	0	1						27 ^m	2	21	30 ^m 29
	4	1	1						5	0	23	28-26 ^m
	1											
	2											
	3											
	4											
Tech Initials												

Comments: _____

Reviewed by: JOU

Date reviewed: Feb. 14/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH-FR1
 Work Order #: 16483

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 1600h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
GH-FR1 (unamended)	1	0	0	0	0	2	0	0	0	0	0	0	0	2
	2	↓	↓	↓	↓	0	↓	↓	0	↓	1	0	↓	1
	3	↓	↓	↓	↓	↓	↓	↓	1	↓	0	1	↓	2
	4	↓	↓	↓	↓	↓	↓	↓	0	↓	1	0	↓	1
14	1	↓	↓	↓	↓	↓	2	↓	↓	↓	1	↓	3	
	2	↓	↓	↓	↓	↓	0	↓	↓	↓	0	↓	1	
	3	↓	↓	↓	↓	↓	2	↓	↓	↓	0	↓	2	
	4	↓	↓	↓	↓	↓	0	1	↓	↓	0	↓	1	
20	1	↓	↓	↓	↓	1	0	0	↓	↓	↓	↓	1	
	2	↓	↓	↓	↓	0	↓	↓	↓	↓	1	↓	2	
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	0	
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	1	
27	1	↓	↓	↓	↓	↓	2	1	↓	↓	0	↓	3	
	2	↓	↓	↓	↓	↓	0	0	↓	↓	0	↓	1	
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	1	↓	1	
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	↓	2	
38	1	↓	↓	↓	↓	↓	2	0	↓	1	0	↓	3	
	2	↓	↓	↓	↓	↓	0	0	↓	0	0	↓	1	
	3	↓	↓	↓	↓	↓	↓	↓	↓	0	0	↓	0	
	4	↓	↓	↓	↓	↓	↓	↓	↓	↓	1	↓	4	
54	1	↓	↓	↓	↓	↓	1	0	0	0	0	↓	1	
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1	
	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	2	
	4	↓	↓	↓	↓	↓	↓	2	↓	↓	↓	↓	4	
75	1	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	0	
	2	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1	
	3	↓	↓	↓	↓	↓	2	1	↓	↓	↓	↓	3	
	4	↓	↓	↓	↓	↓	0	1	0	↓	↓	↓	1	
	1													
	2													
	3													
	4													
Tech Initials		ka	ka	ka	ka	ka	ka	ka	ka	ka	ka	ka	ka	

Comments: _____

Reviewed by: JCA

Date reviewed: Feb-9/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH-FRI
 Work Order #: 16483

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9, 2016 @ 0000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13	14	15	16	17	18	19	20	21	22	23	24	
GH-FRI (unamended)	1	1	0	3	5	3	0	3	14	0	0	0	0	16
	2	3	2	1	0	1	0	1	0	0	0	0	8	
	3	0	0	0	0	1	1	1	2	0	1	0	6	
	4	0	0	1	0	0	1	0	2	0	0	0	4	
14	1	0	0	1	4	2	0	0	2	1	0	0	10	
	2	0	0	0	0	0	1	1	0	0	1	0	2	
	3	1	0	1	0	0	0	1	12	0	0	0	14	
	4	0	2	2	0	0	0	1	0	0	0	1	5	
20	1	0	0	0	4	7	0	1	2	1	2	0	16	
	2	1	1	0	0	0	0	1	2	0	1	1	4	
	3	1	1	0	0	4	1	2	0	0	0	1	9	
	4	1	1	1	0	0	0	0	0	0	0	0	2	
27	1	2	2	0	3	1	1	2	2	0	0	0	11	
	2	0	0	0	0	0	1	1	0	0	0	0	0	
	3	0	0	1	0	0	1	1	3	0	2	0	6	
	4	0	2	2	0	0	0	0	1	1	0	0	6	
38	1	2	1	6	9	1	1	0	0	0	0	0	19	
	2	0	0	0	0	0	1	1	1	0	4	0	5	
	3	0	0	0	1	0	1	1	2	0	0	1	4	
	4	1	0	2	0	0	1	1	0	0	0	0	3	
54	1	4	2	5	1	0	1	1	1	0	0	0	13	
	2	0	0	0	1	0	0	1	0	0	1	0	1	
	3	0	0	0	1	0	0	1	0	0	0	1	3	
	4	2	0	0	1	0	0	2	1	0	0	1	6	
75	1	0	0	0	1	0	0	0	0	0	0	0	0	
	2	0	0	1	1	0	0	0	4	0	0	0	5	
	3	4	1	0	1	2	2	2	1	0	2	0	13	
	4	0	0	0	1	0	0	0	2	0	3	0	5	
	1													
	2													
	3													
	4													
Tech Initials		mm	mm	mm	h	A	A	A	h	h	h	ap	h	

Comments: Day eyed stage (all reps) 2) Two fuzzy eggs + 3 attached
1) 1 fuzzy egg + 2 attached 2) 1 fuzzy egg + 2 attached
3) 3 fuzzy 4) 50% hatched 5) start to hatch 6) small body and tail fin
7) inverted development 8) iordosis 9) snail shaped body 10) iordosis 11) fuzzy, almost full absorbed yolk sac
12) 1 iordosis, small yolk sac, 1 two headed, small body & yolk sac 13) fuzzy, iordosis 14) 1 edema, 1 stain

Reviewed by: JG
 Date reviewed: Feb. 9/17
15) partially destroyed yolk sack
 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: TECK
 Sample ID: GH FPI
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 0000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₂ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		25	26	27	28	29	30	31	32	33	34	35	36	
GH FPI	1	0	0	0	0	0	0	0	0	0	0	0	0	0
(unamended)	2			0	0						0 [Ⓣ]	0	0	0
	3			0	0						0	0 [Ⓣ]	0	2
	4			10	0						0	0	0	1
14	1			0	20 [Ⓣ]						1	0	0	3
	2			0	0						0	0 [Ⓣ]		0
	3			10							2	0		3
	4			0							0 [Ⓣ]	0		0
20	1										0	0		0
	2										0 [Ⓣ]	0		0
	3										0	0		0
	4										0	0 [Ⓣ]		0
27	1				1 [Ⓣ]	1					1	1		4
	2				0	0					0	0 [Ⓣ]		0
	3										1	1		2
	4				1 [Ⓣ]						1	0		1
38	1			0							1	0		1
	2										0	4	1	47
	3				0	10					2	0	0	3
	4				0	0					0	0	0 [Ⓣ]	0
54	1			1	2	10 [Ⓣ]	1				2	1	1	11
	2			0	0	0	0				0	0	1	2
	3										2	1	1	4
	4										0	0	0	1
75	1		1			47					1	0	3	7
	2		0			10					60	1	0	7
	3		1	10	20 [Ⓣ]	4					2	0	1	8
	4		0	0	0	0					0	1	0	12
	1		0	0	0	0					0	1	0	4
	2													
	3													
	4													
Tech Initials		A	a	k	k	k	B	MM	a	a	k	k	B	k

Comments: [Ⓣ] yolk sac edema [Ⓣ] really small and missing tail [Ⓣ] scoliosis and edema [Ⓣ] two-headed; 1 tortoise and [Ⓣ] yolk edema [Ⓣ] water looks cloudy and smelly [Ⓣ] Scoliosis [Ⓣ] > 50% Survival

Reviewed by: Jlu Date reviewed: Feb-9/17
 Version 1.1 Issued October 6, 2015 Nautilus Environmental Company Inc.

Embryo-Alevin Toxicity Test Daily Mortality

Client: Tecv
 Sample ID: GH-FP1
 Work Order #: 16483

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9/16 @ 1600h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities							Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		37	38	39	40	41	42	43				
GH-FP1 (unamended)	1	0	0						18	0	12	30
	2	↓	2 ^h						9	0	22	31
	3		2 ^h						10	0	19	29
	4		2 ^h						5 ^h 7	0	22	28 29
14	1	↓	2 ^h						16 ^h	0	14	30 31
	2	↓	0						3	0	27	30
	3	7	2 ^h 3						29 ^h 29	2	9	30 40
	4	0	0						6	0	24	30
20	1	0	2 ^h 2						19	0	12	24 31
	2	0	0						6	0	24	30
	3	0	0						9	1	21	31
	4	0	0						3	0	26	29
27	1	1	3						19 ^h 23	0	7	26 30
	2	0	0						1	0	29	30
	3	0	0						9	1	21	31
	4	0	2						4 ^h 11	0	18	29
38	1	↓	0						23	0	7	30
	2	↓	6						13 ^h 19	3	14	36
	3	↓	1						8	3	20	30 31
	4	↓	0						7	0	22	29
54	1	↓	0						25	1	4	30
	2	↓	0						4	0	26	30
	3	↓	0						9	1	19	29
	4	↓	0						11	2	14	27
75	1	↓	3						17 ^h 20	0	14	34
	2	↓	0						14	2	14	30
	3	↓	0						28	0	2	30
	4	1	0						20 ^h 11	0	17	28
	1											
	2											
	3											
	4											
Tech Initials		AS	W						W	W	W	W

Comments: fish appear very dark (all)

Reviewed by: JOU

Date reviewed: Feb. 14/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH-FRI-HH
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9/16 @ 0000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		1	2	3	4	5	6	7	8	9	10	11	12	
GH-FRI-HH (unamended)	1	0	0	0	0	0	0	0	1	0	0	0	1	2
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	0	0	0	0	0	2	0	0	0	0	0	2
	2	0	0	0	0	0	0	1	0	0	0	0	0	1
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
23	1	0	0	0	0	↓	0	0	↓	0	0	0	0	0
	2	0	0	0	0	↓	0	1	↓	0	0	↓	0	3
	3	0	0	0	0	↓	0	0	0	2	0	0	0	3
	4	0	0	0	0	↓	0	1	0	0	0	0	1	1
34	1	0	0	0	0	↓	0	↓	1	↓	1	1	1	4
	2	0	0	0	0	↓	0	0	1	↓	0	0	0	1
	3	0	0	0	0	↓	0	0	0	1	0	0	0	1
	4	0	0	0	0	↓	0	0	0	0	0	0	0	1
51	1	0	0	0	0	↓	0	0	0	0	0	0	0	0
	2	0	0	0	0	↓	2	0	0	0	0	0	0	2
	3	0	0	0	0	↓	0	0	0	2	0	0	0	2
	4	0	0	0	0	↓	0	0	0	0	0	0	0	0
76	1	0	0	0	↓	0	0	0	0	0	0	1	0	0
	2	0	0	0	↓	1	↓	0	0	0	0	1	0	6
	3	0	0	0	↓	0	0	0	0	0	0	1	0	1
	4	0	0	0	↓	0	0	0	0	0	0	0	0	0
114	1	0	0	0	↓	0	↓	0	0	0	0	1	0	2
	2	0	0	0	↓	0	↓	0	0	0	0	0	0	0
	3	0	0	0	↓	0	1	↓	0	0	0	0	0	1
	4	↓	↓	↓	↓	0	1	↓	↓	↓	0	↓	0	1
	1													
	2													
	3													
	4													
Tech Initials		Ka	Ka	Ka	A	Ka	Ka	Ka	MM	MM	JW	A	A	Ka

Comments:

Reviewed by: JGh

Date reviewed: Feb. 9/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: Teck
 Sample ID: GH-FRI-HH
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: Dec 9th @ 1600h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		13	14	15	16	17	18	19	20	21	22	23	24	
GH-FRI-HH (unamended)	1	15	0	9	0	0	0	0	2	0	0	0	24	
	2	1	0	2	0	0	1	0	6	1	11	0	21	
	3	1	1	1	3	1	0	0	4	0	0	0	11	
	4	1	4	9	0	0	0	1	0	0	0	0	15	
15	1	3	4	2	0	1	1	0	0	0	0	0	11	
	2	3	0	2	3	1	0	1	3	0	0	0	12	
	3	1	0	0	0	1	0	1	2	0	0	0	15	
	4	6	6	5	4	1	0	2	0	0	0	0	24	
23	1	3	2	1	2	0	2	2	0	0	0	0	18	
	2	3	0	3	4	4	0	2	1	1	0	0	18	
	3	6	2	2	1	0	2	0	0	0	0	0	13	
	4	0	0	6	1	2	1	0	2	3	0	0	15	
34	1	2	9	6	2	4	0	1	0	0	0	0	24	
	2	0	0	0	0	0	0	0	1	1	0	0	2	
	3	2	0	0	0	0	0	0	1	0	0	0	4	
	4	2	0	5	0	0	0	0	4	0	0	0	11	
51	1	0	0	0	0	0	1	1	2	0	1	0	4	
	2	2	0	0	0	4	1	2	1	0	0	0	11	
	3	4	6	7	1	1	0	2	1	0	0	0	24	
	4	6	1	3	0	1	1	1	2	0	0	0	15	
76	1	0	0	0	0	0	0	0	2	0	0	0	3	
	2	5	3	5	2	1	0	0	3	0	0	0	19	
	3	1	2	2	0	4	1	0	0	0	0	0	10	
	4	0	0	1	0	1	0	1	3	2	1	0	12	
114	1	0	0	3	1	7	1	0	0	0	0	0	12	
	2	0	0	0	2	0	0	0	0	4	0	2	4	
	3	5	2	2	0	0	0	0	1	0	0	0	10	
	4	0	2	2	0	0	1	1	1	0	0	1	8	
	1													
	2													
	3													
	4													
Tech Initials		MM	MM	EC	W	KL	A	A	W	W	A	W	W	

Comments: Del eyed stage (all reps) ① 3 fuzzy eggs w/ 4 attached ② all fuzzy-
③ > 50% hatched ④ 1 fuzzy start to hatch ⑤ 1 fuzzy ⑥ snoman-shaped bodies
⑦ yolk sac edema and another unhatched body ⑧ small body, yolk sac almost fully absorbed ⑨ bump on

Reviewed by: JHU Date reviewed: Feb. 9/17

⑬ fully absorbed yolk sac ⑭ sample cloudy, fully absorbed egg sac, ⑮ cloudy sample

Embryo-Alevin Toxicity Test Daily Mortality

Client: Rock
 Sample ID: GH FR1-HH
 Work Order #: 161183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 6 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration (mg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities												Total Dead Eggs/Embryos/ Alevins
		25	26	27	28	29	30	31	32	33	34	35	36	
GH FR1-HH (unattended)	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
15	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
23	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
34	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
51	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
76	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
114	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0
	1													
	2													
	3													
	4													
Tech Initials														

Comments: ① oil sheen present on surface ② sample appears cloudy (diverse eggs) ③ egg yolk edema
 ④ kyphosis ⑤ scoliosis ⑥ 75% swim

Reviewed by: JGU

Date reviewed: Feb-9/17

Embryo-Alevin Toxicity Test Daily Mortality

Client: TECO
 Sample ID: GH FRI-HH
 Work Order #: 16183

Start Date & Time: November 1, 2016 @ 1620h
 Stop Date & Time: December 9/16 @ 1000h
 Test Species: Oncorhynchus mykiss

Concentration (µg/L NO ₃ -N)	Rep	Day of Test - No. of Mortalities						Total Dead Embryos/Alevins	Total Undeveloped/Unhatched (abnormal)	Total No. Alevins (normal)	Total Exposed Eggs
		37	38								
GH FRI-HH (unamended)	1	0	0				26	26 0	4	30	
	2	0	7				28	21 0	9	37 20 ^m	
	3	0	2				15	13 0	15	30 25 ^m	
	4	0	0				17	17 0	13	30	
15	1	2	2				13 17	13 0	14	31 27 ^m	
	2	0	0				16	16 1	10	27	
	3	4	7				24 32	2 0	8	40 29 ^m	
	4	0	0				26	26 0	2	28	
23	1		0				19	19 0	10	29	
	2		0				23	1	7	31	
	3		0				17	0	13	30	
	4		4				20 24	1	9	34 35 ^m	
34	1		0				30	0	0	30	
	2		4				17 17	0	15	32 28 ^m	
	3		0				16	0	9	25 25	
	4	↓	0				12	0	17	29	
51	1	1	3				11 15	1	13	25 29	
	2	1	4				26 31	0	4	30 35	
	3	0	0				27	0	4	31	
	4	0	1				16 17	0	11	28	
76	1	3	0				26 29	0	1	27 30	
	2	0	0				30	0	0	30	
	3	1	1				13 11 ^m	0	17	28 30	
	4	0	2				23 24 ^m	2	5	28 30	
114	1	1	1				24 24 ^m	0	5	29	
	2	2 3	1				26 22 ^m	0	6	28 32	
	3	1	4				32 28 ^m	0	5	33 38	
	4	0	2				27 25 ^m	1	3	28 31	
	1										
	2										
	3										
	4										
Tech Initials		AS	K				K	K	K	K	

Comments: _____

Reviewed by: John

Date reviewed: Feb. 14/17

Client: Teck
 WO#: 161183

CONTROL

GH_ER2 (unamanded)

Fish #	Control A	Control B	Control C	Control D	100 A	100 B	100 C	100 D
1	23.5	22.0	20.5	22.5	22.0	24.5	21.0	23.0
2	23.5	24.0	21.0	23.0	24.0	26.0	23.0	24.0
3	24.0	23.5	21.0	23.5	22.5	25.5	23.0	22.0
4	22.5	22.5	21.0	22.0	23.0	24.5	23.0	22.0
5	24.0	24.0	20.0	23.5	24.0	24.5	21.5	21.0
6	24.0	20.0	20.0	21.0	24.0	24.0	23.5	22.5
7	24.0	19.0	21.0	22.0	24.0	26.0	22.0	23.0
8	23.5	19.5	20.0	22.0	24.5	25.0	23.0	23.0
9	23.5		22.5	21.5	25.0	25.0	23.0	22.5
10	24.0		22.0	22.0	25.0	25.5	21.0	24.0
11	23.0		22.5	21.0	22.5	22.0	21.0	23.5
12	23.5		20.5	22.0	24.0	24.0	22.0	24.0
13	24.0		21.0	22.5	24.0	24.5	24.0	23.0
14	23.5		20.5	21.5	24.0	25.0	22.5	24.0
15	24.5		21.0	22.0	24.5	23.5	21.0	24.0
16	23.0		22.0	22.0	22.0	26.0	18.0	24.0
17	24.0		22.0	22.5	23.5	25.0	16.0	25.0
18	19.5		19.5	23.0	22.5	24.5	23.0	23.5
19	22.0		16.5	24.0	23.5	24.0	21.0	21.0
20			17.5	22.0	20.0	24.0	21.0	24.0
21			18.5	22.5	18.0	25.0		24.0
22			17.0	22.0	19.0	24.5		24.0
23			15.0	22.0		22.5		24.0
24			17.0	23.0		24.5		23.5
25				23.0		21.0		25.0
26				20.0		25.0		23.5
27				21.0				20.0
28				21.0				
29								
30								
31								
# Survivors	19	8	24	28	22	26	20	27
Average Length (mm)	23.34	21.81	19.98	22.14	22.98	24.44	21.68	23.22
Pooled Weight (mg)	2230.00	1130.00	2940.00	2460.00	2560.00	3300.00	2210.00	2930.00
Pooled Weight (g)	2.23	1.13	2.94	2.46	2.56	3.30	2.21	2.93
Average Weight (g)	0.117	0.141	0.123	0.088	0.116	0.127	0.111	0.109

= abnormal

Joh
 Feb. 14/17

Client: Teck
 WO#: 161183

GH_ER2 (mg/L NO3-N)

GH_ER2 (mg/L NO3-N)

Fish #	3 A	3 B	3 C	3 D	5 A	5 B	5 C	5 D
1	21.0	20.0	17.0	23.0	22.0	24.0	24.0	22.0
2	19.5	25.5	19.0	23.5	22.5	25.0	23.0	20.5
3	21.0	23.0	19.0	23.5	19.5	24.0	23.0	20.5
4	15.5	23.5	20.0	23.5	23.0	25.0	24.0	21.0
5	25.0	22.0	19.0	23.0	21.0	24.5	23.0	24.0
6	21.5	25.0	20.0	22.0	22.0	25.0	23.5	24.0
7	23.0	24.0	25.0	24.0	22.5	25.5	21.0	21.0
8	23.0	23.0	25.0	23.0	22.0	26.0	23.0	19.0
9	24.0	21.0	21.0	24.0	21.0	25.5	22.5	21.0
10	23.0	22.0	21.0	23.0	20.0	25.0	23.0	23.0
11	24.0	21.0	21.0	24.5		25.0	22.0	19.5
12	20.5	26.0	23.0	22.0		25.5	22.0	17.0
13	23.0	25.5	22.0	22.0		24.0	23.0	20.0
14	22.5	24.5	22.0	23.5		25.5	21.0	19.5
15	23.0	21.0	21.0	23.0		25.5	23.5	22.0
16	22.5	25.0	18.0	22.0		25.5	22.0	
17	25.0	23.5		23.0		26.0	22.5	
18	22.0	22.5		19.5		26.0	23.5	
19	25.0	22.0		24.0		24.0	22.0	
20		20.0		23.5		26.5	21.0	
21		24.0		21.0		25.0	22.0	
22		23.0		23.0		25.0	22.0	
23		24.0				25.0	22.5	
24		23.0				25.0	21.5	
25		23.5				26.0	22.0	
26		25.0				26.0		
27		25.0						
28		24.0						
29		22.0						
30		23.0						
31								
# Survivors	19	30	16	22	10	26	25	15
Average Length (mm)	22.32	23.22	20.81	22.89	21.55	25.19	22.50	20.93
Pooled Weight (mg)	2260.00	3630.00	1700.00	2060.00	1070.00	3420.00	2520.00	1610.00
Pooled Weight (g)	2.26	3.63	1.70	2.06	1.07	3.42	2.52	1.61
Average Weight (g)	0.119	0.121	0.106	0.094	0.107	0.132	0.101	0.107

= abnormal

JGK
 Feb. 14/12

Client: Teck
WO#: 161183

GH_ER2 (mg/L NO3-N)

GH_ER2 (mg/L NO3-N)

Fish #	9 A	9 B	9 C	9 D	15 A	15 B	15 C	15 D
1	22.0	23.0	15.5	21.5	21.0	21.0	17.0	20.5
2	22.0	24.0	16.0	21.0	20.5	22.5	19.0	21.0
3	22.5	25.0	19.5	21.5	22.0	24.0	16.0	21.0
4	23.0	23.5	18.0	22.0	20.0	19.5	18.5	21.0
5	22.5	23.0	22.0	20.0	19.5	23.0	21.0	22.0
6	22.5	24.0	22.0	21.5	20.0	22.0	22.0	20.5
7	23.0	24.5	20.5	21.0	21.0	20.0	22.0	21.5
8	20.5	24.5	22.0	20.5	21.0	22.5	20.0	20.5
9	22.0	24.5	21.0	20.0	20.5	20.5	21.0	20.5
10	22.5	24.5	21.0	20.0	20.0	21.0	21.5	19.5
11	20.5	24.5	20.5	23.0	21.0	22.0	20.5	20.5
12	23.0	24.5	20.0	24.0	20.0	20.0	19.0	21.0
13	22.0	22.5	19.5	19.5	19.5	20.5	21.0	21.5
14	23.0	22.5	18.5	23.0	20.5	21.0	21.0	21.0
15	21.5	22.5		20.5	16.5	21.0	20.5	20.0
16	22.5	23.0		19.5	17.0	22.0	20.5	21.5
17	22.0	23.5		19.5	15.0	23.0		20.5
18	22.5	25.0		20.5		22.5		19.5
19	23.5	24.5		20.0		22.0		19.0
20	17.5	23.5		22.5		20.0		21.0
21	21.5	24.5		22.5				21.0
22	22.0	24.0		23.0				20.5
23	21.0			23.5				22.5
24	22.0			21.0				20.0
25	22.5			23.0				
26				22.0				
27								
28								
29								
30								
31								
# Survivors	25	22	14	26	17	20	16	24
Average Length (mm)	21.98	23.86	19.71	21.38	19.71	21.50	20.03	20.73
Pooled Weight (mg)	2900.00	2940.00	1400.00	2170.00	1750.00	2270.00	1620.00	2300.00
Pooled Weight (g)	2.90	2.94	1.40	2.17	1.75	2.27	1.62	2.30
Average Weight (g)	0.116	0.134	0.100	0.083	0.103	0.114	0.101	0.096

= abnormal

JOU
Feb. 14/12

Client: Teck
 WO#: 161183

GH_ER2 (mg/L NO3-N)

GH_ER2 (mg/L NO3-N)

Fish #	GH_ER2 (mg/L NO3-N)				GH_ER2 (mg/L NO3-N)			
	25 A	25 B (no survival)	25 C	25 D	43 A	43 B	43 C	43 D
1	21.0		26.0	20.0	17.5	15.5	20.0	20.5
2	19.0		18.5	20.5	16.5	18.0		20.0
3	19.5		18.5	19.5	19.0	18.0		20.0
4	21.0		14.5	21.5		15.0		20.0
5	21.0		14.0	20.5				20.0
6	20.0		17.0	19.0				21.0
7	20.5		17.0	20.5				20.5
8	21.0		17.0	20.0				
9	20.0		17.0	21.0				
10	20.0		17.5	20.5				
11	20.5		18.0	21.0				
12	19.5		18.0	21.0				
13				20.5				
14				20.5				
15				22.0				
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
# Survivors	12	0	12	15	3	4	1	7
Average Length (mm)	20.25	-	17.75	20.53	17.67	16.63	20.00	20.29
Pooled Weight (mg)	1190.00	0.00	970.00	1410.00	290.00	310.00	104.00	590.00
Pooled Weight (g)	1.19	0.00	0.97	1.41	0.29	0.31	0.10	0.59
Average Weight (g)	0.099	0.000	0.081	0.094	0.097	0.078	0.104	0.084

= abnormal

Jon
 Feb. 14/17

Client: Teck
 WO#: 161183

EV_ER4 (Unamended)

EV_ER4 (mg/L NO3-N)

Fish #	100 A	100 B	100 C	100 D	5 A	5 B	5 C	5 D
1	24.5	24.0	22.5	24.5	19.0	24.5	20.0	23.0
2	24.5	24.0	24.0	24.0	16.0	24.5	24.0	24.5
3	23.5	24.5	23.5	24.0	18.0	24.0	22.0	24.5
4	24.0	24.5	23.0	24.5	17.5	24.0	21.0	24.5
5	25.0	24.5	25.0	23.0	21.0	25.0	23.5	24.0
6	25.0	25.5	22.5	24.5	25.0	24.5	23.5	24.0
7	25.5	26.0		24.0	25.0	24.0	22.0	22.5
8	25.0	25.5		25.0	24.0	23.5	24.0	23.0
9	25.0	24.0		25.0	21.0	25.5	23.5	24.0
10	25.0	23.5		22.0	25.0	24.5	24.0	23.5
11	25.5	24.0		22.0	23.0	25.0	23.5	24.0
12	24.5	26.0		23.0	23.0	25.0	22.5	23.5
13	25.0	26.5		25.0	20.5	25.0	23.5	24.0
14	24.5	24.5		24.0	23.0	24.0	22.5	23.0
15	25.5	25.5		23.5	24.0	24.5	23.0	23.5
16	23.0	25.5		23.0	22.0	25.0	23.5	24.0
17	20.5	26.0		23.5	21.0	24.0	23.5	24.0
18	19.0	26.0		23.0	23.5	23.5	22.5	24.0
19	18.5	26.0		23.0	24.0	24.0	22.0	23.0
20		23.0			22.5	24.0	23.5	23.0
21		24.5			23.0	24.0	19.5	23.5
22		24.5			23.0	26.0		23.5
23		24.5			23.0	24.5		22.0
24		25.0			23.0	26.0		22.5
25		25.0			24.0	25.0		23.0
26		25.5						
27		25.5						
28		26.0						
29								
30								
31								
# Survivors	19	28	6	19	25	25	21	25
Average Length (mm)	23.84	24.98	23.42	23.71	22.16	24.54	22.71	23.52
Pooled Weight (mg)	2610.00	3990.00	740.00	2060.00	3180.00	3370.00	2580.00	2780.00
Pooled Weight (g)	2.61	3.99	0.74	2.06	3.18	3.37	2.58	2.78
Average Weight (g)	0.137	0.143	0.123	0.108	0.127	0.135	0.123	0.111

= abnormal

JGL
 Feb. 14/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L NO3-N)

EV_ER4 (mg/L NO3-N)

Fish #	9 A	9 B	9 C	9 D	15 A	15 B	15 C	15 D
1	19.0	24.0	21.0	23.5	16.5	26.0	18.0	23.5
2	22.0	24.0	21.0	25.0	22.0	24.5	20.5	24.0
3	22.0	25.0	24.0	24.0	22.5	23.0	20.5	23.0
4	22.0	24.0	23.0	24.5	21.0	23.0	21.0	24.5
5	22.0	26.0	20.0	23.0	23.0	24.0	20.0	25.0
6	22.5	26.0	23.0	23.0	23.0	23.0	21.0	23.0
7	24.0	24.0	24.0	24.5	23.5	20.0	21.5	23.0
8	22.5	25.5	22.0	24.0	24.0	22.0	22.0	22.5
9	24.0	24.0	23.5	23.5	23.5	24.0	20.0	24.0
10	22.5	25.5	21.5	24.0	22.5	23.0	23.5	24.5
11		25.5	23.0	23.5	22.0	24.0	19.5	23.0
12		25.5	23.5	24.0	22.5	21.0	20.5	23.0
13		24.5	24.0	23.5	24.0	23.0	19.5	24.0
14		25.0	23.5	24.0	22.5	24.0	21.0	23.5
15		23.0	21.5	24.0	22.0	23.0	20.5	23.5
16		24.0	16.0	22.5	22.0	23.0	19.5	23.0
17		25.5	23.0	23.5	22.5	23.0	21.0	22.0
18		25.0	19.0	24.0	22.0	24.0	22.5	23.0
19		26.0	21.0	23.5	23.5	22.0	17.5	23.5
20		24.0	20.5		20.5	23.0	22.5	23.0
21		25.0	17.0			23.0	21.0	24.0
22		24.0				24.0		24.0
23		26.0				25.0		24.0
24		25.0				23.0		23.0
25		24.5				25.0		24.5
26		25.0				21.0		24.5
27		25.0				23.0		
28		24.0				24.0		
29		24.5						
30								
31								
# Survivors	10	29	21	19	20	28	21	26
Average Length (mm)	22.25	24.79	21.67	23.76	22.25	23.23	20.62	23.56
Pooled Weight (mg)	1130.00	3860.00	2470.00	2090.00	2460.00	3760.00	2320.00	2890.00
Pooled Weight (g)	1.13	3.86	2.47	2.09	2.46	3.76	2.32	2.89
Average Weight (g)	0.113	0.133	0.118	0.110	0.123	0.134	0.110	0.111

= abnormal

JGh
 Feb. 14/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L NO3-N)

EV_ER4 (mg/L NO3-N)

Fish #	25 A	25 B	25 C	25 D	43 A	43 B	43 C	43 D
1	20.0	24.5	16.0	23.0	14.0	24.0	16.0	22.5
2	19.5	24.0	19.5	23.5	18.0	24.0	18.0	23.0
3	18.0	23.5	18.0	22.5	22.0	22.5	20.5	20.0
4	18.0	25.0	18.0	24.0	21.5	21.0	21.0	21.5
5	22.0	24.5	20.0	24.0	22.5	22.5	20.5	21.0
6	20.5	23.5	21.5	22.5	19.0	24.0	21.5	22.5
7	21.0	25.5	24.5	23.0	22.5	25.0	17.0	23.0
8	24.0	24.5	22.5	23.5	22.0	21.5	19.5	23.0
9	24.5	21.0	22.0	24.0	21.5	23.0	20.0	22.5
10	20.0	24.5	24.0	22.0	22.0	23.5	20.0	21.0
11	24.0	24.5	21.0	23.5	21.0	22.0	21.5	22.0
12	21.0	24.0	21.0	24.0	21.5	21.5	20.0	20.5
13	24.0	24.0	22.5	23.5	22.0	22.0	19.0	22.0
14	23.5	23.0	23.0	24.0	21.0	22.5	20.5	23.0
15	24.0	25.0	21.5	24.0	22.0	24.0	19.0	23.5
16	21.0	25.0	22.5	23.5	21.5	23.0	21.0	
17	23.0	24.0	24.0	24.0	22.0	20.5	21.0	
18	23.5	23.0	22.5	23.5		23.5	21.5	
19	24.0	25.5	20.5			23.5	19.5	
20	21.5	19.5	20.5			24.0	19.0	
21		23.0	22.5			24.0		
22		24.5	21.0			24.0		
23		23.0	22.5			22.0		
24		25.5	23.0			22.0		
25		25.5	24.0			22.0		
26		24.0	24.5					
27		23.0						
28								
29								
30								
31								
# Survivors	20	27	26	18	17	25	20	15
Average Length (mm)	21.85	23.94	21.63	23.44	20.94	22.86	19.80	22.07
Pooled Weight (mg)	2370.00	3780.00	3160.00	2080.00	1900.00	3210.00	2050.00	1490.00
Pooled Weight (g)	2.37	3.78	3.16	2.08	1.90	3.21	2.05	1.49
Average Weight (g)	0.119	0.140	0.122	0.116	0.112	0.128	0.103	0.099

= abnormal

JGU
 Feb. 14/17

Client: Teck
 WO#: 161183

EV_ER4 (mg/L NO3-N)

GH_FR1 (Unamended)

Fish #	72 A	72 B	72 C	72 D	100 A	100 B	100 C	100 D
1	19.0	19.5	20.0	22.0	21.0	21.0	22.0	20.5
2	16.0	22.0	20.5	20.5	19.0	22.0	21.0	20.0
3	20.5	22.5	20.5	22.0	24.0	23.0	22.0	21.5
4		20.5	19.0	21.0	22.0	23.5	21.0	21.0
5		21.0	19.5	20.0	22.0	23.0	22.0	21.0
6		23.5	19.5	20.5	21.0	23.5	21.5	21.5
7		22.0	19.0	21.0	21.5	23.5	23.0	20.5
8		24.0	20.5	21.0	21.5	23.0	21.0	22.0
9		23.5	19.5	22.0	21.0	21.0	22.0	22.5
10		22.0	19.5	22.0	21.0	22.5	19.5	23.0
11		22.5	19.0	19.5	23.0	24.0	23.0	22.5
12		22.0	20.5	22.0	22.0	22.5	21.5	22.0
13		21.0	19.0	21.0		24.0	20.0	23.0
14		22.0	17.0	21.0		24.0	19.5	22.0
15		23.5	19.0	22.0		21.0	20.0	22.5
16		24.0	20.5	21.5		24.0	20.0	22.0
17		22.0	20.0	21.5		23.0	23.0	23.5
18		23.0	19.0	21.0		22.5	22.0	22.5
19		24.0	21.0	20.0		22.5	20.5	22.5
20			21.0	20.5		23.5		23.0
21			22.0	21.0		24.0		23.0
22			17.0	21.0		23.0		22.0
23			17.0	20.5				
24								
25								
26								
27								
28								
29								
30								
31								
# Survivors	3	19	23	23	12	22	19	22
Average Length (mm)	18.50	22.34	19.54	21.07	21.58	22.91	21.29	22.00
Pooled Weight (mg)	300.00	2380.00	2250.00	2270.00	1230.00	2570.00	2260.00	2180.00
Pooled Weight (g)	0.30	2.38	2.25	2.27	1.23	2.57	2.26	2.18
Average Weight (g)	0.100	0.125	0.098	0.099	0.103	0.117	0.119	0.099

= abnormal

JGH
 Feb. 14/12

Client: Teck
 WO#: 161183

GH_FR1 (mg/L NO3-N)

GH_FR1 (mg/L NO3-N)

Fish #	14 A	14 B	14 C	14 D	20 A	20 B	20 C	20 D
1	21.0	23.0	18.0	23.0	22.0	24.0	19.0	22.5
2	20.0	23.5	17.5	21.0	22.5	24.5	22.0	21.0
3	22.0	22.5	20.5	20.0	22.0	25.0	21.0	22.0
4	23.0	23.0	22.0	22.0	20.0	25.5	23.0	23.0
5	21.0	24.0	21.0	23.5	21.0	24.5	22.5	22.0
6	21.0	23.0	21.0	23.0	21.0	24.5	21.5	24.0
7	21.0	24.0	19.0	23.5	22.0	24.0	19.5	23.5
8	22.5	23.0	20.0	22.0	22.0	25.0	20.0	22.5
9	22.0	22.0	21.5	22.5	21.0	26.0	20.5	23.0
10	21.0	21.0	21.0	21.5	22.0	25.0	21.0	24.0
11	22.5	25.0	20.0	24.0	20.5	23.0	20.5	24.0
12	19.5	25.0		23.0	21.0	24.5	22.0	23.0
13	22.0	24.0		23.0		25.0	20.5	23.0
14	21.5	22.5		23.0		24.5	21.0	22.0
15		24.5		22.5		24.0	20.5	23.5
16		23.0		24.0		24.0	21.0	23.5
17		24.0		22.5		24.5	21.0	24.0
18		24.0		22.0		23.0	22.0	23.0
19		24.0		22.0		24.0	20.5	20.0
20		24.5		22.5		22.0	21.0	20.0
21		22.5		23.0		24.5	19.5	21.0
22		21.0		21.5		25.5	21.5	24.0
23		24.0		20.0		24.0		23.0
24		22.5		24.0		24.5		22.5
25		23.5						22.5
26		25.0						22.5
27		24.5						
28								
29								
30								
31								
# Survivors	14	27	11	24	12	24	22	26
Average Length (mm)	21.43	23.43	20.14	22.46	21.42	24.38	20.95	22.65
Pooled Weight (mg)	1460.00	3420.00	1140.00	2450.00	1270.00	3280.00	2540.00	2700.00
Pooled Weight (g)	1.46	3.42	1.14	2.45	1.27	3.28	2.54	2.70
Average Weight (g)	0.104	0.127	0.104	0.102	0.106	0.137	0.115	0.104

= abnormal

JGh
 Feb. 14/12

Client: Teck
 WO#: 161183

GH_FR1 (mg/L NO3-N)

GH_FR1 (mg/L NO3-N)

Fish #	27 A	27 B	27 C	27 D	38 A	38 B	38 C	38 D
1	20.0	24.0	20.0	21.0	22.0	20.0	16.0	22.0
2	19.0	25.0	19.5	21.5	20.5	21.0	16.0	23.0
3	22.0	25.0	20.0	22.0	19.5	21.0	16.0	22.0
4	22.0	25.5	21.0	23.0	19.0	21.5	21.0	21.5
5	19.0	25.0	20.5	21.0	20.5	21.0	21.0	22.0
6	20.5	23.0	22.0	22.5	20.0	21.0	20.0	21.5
7	19.5	24.0	22.0	22.0	20.0	21.0	19.5	24.0
8		23.0	21.0	20.5		23.0	19.5	24.0
9		23.0	22.0	21.0		20.5	20.5	23.0
10		23.0	22.5	21.0		22.5	21.0	22.5
11		24.0	20.5	21.0		24.0	19.0	24.0
12		24.5	23.0	22.0		22.0	19.5	22.0
13		23.0	22.0	21.5		22.5	21.0	22.0
14		23.0	21.0	19.5		22.0	19.0	20.5
15		22.5	22.5	21.0		21.0	19.0	23.0
16		25.0	22.0	21.0		22.0	19.0	22.0
17		23.0	21.5	22.0		21.0	19.0	22.0
18		24.0	22.0	22.0			21.0	22.0
19		24.0	18.5				20.0	23.0
20		26.0	18.0				20.0	22.5
21		25.0	21.0				21.0	23.5
22		24.0	18.0				20.5	22.5
23		23.0					20.5	
24		24.0						
25		24.5						
26		25.0						
27		23.0						
28		25.0						
29		24.5						
30								
31								
# Survivors	7	29	22	18	7	17	23	22
Average Length (mm)	20.29	24.05	20.93	21.42	20.21	21.59	19.52	22.48
Pooled Weight (mg)	750.00	3990.00	2390.00	1690.00	720.00	2080.00	2320.00	2150.00
Pooled Weight (g)	0.75	3.99	2.39	1.69	0.72	2.08	2.32	2.15
Average Weight (g)	0.107	0.138	0.109	0.094	0.103	0.122	0.101	0.098

= abnormal

JGH
 Feb. 14/17

Client: Teck
 WO#: 161183

GH_FR1 (mg/L NO3-N)

GH_FR1 (mg/L NO3-N)

Fish #	54 A	54 B	54 C	54 D	75 A	75 B	75 C	75 D
1	16.0	22.0	20.0	18.0	21.0	16.0	17.0	18.0
2	19.5	21.0	21.0	18.5	20.5	18.0	16.5	17.5
3	20.5	23.0	21.0	19.0	20.0	16.0		21.0
4	20.5	22.5	18.5	19.5	20.5	19.0		20.0
5	21.0	20.5	19.0	20.0	20.5	18.0		20.0
6		23.5	22.5	18.0	21.0	18.0		20.5
7		22.0	19.0	17.5	20.5	18.0		19.0
8		20.5	20.0	19.0	20.5	18.0		19.5
9		21.0	20.0	19.0	20.5	18.0		19.0
10		21.0	17.0	20.5	22.0	18.0		19.5
11		22.0	20.0	19.0	22.0	19.0		19.0
12		22.5	19.5	19.5	22.0	18.5		20.0
13		21.0	17.0	19.5	21.0	18.5		19.0
14		23.5	19.0	19.5	22.0	18.0		20.0
15		22.0	19.5	19.5		17.5		18.5
16		21.0	18.0	18.0		16.5		19.5
17		20.5	19.0					18.5
18		23.0	19.0					
19		19.5	18.0					
20		22.0	20.0					
21		22.0						
22		22.0						
23		21.0						
24		23.5						
25		22.0						
26		23.5						
27								
28								
29								
30								
31								
# Survivors	5	26	20	16	14	16	2	17
Average Length (mm)	19.50	21.85	19.35	19.00	21.00	17.81	16.75	19.32
Pooled Weight (mg)	490.00	2990.00	1880.00	1290.00	1720.00	1470.00	130.00	1540.00
Pooled Weight (g)	0.49	2.99	1.88	1.29	1.72	1.47	0.13	1.54
Average Weight (g)	0.098	0.115	0.094	0.081	0.123	0.092	0.065	0.091

= abnormal

JGh
 Feb. 14/17

Client: Teck
 WO#: 161183

GH_FR1-HH (Unamended)

GH_FR1-HH (mg/L NO3-N)

Fish #	GH_FR1-HH (Unamended)				GH_FR1-HH (mg/L NO3-N)			
	100 A	100 B	100 C	100 D	15 A	15 B	15 C	15 D
1	21.0	21.0	22.0	19.5	21.0	16.5	24.0	20.0
2	21.5	22.0	21.0	22.5	22.0	20.5	24.0	20.5
3	23.0	21.0	22.0	22.0	20.5	21.0	21.0	
4	22.5	22.0	23.0	23.0	21.0	20.5	22.0	
5		22.0	19.5	23.0	22.0	20.5	21.5	
6		22.5	22.0	22.0	21.5	19.0	23.0	
7		20.0	22.0	23.0	19.5	21.0	22.0	
8		21.0	21.0	23.0	21.0	20.0	21.5	
9		21.0	19.0	23.0	21.5	19.5		
10			22.0	21.5	21.5	20.0		
11			23.0	21.0	19.5	16.5		
12			21.0	21.0	21.0			
13			21.5	22.0	21.0			
14			21.5		21.0			
15			21.0					
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
# Survivors	4	9	15	13	14	11	8	2
Average Length (mm)	22.00	21.39	21.43	22.04	21.00	19.55	22.38	20.25
Pooled Weight (mg)	480.00	1190.00	1670.00	1360.00	1430.00	1280.00	1060.00	190.00
Pooled Weight (g)	0.48	1.19	1.67	1.36	1.43	1.28	1.06	0.19
Average Weight (g)	0.120	0.132	0.111	0.105	0.102	0.116	0.133	0.095

= abnormal

JGh
 Feb. 14/12

Client: Teck
 WO#: 161183

GH_FR1-HH (mg/L NO3-N)

GH_FR1-HH (mg/L NO3-N)

Fish #	GH_FR1-HH (mg/L NO3-N)				GH_FR1-HH (mg/L NO3-N)			
	23 A	23 B	23 C	23 D	34 A (no survival)	34 B	34 C	34 D
1	21.0	21.0	22.0	20.0		21.0	20.0	19.0
2	21.0	22.0	19.5	19.5		20.5	17.0	19.5
3	22.5	22.0	19.5	20.5		18.0	20.5	18.5
4	22.0	18.0	21.0	20.0		18.5	18.0	19.5
5	20.5	22.0	20.0	19.0		19.5	18.5	19.5
6	20.0	23.0	20.5	19.5		19.5	19.0	16.5
7	16.0	21.0	19.0	20.0		20.5	17.5	19.0
8	19.5	22.0	20.5	18.0		19.5	15.0	19.0
9	21.0		20.5	18.5		20.5	19.5	16.0
10	20.5		21.0	17.0		20.0		16.5
11			20.0			18.0		17.0
12			19.5			19.0		20.0
13			19.5			18.5		19.5
14						20.5		19.5
15						21.0		19.5
16								17.0
17								19.0
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
# Survivors	10	8	13	10	0	15	9	17
Average Length (mm)	20.40	21.38	20.19	19.20	-	19.63	18.33	18.50
Pooled Weight (mg)	1140.00	1000.00	1230.00	960.00	0.00	1560.00	940.00	1470.00
Pooled Weight (g)	1.14	1.00	1.23	0.96	0.00	1.56	0.94	1.47
Average Weight (g)	0.114	0.125	0.095	0.096	0.000	0.104	0.104	0.086

= abnormal

JGk
 Feb. 14/17

Client: Teck
 WO#: 161183

GH_FR1-HH (mg/L NO3-N)

GH_FR1-HH (mg/L NO3-N)

Fish #	GH_FR1-HH (mg/L NO3-N)				GH_FR1-HH (mg/L NO3-N)			
	51 A	51 B	51 C	51 D	76 A	76 B (no survival)	76 C	76 D
1	20.5	16.0	17.0	18.5	20.0		19.0	16.0
2	19.0	19.5	16.0	19.5			19.5	19.0
3	19.0	17.0	16.5	20.5			17.0	17.0
4	19.0	18.0	15.0	19.0			19.0	16.0
5	19.5			20.0			19.5	17.5
6	19.5			19.5			19.5	19.0
7	19.0			17.0			19.0	18.0
8	19.0			19.5			19.0	
9	18.5			16.0			19.5	
10	20.0			19.5			18.5	
11	19.5			16.0			19.5	
12	19.5						19.5	
13	19.5						20.0	
14	19.0						16.0	
15							21.0	
16							18.0	
17							19.0	
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								
# Survivors	14	4	4	11	1	0	17	7
Average Length (mm)	19.32	17.63	16.13	18.64	20.00	-	18.97	17.50
Pooled Weight (mg)	1460.00	390.00	310.00	880.00	100.00	0.00	1380.00	650.00
Pooled Weight (g)	1.46	0.39	0.31	0.88	0.10	0.00	1.38	0.65
Average Weight (g)	0.104	0.098	0.078	0.080	0.100	0.000	0.081	0.093

= abnormal

John
 Feb 14/17

Client: Teck
 WO#: 161183

GH_FR1-HH (mg/L NO3-N)

Fish #	114 A	114 B	114 C	114 D
1	17.0	21.0	19.5	16.0
2	18.0	18.0	18.0	18.0
3	17.0	20.0	19.0	17.0
4	19.0	18.0	19.5	16.0
5	17.5	19.0	19.0	
6		20.0		
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
# Survivors	5	6	5	4
Average Length (mm)	17.70	19.33	19.00	16.75
Pooled Weight (mg)	520.00	490.00	440.00	370.00
Pooled Weight (g)	0.52	0.49	0.44	0.37
Average Weight (g)	0.104	0.082	0.088	0.093

= abnormal

JGh
 Feb. 14/17

P3 1/16
13

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: Lab Control

Termination Date: December 9, 2016

Work-Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
Control A	1	23.5	/		0		
	2	23.5	/		0		
	3	24.0	/		0		
	4	22.5	/		0		
	5	24.0	/		0		
	6	24.0	/		0		
	7	24.0	/		0		
	8	23.5	/		1		
	9	23.5	/		0		
	10	24.0	/		0		
	11	23.0	/		0		
	12	23.5	/		0		
	13	24.0	/		0		
	14	23.5	/		0		
	15	24.5	/		0		
	16	23.0	/		0		
	17	24.0	/		0		
	18	19.5			✓	1	2 heads
	19	22.0	/			0	
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 2.23g

Number of survivors: 19

Number of deformed/have difficulty swimming: 1/1

Initials: KJL, JAB, KL, EMN

Reviewed by: JGU

Date Reviewed: Feb - 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: Lab Control

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
Control B	1	22.0	/		2		
	2	24.0	/		2		
	3	23.5	/		2		
	4	22.5	/		2		
	5	24.0	/		2		
	6	20.0	/		2		
	7	19.0	/		1		
	8	19.5	/		1		
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 1.13g

Number of survivors: 8

Number of deformed/have difficulty swimming: 0/0

Initials: KJ, JAS, K, EMM

Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: Lab Control
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
Control C	1	20.5	/		1		
	2	21.0	/		2		
	3	21.0	/		1		
	4	21.0	/		1		
	5	20.0	/		1		
	6	20.0	/		1		
	7	21.0	/		1		
	8	20.0	/		1		
	9	22.5	/		1		
	10	22.0	/		1		
	11	22.5	/		1		
	12	20.5	/		2		
	13	21.0	/		1		
	14	20.5	/		2		
	15	21.0	/		1		
	16	22.0	/		1		
	17	22.0	/		1		
	18	19.5				1	
	19	16.5			✓	1	bent tail
	20	17.5			✓	1	
	21	18.5			✓	1	
	22	17.0			✓	1	
	23	15.0			✓	2	
	24	17.0			✓	1	
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 2.94 g
 Number of survivors: 24
 Number of deformed/have difficulty swimming: 6/6
 Initials: KSL, JAB, KL, EMM
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: Lab Control
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
Control 0	1	22.5	/		0	
	2	23.0	/		0	
	3	23.5	/		0	
	4	22.0	/		0	
	5	23.8	/		0	
	6	21.0	/		0	
	7	22.0	/		0	
	8	22.0	/		0	
	9	21.5	/		0	
	10	22.0	/		0	
	11	21.0	/		0	
	12	22.0	/		0	
	13	22.5	/		0	
	14	21.5	/		0	
	15	22.0	/		0	
	16	22.0	/		0	
	17	22.5	/		0	
	18	23.0	/		0	
	19	24.0	/		0	
	20	22.0	/		0	
	21	22.5	/		0	
	22	22.0	/		0	
	23	22.0	/		0	
	24	23.0	/		0	
	25	23.0	/		0	
	26	20.0	/		0	
	27	21.0	/		0	
	28	21.0	/		0	
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.46g
 Number of survivors: 28
 Number of deformed/have difficulty swimming: 0/0
 Initials: HL, SAB, W, EMM
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended A	1	22.0	/		1		
	2	24.0	/		0		
	3	22.5	/		1		
	4	23.0	/		1		
	5	24.0	/		0		
	6	24.0	/		0		
	7	24.0	/		0		
	8	24.5	/		0		
	9	25.0	/		0		
	10	25.0	/		1		
	11	22.5	/		0		
	12	24.0	/		0		
	13	24.0	/		0		
	14	24.0	/		0		
	15	24.5	/		0		
	16	22.0	/		1		
	17	23.5	/		0		
	18	22.5	/		0		
	19	23.5	/		0		
	20	20.0			✓	1	Conifacial
	21	18.0			✓	1	Two-Headed
	22	19.0			✓	1	Two-Headed
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 256g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 3/3
 Initials: KSL, JAB, H, EMM
 Reviewed by: Jon

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended B	1	24.5	/		1	
	2	26.0	/		0	
	3	25.5	/		0	
	4	24.5	/		0	
	5	24.5	/		0	
	6	24.0	/		0	
	7	26.0	/		0	
	8	25.0	/		0	
	9	25.0	/		1	
	10	25.5	/		0	
	11	22.0	/		2	
	12	24.0	/		0	
	13	24.5	/		0	
	14	25.0	/		0	
	15	23.5	/		1	
	16	26.0	/		0	
	17	25.0	/		0	
	18	24.5	/		0	
	19	24.0	/		0	
	20	24.0	/		0	
	21	25.0	/		0	
	22	24.5	/		0	
	23	22.5	/		2	
	24	24.5	/		1	
	25	21.0	/		2	
	26	25.0	/		0	
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 3.30g

Number of survivors: 26

Number of deformed/have difficulty swimming: 0/0

Initials: KJL, JAB, K, JEMM

Reviewed by: JGK

Date Reviewed: Feb - 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended C	1	21.0	/		1		
	2	23.0	/		0		
	3	23.0	/		0		
	4	23.0	/		1		
	5	21.5	/		0		
	6	23.5	/		0		
	7	22.0	/		1		
	8	23.0	/		0		
	9	23.0	/		0		
	10	21.0	/		1		
	11	21.0	/		0		
	12	22.0	/		0		
	13	24.0	/		0		
	14	22.5	/		0		
	15	21.0	/		1		
	16	18.0			✓	1	Fin-tail deformed
	17	16.0			✓	1	Fin-tail deformed
	18	23.0	/			0	
	19	21.0	/			0	
	20	21.0	/			0	
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							

Total Weight (pooled): 2.21g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 2/2
 Initials: ESL, JPB, KL, EMM
 Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended D	1	23.0	/		0	
	2	24.0	/		0	
	3	22.0	/		0	
	4	22.0	/		0	
	5	21.0	/		0	
	6	22.5	/		0	
	7	23.0	/		0	
	8	23.0	/		0	
	9	22.5	/		0	
	10	24.0	/		0	
	11	23.5	/		0	
	12	24.0	/		0	
	13	23.0	/		0	
	14	24.0	/		0	
	15	24.0	/		0	
	16	24.0	/		0	
	17	25.0	/		0	
	18	23.5	/		0	
	19	21.0	/		0	
	20	24.0	/		0	
	21	24.0	/		0	
	22	24.0	/		0	
	23	24.0	/		0	
	24	23.5	/		0	
	25	25.0	/		0	
	26	23.5	/		0	
	27	20.0			✓	1 Cranio-facial
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.93g
 Number of survivors: 27
 Number of deformed/have difficulty swimming: 1/1
 Initials: FIL, JAB, KL, EMM
 Reviewed by: JGH

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
3 mg/L NO3-N A	1	21.0	/		0		
	2	19.5		✓	1	Cranio-facial	
	3	21.0		✓	0	Lordosis	
	4	15.5		✓	0	Two-headed	
	5	25.0	/		0		
	6	21.5	/		0		
	7	23.0	/		0		
	8	23.0	/		0		
	9	24.0	/		0		
	10	23.0	/		0		
	11	24.0	/		0		
	12	20.5	/		0		
	13	23.0	/		0		
	14	22.5	/		0		
	15	23.0	/		0		
	16	22.5	/		0		
	17	25.0	/		0		
	18	22.0	/		0		
	19	25.0	/		0		
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 2.26g
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 3/3
 Initials: EJL, JAB, K, EMM
 Reviewed by: JGW

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
3 mg/L NO3-N B	1	20.0		✓	2	Deformed jaw. Cranio-facial
	2	25.5	/		0	
	3	23.0	/		0	
	4	23.5	/		0	
	5	22.0	/		1	
	6	25.0	/		0	
	7	24.0	/		1	
	8	23.0	/		0	
	9	21.0	/		0	
	10	22.0	/		1	
	11	21.0	/		1	
	12	26.0	/		0	
	13	25.5	/		0	
	14	24.5	/		0	
	15	21.0	/		1	
	16	25.0	/		0	
	17	23.5	/		1	
	18	22.5	/		0	
	19	22.0	/		1	
	20	20.0	/		1	
	21	24.0	/		0	
	22	23.0	/		0	
	23	24.0	/		0	
	24	23.0	/		1	
	25	23.5	/		1	
	26	25.0	/		0	
	27	25.0	/		0	
	28	24.0	/		1	
	29	22.0	/		1	
	30	23.0	/		2	2/1
31						
32						
33						
34						
35						

Total Weight (pooled): 3.63 g

Number of survivors: 30

Number of deformed/have difficulty swimming: 1/1

Initials: KL, JAB, VL, EMM

Reviewed by: Joh

Date Reviewed: Feb. 14/17

134/116
13

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
3 mg/L NO3-N C	1	17.0		✓	1	Tail deformity	
	2	19.0		✓	2	Tail deformity	
	3	19.0		✓	0	Tail deformity	
	4	20.0		✓	2	Edema	
	5	19.8		✓	0	Deformed yolk sac	
	6	20.0	—		1		
	7	25.0	—		0		
	8	25.0	—		0		
	9	21.0	—		1		
	10	21.0	—		0		
	11	21.0	—		1		
	12	23.0	—		0		
	13	22.0	—		0		
	14	22.0	—		0		
	15	21.0	—		1		
	16	18.0	—		2		
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 1.70g

Number of survivors: 16

Number of deformed/have difficulty swimming: 5/16

Initials: FJL, JAB, KL, EMM

Reviewed by: JCA

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
3 mg/L NO3-N D	1	23.0	/		0	
	2	23.5	/		0	
	3	23.5	/		0	
	4	23.5	/		0	
	5	23.0	/		0	
	6	22.0	/		0	
	7	24.0	/		0	
	8	23.0	/		0	
	9	24.0	/		0	
	10	23.0	/		0	
	11	24.5	/		0	
	12	22.0	/		0	
	13	22.0	/		0	
	14	23.5	/		0	
	15	23.0	/		0	
	16	22.0	/		0	
	17	23.0	/		0	
	18	19.5	/		0	
	19	24.0	/		0	
	20	23.5	/		0	
	21	24.0	/		0	
	22	23.0	/		0	
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ^{KSL} 1.6 2.06 g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 0%
 Initials: KSL, JAB, KL, EMM
 Reviewed by: JOK

Date Reviewed: Feb. 19/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
5 mg/L NO3-N A	1	22.0	/		1		
	2	22.5	/		1		
	3	19.5	/		0		
	4	23.0	/		1		
	5	21.0	/		1		
	6	22.0	/		0		
	7	22.5	/		1		
	8	22.0	/		0		
	9	21.0	/		0		
	10	20.0	/		1		
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 1.07g
 Number of survivors: 10
 Number of deformed/have difficulty swimming: 0/0
 Initials: KJL, JAB, KL, EMM
 Reviewed by: JON

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
5 mg/L NO3-N B	1	24.0	/		0	
	2	25.0	/		0	
	3	24.0	/		0	
	4	25.0	/		0	
	5	24.5	/		0	
	6	25.0	/		0	
	7	25.5	/		0	
	8	26.0	/		0	
	9	25.5	/		0	
	10	25.0	/		0	
	11	25.0	/		0	
	12	25.5	/		0	
	13	24.0	/		1	
	14	25.5	/		0	
	15	25.5	/		0	
	16	25.5	/		0	
	17	26.0	/		0	
	18	26.0	/		0	
	19	24.0	/		0	
	20	26.5	/		0	
	21	25.0	/		0	
	22	25.0	/		0	
	23	25.0	/		0	
	24	25.0	/		1	
	25	26.0	/		6	
	26	26.0	/		0	
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 3.42g

Number of survivors: 26

Number of deformed/have difficulty swimming: 6

Initials: KSL, JAB, RL, EMM

Reviewed by: JGU

Date Reviewed: Feb. 14/17

PJIS #16
u3

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
5 mg/L NO3-N C	1	24.0	/		0	
	2	23.0	/		0	
	3	23.0	/		0	
	4	24.0	/		0	
	5	23.0	/		0	
	6	23.5	/		0	
	7	21.0	/		0	
	8	23.0	/		0	
	9	22.5	/		0	
	10	23.0	/		0	
	11	22.0	/		0	
	12	22.0	/		1	
	13	23.0	/		0	
	14	21.0	/		0	
	15	23.5	/		0	
	16	22.0	/		0	
	17	22.5	/		0	
	18	23.5	/		0	
	19	22.0	/		0	
	20	21.0	/		1	
	21	22.0	/		0	
	22	22.0	/		0	
	23	22.5	/		0	
	24	21.5	/		0	
	25	22.0	/		0	
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.52g

Number of survivors: 25

Number of deformed/have difficulty swimming: 0

Initials: KSL, JAB, K, EMM

Reviewed by: JCh

Date Reviewed: Feb. 17/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
5 mg/L NO3-N D	1	22.0	/		1	
	2	20.5	/		0	
	3	20.5	/		1	
	4	21.0	/		0	
	5	24.0	/		0	
	6	24.0	/		0	
	7	21.0	/		0	
	8	19.0 19.0	/		1	
	9	21.0	/		1	
	10	23.0	/		0	
	11	19.5 19.5	/		1	
	12	17.0	/		1	
	13	20.0	/		1	
	14	19.5	/		0	
	15	22.0	/		1	
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.61g
 Number of survivors: 5
 Number of deformed/have difficulty swimming: 0/0
 Initials: FSL, JAB, KL, EMM
 Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
9 mg/L NO3-N A	1	22.0	/		0		
	2	22.0	/		0		
	3	22.5	/		0		
	4	23.0	/		0		
	5	22.5	/		0		
	6	22.5	/		0		
	7	23.0	/		0		
	8	20.5	/		1		
	9	22.0	/		0		
	10	22.5	/		0		
	11	20.5	/		1		
	12	23.0	/		0		
	13	22.0	/		0		
	14	23.0	/		0		
	15	21.5	/		1		
	16	22.5	/		0		
	17	22.0	/		0		
	18	22.5	/		0		
	19	23.5	/		0		
	20	17.5			✓	1	Two-headed, Cranio-facial
	21	21.5	/		0		
	22	22.0	/		0		
	23	21.0	/		1		
	24	22.0	/		1		
	25	22.5	/		0		
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							

Total Weight (pooled): 2.90g
 Number of survivors: 25
 Number of deformed/have difficulty swimming: 1/1
 Initials: KSL, JAB, M, EMM
 Reviewed by: JCA

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
9 mg/L NO3-N B	1	23.0	/		1	
	2	24.0	/		0	
	3	25.0	/		0	
	4	23.5	/		1	
	5	23.0	/		0	
	6	24.0	/		1	
	7	24.5	/		0	
	8	24.5	/		1	
	9	24.5	/		0	
	10	24.5	/		0	
	11	24.5	/		0	
	12	24.5	/		0	
	13	22.5	/		1	
	14	22.5	/		1	
	15	22.5	/		0	
	16	23.0	/		1	
	17	23.5	/		0	
	18	25.0	/		0	
	19	24.5	/		0	
	20	23.5	/		0	
	21	24.5	/		0	
	22	24.0	/		0	
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.94 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 0/0

Initials: KJL, JAB, KL, EMM

Reviewed by: JOM

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
9 mg/L NO3-N C	1	15.5		✓	2	Tail deformed
	2	16.0		✓	0	Tail deformed
	3	19.5	-		1	
	4	18.0	-		1	
	5	22.0	-		0	
	6	22.0	-		0	
	7	20.5	-		0	
	8	22.0	-		0	
	9	21.0	-		1	
	10	21.0	-		0	
	11	20.5	-		0	
	12	20.0	-		1	
	13	19.5	-		0	
	14	18.5	-		1	
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.40g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 2/2
 Initials: KSL, JAB, RL, emm
 Reviewed by: JCh

Date Reviewed: Feb-14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
9 mg/L NO3-N D	1	21.5	/		0	
	2	21.0	/		0	
	3	21.5	/		0	
	4	22.0	/		0	
	5	20.0	/		0	
	6	21.5	/		0	
	7	21.0	/		0	
	8	20.5	/		0	
	9	20.0	/		0	
	10	20.0	/		0	
	11	23.0	/		0	
	12	24.0	/		0	
	13	19.5	/		0	
	14	23.0	/		0	
	15	20.5	/		0	
	16	19.5	/		1	
	17	19.5	/		0	
	18	20.5	/		0	
	19	20.0	/		0	
	20	22.5	/		0	
	21	22.5	/		0	
	22	23.0	/		0	
	23	23.5	/		0	
	24	21.0	/		0	
	25	23.0	/		0	
	26	22.0	/		0	
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.17g

Number of survivors: 26

Number of deformed/have difficulty swimming: 0/0

Initials: KSL, JAB, M, M

Reviewed by: JOM

Date Reviewed: Feb. 19/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
15 mg/L NO3-N A	1	21.0	/		1		
	2	20.5	/		0		
	3	22.0	/		1		
	4	20.0	/		0		
	5	19.5	/		1		
	6	20.0	/		0		
	7	21.0	/		0		
	8	21.0	/		0		
	9	20.5	/		1		
	10	20.0	/		0		
	11	21.0	/		1		
	12	20.0	/		1		
	13	19.5	/		1		
	14	20.5	/		0		
	15	16.5			✓	1	Two-headed
	16	17.0			✓	0	Lordosis
	17	15.0			✓	2	Two-headed
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
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	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 1.75 g

Number of survivors: A

Number of deformed/have difficulty swimming: 3/3

Initials: SL, JAB, A, GMM

Reviewed by: JGA

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N B	1	21.0		✓	2	Edema
	2	22.5	/		0	
	3	24.0	/		0	
	4	19.5	/		2	
	5	23.0	/		0	
	6	22.0	/		0	
	7	20.0	/		1	
	8	22.5	/		0	
	9	20.5	/		2	
	10	21.0	/		1	
	11	22.0	/		1	
	12	20.0	/		2	
	13	20.5	/		1	
	14	21.0	/		1	
	15	21.0	/		1	
	16	22.0	/		0	
	17	23.0	/		0	
	18	22.5	/		0	
	19	22.0	/		0	
	20	20.0	/		1	
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.27g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 1/0/0/1
 Initials: KSL, JAB, K, EMM
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

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Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
15 mg/L NO3-N C	1	17.0		✓	2	Edema	
	2	19.0		✓	0	Tail deformed	
	3	16.0		✓	1	Tail deformed	
	4	18.5	/		0		
	5	21.0	/		0		
	6	22.0	/		0		
	7	22.0	/		1		
	8	20.0	/		0		
	9	21.0	/		1		
	10	21.5	/		0		
	11	20.5	/		0		
	12	20.5 19.0	/		0		
	13	21.0	/		1		
	14	21.0	/		0		
	15	20.5	/		1		
	16	20.5	/		1		
	17						
	18						
	19						
	20						
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	22						
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	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 1.62 g

Number of survivors: 16

Number of deformed/have difficulty swimming: 3/3

Initials: KSL, JAB, K, EMM

Reviewed by: JOK

Date Reviewed: Feb-14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N D	1	20.5	/		1	
	2	21.0	/		0	
	3	21.0	/		0	
	4	21.0	/		0	
	5	22.0	/		0	
	6	20.5	/		0	
	7	21.5	/		0	
	8	20.5	/		0	
	9	20.5	/		0	
	10	19.5	/		0	
	11	20.5	/		0	
	12	21.0	/		0	
	13	21.5	/		0	
	14	21.0	/		0	
	15	20.0	/		0	
	16	21.5	/		0	
	17	20.5	/		0	
	18	19.5	/		0	
	19	19.0	/		0	
	20	21.0	/		0	
	21	21.0	/		0	
	22	20.5	/		0	
	23	22.5	/		0	
	24	20.0	sym			0
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.30g
 Number of survivors: 24
 Number of deformed/have difficulty swimming: 0/0
 Initials: KL, KL, JAS, ENM
 Reviewed by: JGK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
25 mg/L NO3-N A	1	21.0	/		0		
	2	19.0		✓	1	Cranio-facial	
	3	19.5	/		0		
	4	21.0	/		0		
	5	21.0	/		1		
	6	20.0	/		0		
	7	20.5	/		0		
	8	21.0	/		0		
	9	20.0	/		0		
	10	20.0	/		1		
	11	20.5	/		1		
	12	19.5	/		0		
	13						
	14						
	15						
	16						
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	33						
	34						
	35						

Total Weight (pooled): 1.19 g
 Number of survivors: 12
 Number of deformed/have difficulty swimming: 1/1
 Initials: KSL, JAB, KL, EMM
 Reviewed by: JCh

Date Reviewed: Feb. 14/17

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Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
25 mg/L NO3-N C	1	26.0	✓	—	2	Scoliosis	
	2	18.5	✓	—	1	Scoliosis	
	3	18.5	✓	—	1	Tail deformed	
	4	14.5	✓	—	2	Tail deformed	
	5	14.0	✓	—	1	Tail deformed	
	6	17.0	✓	—	1		
	7	17.0	✓	—	1		
	8	17.0	✓	—	2		
	9	17.0	✓	—	1		
	10	17.5	✓	—	0		
	11	18.0	✓	—	1		
	12	18.0	✓	—	0		
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
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	35						

Total Weight (pooled): 0.97 g

Number of survivors: 12

Number of deformed/have difficulty swimming: 5/5

Initials: EL, JAS, K, EMM

Reviewed by: [Signature]

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
25 mg/L NO3-N 0	1	20.0	/		0	
	2	20.5	/		0	
	3	19.5	/		0	
	4	21.5	/		0	
	5	20.5	/		0	
	6	19.0	/		0	
	7	20.5	/		0	
	8	20.0	/		0	
	9	21.0	/		0	
	10	20.5	/		0	
	11	21.0	/		0	
	12	21.0	/		0	
	13	20.5	/		0	
	14	20.5	/		0	
	15	20.0 22.0	/		0	
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.41 g
 Number of survivors: 15
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, JAS, K. EMAN
 Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_ER2

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
43 mg/L NO3-N A	1	17.5	✓		2		
	2	16.5	✓		2		
	3	19.0	✓		1		
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
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	21						
	22						
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	24						
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	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 0.29 g

Number of survivors: 3

Number of deformed/have difficulty swimming: 0/0

Initials: ES, JAB, K, EMM

Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
43 mg/L NO3-N B	1	15.5	-		2		
	2	18.0	-		1		
	3	18.0	-		0		
	4	19.0			2	Tail deformed	
	5				JAB ✓	Extra abnormal JAB	
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
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	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 0.31g
 Number of survivors: 4
 Number of deformed/have difficulty swimming: 1/1
 Initials: KL, JAB, KL, Emm
 Reviewed by: JG

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
43 mg/L NO3-N 0	1	20.0		✓	1	Extra growth on yolk sac
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.104^{KL} 0-10 g
 Number of survivors: 1
 Number of deformed/have difficulty swimming: 0/0
 Initials: KL, JAB, M, SEMM
 Reviewed by: JGH

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_ER2
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
43 mg/L NO3-N D	1	20.5	/		0	
	2	20.0	/		0	
	3	20.0	/		0	
	4	20.0	/		0	
	5	20.0	/		0	
	6	21.0	/		0	
	7	20.0	/		0	
	8	20.5	xn			
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.59g
 Number of survivors: 7
 Number of deformed/have difficulty swimming: 0/0
 Initials: VSL, JAB, K, EMM
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended A	1	24.5	/		0		
	2	24.5	/		0		
	3	23.5	/		0		
	4	24.0	/		0		
	5	25.0	/		0		
	6	25.0	/		0		
	7	25.5	/		0		
	8	25.0	/		0		
	9	25.0	/		0		
	10	25.0	/		0		
	11	25.5	/		0		
	12	24.5	/		0		
	13	25.0	/		0		
	14	24.5	/		0		
	15	25.5	/		0		
	16	23.0	/		0		
	17	20.5 20.5	/	X	-	1	Extra growth on yolk sac
	18	19.0	/	X	-	1	Two-heads, two tails
	19	18.5	/	X	-	2	Two-heads
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 261 g
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 3/2
 Initials: KSL, JAB, KL, IEMM
 Reviewed by: Jon

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended B	1	24.0	/		1	
	2	24.0	/		0	
	3	24.5	/		0	
	4	24.5	/		1	
	5	24.5	/		0	
	6	25.5	/		0	
	7	26.0	/		0	
	8	25.5	/		0	
	9	24.0	/		0	
	10	23.5	/		1	
	11	24.0	/		0	
	12	26.0	/		0	
	13	26.5	/		0	
	14	24.5	/		0	
	15	25.5	/		0	
	16	25.5	/		0	
	17	26.0	/		0	
	18	26.0	/		0	
	19	26.0	/		0	
	20	23.0	/		1	
	21	24.5	/		0	
	22	24.5	/		0	
	23	24.5	/		0	
	24	25.0	/		0	
	25	25.0	/		0	
	26	25.5	/		0	
	27	25.5	/		0	
	28	26.0	/		0	
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 3.99 g

Number of survivors: 28

Number of deformed/have difficulty swimming: 0/0

Initials: KL, JAG, EL, GMM

Reviewed by: JGU

Date Reviewed: Feb 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended C	1	22.5	—		0		
	2	24.0	—		0		
	3	23.3	—		0		
	4	23.0	—		0		
	5	25.0	—		0		
	6	22.5	—		0		
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
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	33						
	34						
	35						

Total Weight (pooled): 0.86^g 0.74g
 Number of survivors: 6
 Number of deformed/have difficulty swimming: 0/6
 Initials: KL, JAB, H, Emm
 Reviewed by: JGh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended D	1	24.5	/		0	
	2	24.0	/		0	
	3	24.0	/		0	
	4	24.5	/		0	
	5	23.0	/		0	
	6	24.5	/		0	
	7	24.0	/		0	
	8	25.0	/		0	
	9	25.0	/		0	
	10	22.0	/		0	
	11	22.0	/		0	
	12	23.0	/		0	
	13	25.0	/		0	
	14	24.0	/		0	
	15	23.5	/		0	
	16	23.0	/		0	
	17	23.5	/		0	
	18	23.0	/		0	
	19	23.0	/		0	
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.056^ug 2.06g

Number of survivors: 19

Number of deformed/have difficulty swimming: 0/0

Initials: KL, JAG, M, EMM

Reviewed by: JAG

Date Reviewed: Feb. 19/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
5 mg/L NO3-N A	1	19.0		✓	1	scoliosis
	2	16.0		✓	2	lordosis
	3	18.0		✓	2	two-headed
	4	17.5		✓	0	two-headed
	5	21.0		✓	1	extra growth on yolk sac
	6	25.0	/		0	
	7	25.0	/		0	
	8	24.0	/		0	
	9	21.0	/		0	
	10	25.0	/		0	
	11	23.0	/		0	
	12	23.0	/		0	
	13	20.5	/		0	
	14	23.0	/		0	
	15	24.0	/		0	
	16	22.0	/		0	
	17	21.0	/		0	
	18	23.5	/		0	
	19	24.0	/		0	
	20	22.5	/		0	
	21	23.0	/		0	
	22	23.0	/		1	
	23	23.0	/		0	
	24	23.0	/		1	
	25	24.0	/		0	
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 3.18 g

Number of survivors: 25

Number of deformed/have difficulty swimming: 5/4

Initials: KSL, JAB, KL, EMM

Reviewed by: JCH

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
5 mg/L NO3-N AB K	1	24.5	/		0	
	2	24.5	/		0	
	3	24.0	/		0	
	4	24.0	/		0	
	5	25.0	/		0	
	6	24.5	/		1	
	7	24.0	/		0	
	8	23.5	/		1	
	9	25.5	/		0	
	10	24.5	/		0	
	11	25.0	/		0	
	12	25.0	/		0	
	13	25.0	/		0	
	14	24.0	/		0	
	15	24.5	/		0	
	16	25.0	/		0	
	17	24.0	/		1	
	18	23.5	/		0	
	19	24.0	/		0	
	20	24.0	/		0	
	21	24.0	/		0	
	22	26.0	/		1	
	23	24.5	/		0	
	24	26.0	/		0	
	25	25.0	/		0	
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 3.37 g
 Number of survivors: 25
 Number of deformed/have difficulty swimming: 0%
 Initials: KSL, JAG, RL, EMM
 Reviewed by: Jon

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
5 mg/L NO3-N AC W	1	20.0		✓	0	Tail Deformed
	2	24.0	/		1	
	3	22.0	/		0	
	4	21.0	/		1	
	5	23.5	/		0	
	6	23.5	/		0	
	7	22.0	/		0	
	8	24.0	/		0	
	9	23.5	/		1	
	10	24.0	/		0	
	11	23.5	/		0	
	12	22.5	/		1	
	13	23.5	/		0	
	14	22.5	/		0	
	15	23.0	/		0	
	16	23.5	/		1	
	17	23.5	/		0	
	18	22.5	/		0	
	19	22.0	/		1	
	20	23.5	/		1	
	21	Wt 19.5	/		1	
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.58g
 Number of survivors: 21
 Number of deformed/have difficulty swimming: 1/1
 Initials: WJL, JAB, M, EMM
 Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
5 mg/L NO3-N AD KL	1	23.0	✓		0	
	2	24.5	✓		0	
	3	24.5	✓		0	
	4	24.5	✓		0	
	5	24.0	✓		0	
	6	24.0	✓		0	
	7	22.5	✓		0	
	8	23.0	✓		0	
	9	24.0	✓		0	
	10	23.5	✓		0	
	11	24.0	✓		0	
	12	23.5	✓		0	
	13	24.0	✓		0	
	14	23.0	✓		0	
	15	23.5	✓		0	
	16	24.0	✓		0	
	17	24.0	✓		0	
	18	24.0	✓		0	
	19	23.0	✓		0	
	20	23.0	✓		0	
	21	23.5	✓		0	
	22	23.5	✓		0	
	23	22.0	✓		0	
	24	22.5	✓		0	
	25	23.0	✓		0	
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.78 g

Number of survivors: 25

Number of deformed/have difficulty swimming: 0/0

Initials: KL, KL, JAS, EMM

Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
9 mg/L NO3-N A	1	21.0		✓	1	lordosis	
	2	22.0	/		0		
	3	22.0	/		0		
	4	22.0	/		0		
	5	22.0	/		0		
	6	22.5	/		0		
	7	24.0	/		0		
	8	22.5	/		0		
	9	24.0	/		0		
	10	22.5	/		0		
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 1.13 g

Number of survivors: 10

Number of deformed/have difficulty swimming: n of 1/1

Initials: KJL, JAB, KL, EMM

Reviewed by: JOU

Date Reviewed: Feb. 17/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
9 mg/L NO3-N B	1	24.0	/		0	
	2	24.0	/		0	
	3	25.0	/		0	
	4	24.0	/		1	
	5	26.0	/		0	
	6	26.0	/		0	
	7	24.0	/		1	
	8	25.5	/		0	
	9	24.0	/		0	
	10	25.5	/		0	
	11	25.5	/		0	
	12	25.5	/		0	
	13	24.5	/		0	
	14	25.0	/		0	
	15	23.0	/		0	
	16	24.0	/		1	
	17	25.5	/		0	
	18	25.0	/		0	
	19	26.0	/		0	
	20	24.0	/		0	
	21	25.0	/		0	
	22	24.0	/		0	
	23	26.0	/		0	
	24	25.0	/		0	
	25	24.5	/		0	
	26	25.0	/		1	
	27	25.0	/		0	
	28	24.0	/		0	
	29	24.5	/		0	
	30					
31						
32						
33						
34						
35						

Total Weight (pooled): 3.86 g
 Number of survivors: 29
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, KL, JAB, ZMM
 Reviewed by: JGn

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
9 mg/L NO3-N C	1	21.0	/		0	
	2	21.0	/		0	
	3	24.0	/		0	
	4	23.0	/		0	
	5	20.0	/		1	
	6	23.0	/		0	
	7	24.0	/		0	
	8	22.0	/		2	
	9	23.5	/		0	
	10	21.5	/		0	
	11	23.0	/		1	
	12	23.5	/		0	
	13	24.0	/		1	
	14	23.5	/		0	
	15	21.5	/		1	
	16	16.0	/		2	
	17	23.0	/		0	
	18	19.0	/		0	
	19	21.0	/		1	
	20	20.5	/		1	
21	17.0			✓	0	Tail deformed
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.47g

Number of survivors: 21

Number of deformed/have difficulty swimming: 1/1

Initials: KJL, JAS, XL, EMM

Reviewed by: JOU

Date Reviewed: Feb. 14/17

10/2/16
13

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
9 mg/L NO3-N D	1	23.5	/		0	
	2	25.0	/		0	
	3	24.0	/		0	
	4	24.5	/		0	
	5	23.0	/		0	
	6	23.0	/		0	
	7	24.5	/		0	
	8	24.0	/		0	
	9	23.5	/		0	
	10	24.0	/		0	
	11	23.5	/		0	
	12	24.0	/		0	
	13	24.5	/		0	
	14	24.0	/		0	
	15	24.0	/		0	
	16	22.5	/		0	
	17	23.5	/		0	
	18	24.0	/		0	
	19	23.5	/		0	
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.07g

Number of survivors: 19

Number of deformed/have difficulty swimming: 0/0

Initials: KL, JAG, KL, EMM

Reviewed by: Joh

Date Reviewed: Feb. 14/17

VJ44/116
113

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N A	1	16.5		/	1	Two-headed
	2	22.0	/		0	
	3	22.5	/		0	
	4	21.0	/		1	
	5	23.0	/		0	
	6	23.0	/		0	
	7	23.5	/		0	
	8	24.0	/		0	
	9	23.5	/		0	
	10	22.5	/		0	
	11	22.0	/		0	
	12	22.5	/		0	
	13	24.0	/		0	
	14	22.5	/		0	
	15	22.0	/		1	
	16	22.0	/		0	
	17	22.5	/		0	
	18	22.0	/		0	
	19	23.5	/		0	
	20	20.5	/		1	
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.46 g

Number of survivors: 20

Number of deformed/have difficulty swimming: 1/1

Initials: KSL, JAB, M, EMM

Reviewed by: Jou

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N B	1	26.0	/		0	
	2	24.5	/		0	
	3	23.0	/		0	
	4	23.0	/		1	
	5	24.0	/		1	
	6	23.0	/		0	
	7	20.0	/		1	
	8	22.0	/		1	
	9	24.0	/		0	
	10	23.0	/		1	
	11	24.0	/		0	
	12	21.0	/		1	
	13	23.0	/		1	
	14	24.0	/		1	
	15	23.0	/		0	
	16	23.0	/		0	
	17	23.0	/		0	
	18	24.0	/		0	
	19	22.0	/		0	
	20	23.0	/		1	
	21	23.0	/		0	
	22	24.0	/		0	
	23	25.0	/		0	
	24	23.0	/		1	
	25	25.0	/		0	
	26	21.0	/		1	
	27	23.0	/		1	
	28	24.0	/		0	
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 3.76 g

Number of survivors: 28

Number of deformed/have difficulty swimming: 0/0

Initials: KJL, JAB, KL, EMM

Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N C	1	18.0		✓	1	Tail deformed
	2	20.5	/		0	
	3	20.5	/		1	
	4	21.0	/		1	
	5	20.0	/		0	
	6	21.0	/		0	
	7	21.5	/		0	
	8	22.0	/		0	
	9	20.0	/		0	
	10	23.5	/		0	
	11	21.8 19.5	/		0	
	12	20.5	/		0	
	13	19.5	/		1	
	14	21.0	/		1	
	15	20.5	/		0	
	16	19.5	/		0	
	17	21.0	/		0	
	18	22.5	/		0	
	19	21.8 17.5	/		1	
	20	22.5	/		0	
	21	21.0	/		0	
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.32g

Number of survivors: 21

Number of deformed/have difficulty swimming: 1/1

Initials: JAG, EMM

Reviewed by: JGU

Date Reviewed: Feb. 14/17

P047/116
113

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N ED W	1	23.5	/		0	
	2	24.0	/		0	
	3	23.0	/		0	
	4	24.5	/		0	
	5	25.0	/		0	
	6	23.0	/		0	
	7	23.0	/		0	
	8	22.5	/		0	
	9	24.0	/		0	
	10	24.5	/		0	
	11	23.0	/		0	
	12	23.0	/		0	
	13	24.0	/		0	
	14	23.5	/		0	
	15	23.5	/		0	
	16	23.0	/		0	
	17	22.0	/		0	
	18	23.0	/		0	
	19	23.5	/		0	
	20	23.0	/		0	
	21	24.0	/		0	
	22	24.0	/		0	
	23	24.0	/		0	
	24	23.0	/		0	
	25	24.5	/		0	
	26	24.5	/		0	
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 289 g

Number of survivors: 26

Number of deformed/have difficulty swimming: 0/0

Initials: VSL, JAB, KL, EMM

Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
25 mg/L NO3-N A	1	20.0		✓	0	lordosis
	2	19.5		✓	0	Two-headed
	3	18.0		✓	1	Two-headed
	4	18.0		✓	0	Two-headed, Two-bodied
	5	22.0	/		0	
	6	20.5	/		0	
	7	21.0	/		0	
	8	24.0	/		0	
	9	24.5	/		0	
	10	20.0	/		0	
	11	24.0	/		0	
	12	21.0	/		0	
	13	24.0	/		0	
	14	23.5	/		0	
	15	24.0	/		0	
	16	21.0	/		0	
	17	23.0	/		0	
	18	20-23.5	/		0	
	19	24.0	/		0	
	20	21.5	/		0	
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.37 g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 4/4
 Initials: WJL, JAB, KL, EMM
 Reviewed by: JOK

Date Reviewed: Feb. 17/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
25 mg/L NO3-N B	1	24.5		/	0	scoliosis	
	2	24.0	/		0		
	3	23.5	/		0		
	4	25.0	/		0		
	5	24.5	/		0		
	6	23.5	/		0		
	7	25.5	/		0		
	8	24.5	/		0		
	9	21.0	/		0		
	10	24.5	/		0		
	11	24.5	/		1		
	12	24.0	/		0		
	13	24.0	/		0		
	14	23.0	/		0		
	15	25.0	/		0		
	16	25.0	/		0		
	17	24.0	/		0		
	18	23.0	/		0		
	19	25.5	/		0		
	20	24.0 19.5	/		1		
	21	24.0	/		1		
	22	24.5	/		0		
	23	23.0	/		0		
	24	25.5	/		0		
	25	25.5	/		0		
	26	24.0	/		0		
	27	23.0	/		0		
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 3.78 g

Number of survivors: 27

Number of deformed/have difficulty swimming: 1/1

Initials: FLJ, JAB, H, EMM

Reviewed by: JAB

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
25 mg/L NO3-N C	1	16.0		/	1	Tail deformity	
	2	19.5		/	0	Tail deformity	
	3	18.0		/	0	Tail deformity	
	4	18.0		/	0	Tail deformity	
	5	20.0		/	0	Tail deformity	
	6	21.5		/	1	Kyphosis	
	7	24.5	/		0		
	8	22.5	/		0		
	9	22.0	/		0		
	10	24.0	/		0		
	11	21.0	/		0		
	12	21.0	/		0		
	13	22.5	/		0		
	14	23.0	/		0		
	15	21.5	/		0		
	16	22.5	/		0		
	17	24.0	/		0		
	18	22.5	/		0		
	19	20.5	/		0		
	20	20.5	/		0		
	21	22.5	/		0		
	22	21.0	/		0		
	23	22.5	/		0		
	24	23.0	/		0		
	25	24.0	/		0		
	26	24.5	/		0		
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 3.16 g

Number of survivors: 26

Number of deformed/have difficulty swimming: 6/6

Initials: WJ, JAB, H, EMM

Reviewed by: JAN

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
25 mg/L NO3-N D	1	23.0	/		0	
	2	23.5	/		0	
	3	22.5	/		0	
	4	24.0	/		0	
	5	24.0	/		0	
	6	22.5	/		0	
	7	23.0	/		0	
	8	23.5	/		0	
	9	24.0	/		0	
	10	22.0 ^u	/		0	
	11	23.55	/		0	
	12	24.0	/		0	
	13	23.5	/		0	
	14	24.0	/		0	
	15	24.0	/		0	
	16	23.5	/		0	
	17	24.0	/		0	
	18	23.5	/		0	
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.08g
 Number of survivors: 18
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, JAB, VL, EMM
 Reviewed by: Joh

Date Reviewed: Feb - 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
43 mg/L NO3-N A	1	14.0		✓	2	Two-headed, Two-bodied	
	2	18.0	/		0		
	3	22.0	/		0		
	4	21.5	/		0		
	5	22.5	/		0		
	6	19.0	/		0		
	7	22.5	/		0		
	8	22.0	/		0		
	9	21.5	/		0		
	10	22.0	/		0		
	11	21.0	/		1		
	12	21.5	/		0		
	13	22.0	/		0		
	14	21.0	/		0		
	15	22.0	/		0		
	16	21.5	/		0		
	17	22.0	/		0		
	18						
	19						
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	32						
	33						
	34						
	35						

Total Weight (pooled): 190 g

Number of survivors: 17

Number of deformed/have difficulty swimming: 1/1

Initials: KL, EMM, JAB

Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
43 mg/L NO3-N B	1	24.0	/		1	
	2	24.0	/		1	
	3	22.5	/		0	
	4	21.0	/		1	
	5	22.5	/		0	
	6	24.0	/		0	
	7	25.0	/		0	
	8	21.5	/		0	
	9	23.0	/		1	
	10	23.5	/		1	
	11	22.0	/		0	
	12	21.5	/		1	
	13	22.0	/		0	
	14	22.5	/		1	
	15	24.0	/		0	
	16	23.0	/		0	
	17	20.5	/		1	
	18	23.5	/		0	
	19	23.5	/		0	
	20	24.0	/		1	
	21	24.0	/		1	
	22	24.0	/		1	
	23	24.2.0	/		1	
	24	22.0	/		0	
	25	22.0	/		0	
26						
27						
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34						
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Total Weight (pooled): 3.21 g
 Number of survivors: 25
 Number of deformed/have difficulty swimming: 0/0
 Initials: IGL, JAB, HL, EMM
 Reviewed by: JGM

Date Reviewed: Feb. 14/17

3/24/17
113

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: EV_ER4
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
43 mg/L NO3-N C	1	16.0		✓	1	Tail Deformed
	2	18.0	/		0	
	3	20.5	/		0	
	4	21.0	/		1	
	5	20.5	/		0	
	6	21.5	/		0	
	7	17.0	/		1	
	8	19.5	/		0	
	9	20.0	/		0	
	10	20.0	/		1	
	11	21.5	/		0	
	12	20.0	/		1	
	13	19.0	/		1	
	14	20.5	/		0	
	15	19.0	/		1	
	16	21.0	/		1	
	17	21.0	/		0	
	18	21.5	/		1	
	19	19.5	/		0	
	20	19.0	/		1	
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
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	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 205 g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 1/1
 Initials: KJL, KL, JAS, EMM

Reviewed by: JGh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
43 mg/L NO3-N D	1	22.5	/		0	
	2	23.0	/		0	
	3	20.0	/		0	
	4	21.5	/		0	
	5	21.0	/		0	
	6	22.5	/		0	
	7	23.0	/		0	
	8	22.0	/		0	
	9	22.5	/		0	
	10	21.0	/		0	
	11	22.0	/		0	
	12	20.5	/		0	
	13	22.0	/		0	
	14	23.0	/		0	
	15	23.5	/		0	
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
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	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.49g

Number of survivors: 15

Number of deformed/have difficulty swimming: 06

Initials: KL, AS, M, EMM

Reviewed by: JGM

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
72 mg/L NO3-N A	1	19.0	/		0	
	2	16.0		✓	1	Two-headed
	3	20.5	/		0	
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
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	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.30g

Number of survivors: 3

Number of deformed/have difficulty swimming: 1/1

Initials: KJL, JAB, KEMM

Reviewed by: Jou

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
72 mg/L NO3-N B	1	19.5	/		1	
	2	22.0	/		0	
	3	22.5	/		0	
	4	20.5	/		0	
	5	21.0	/		1	
	6	23.5	/		0	
	7	22.0	/		1	
	8	24.0	/		0	
	9	23.5	/		1	
	10	22.0	/		0	
	11	22.5	/		0	
	12	22.0	/		0	
	13	21.0	/		1	
	14	22.0	/		0	
	15	23.5	/		0	
	16	24.0	/		0	
	17	22.0	/		1	
	18	23.0	/		0	
	19	24.0	/		0	
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.38 g

Number of survivors: 19

Number of deformed/have difficulty swimming: 0/0

Initials: KSL, JAB, K, emm

Reviewed by: JGh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
72 mg/L NO3-N C	1	20.0	/		1		
	2	20.5	/		0		
	3	20.5	/		0		
	4	19.0	/		1		
	5	19.5	/		1		
	6	19.5	/		1		
	7	19.0	/		1		
	8	20.5	/		0		
	9	19.5	/		1		
	10	19.5	/		0		
	11	19.0	/		0		
	12	20.5	/		1		
	13	19.0	/		1		
	14	17.0	/		1		
	15	19.0	/		0		
	16	20.5	/		0		
	17	20.0	/		1		
	18	19.0	/		0		
	19	21.0	/		0		
	20	21.0	/		1		
	21	22.0	/		0		
	22	17.0			✓	1	Tail deformity
	23	17.0			✓	0	Tail deformity
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 2.25 g

Number of survivors: 23

Number of deformed/have difficulty swimming: 2/2

Initials: KSL, JAR, M, GMM

Reviewed by: JGh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: EV_ER4

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
72 mg/L NO3-N D	1	22.0	/		0	
	2	20.5	/		0	
	3	22.0	/		0	
	4	21.0	/		0	
	5	20.0	/		0	
	6	20.5	/		0	
	7	21.0	/		0	
	8	21.0	/		0	
	9	22.0	/		0	
	10	22.0	/		0	
	11	19.5	/		0	
	12	22.0	/		0	
	13	21.0	/		0	
	14	21.0	/		0	
	15	22.0	/		0	
	16	21.5 21.5	/		0	
	17	21.5	/		0	
	18	21.0	/		0	
	19	20.0	/		0	
	20	20.5	/		0	
	21	21.0	/		0	
	22	21.0	/		0	
	23	20.5	/		0	
24						
25						
26						
27						
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30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.27g

Number of survivors: 23

Number of deformed/have difficulty swimming: 0/0

Initials: KSL, JAB, K, GMM

Reviewed by: JOK

Date Reviewed: Feb - 14/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended A	1	21.0	/		1		
	2	19.0	/		0		
	3	24.0	/		0		
	4	22.0	/		0		
	5	22.0	/		0		
	6	21.0	/		0		
	7	21.5	/		0		
	8	21.5	/		0		
	9	21.0	/		0		
	10	21.0	/		0		
	11	23.0	/		0		
	12	22.0	/		0		
	13						
	14						
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	32						
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	34						
	35						

Total Weight (pooled): 1.23g

Number of survivors: 12

Number of deformed/have difficulty swimming: 0/0

Initials: KJ, LL, JAB, ENM

Reviewed by: JOK

Date Reviewed: Feb. 19/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended B	1	21.0	/		0	
	2	22.0	/		0	
	3	23.0	/		0	
	4	23.5	/		0	
	5	23.0	/		0	
	6	22.5 23.5	/		1	
	7	23.5	/		0	
	8	23.0	/		0	
	9	21.0	/		1	
	10	22.5	/		0	
	11	24.0	/		0	
	12	22.5	/		0	
	13	24.0	/		1	
	14	24.0	/		0	
	15	21.0	/		0	
	16	24.0	/		0	
	17	23.0	/		0	
	18	22.5	/		1	
	19	22.5	/		0	
	20	23.5	/		0	
	21	24.0	/		0	
	22	22.0	/		0	
23						
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32						
33						
34						
35						

Total Weight (pooled): 2.57g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 0/0
 Initials: ESL, KL, JHB, EDM
 Reviewed by: Jou

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended C	1	22.0	/		0		
	2	21.0	/		1		
	3	22.0	/		1		
	4	21.0	/		0		
	5	22.0	/		0		
	6	21.5	/		0		
	7	23.0	/		0		
	8	21.0	/		0		
	9	22.0	/		0		
	10	19.5	/		0		
	11	23.0	/		0		
	12	21.5	/		0		
	13	20.0	/		1		
	14	19.5	/		1		
	15	20.0	/		0		
	16	20.0	/		0		
	17	23.0	/		0		
	18	22.0	/		0		
	19	20.5	/		0		
	20						
	21						
	22						
	23						
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	25						
	26						
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	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 2.26g
 Number of survivors: 19
 Number of deformed/have difficulty swimming: 0/6
 Initials: KSL, KL, JAB, EMM
 Reviewed by: JKH

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended D	1	20.5	/		0	
	2	20.0	/		0	
	3	21.5	/		0	
	4	21.0	/		0	
	5	21.0	/		0	
	6	21.5	/		0	
	7	20.5	/		0	
	8	22.0	/		0	
	9	22.5	/		0	
	10	23.0	/		0	
	11	22.5	/		0	
	12	22.0	/		0	
	13	23.0	/		0	
	14	22.0	/		0	
	15	22.5	/		0	
	16	22.0	/		0	
	17	23.5	/		0	
	18	22.5	/		0	
	19	22.5	/		0	
	20	23.0	/		0	
	21	23.0	/		0	
	22	22.0	/		0	
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.18 g
 Number of survivors: 22
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, KJAG, EMM
 Reviewed by: JGH

Date Reviewed: Feb - 14 / 17

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Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
14 mg/L NO3-N A	1	21.0	/		0	
	2	20.0	/		0	
	3	22.0	/		0	
	4	23.0	/		0	
	5	21.0	/		0	
	6	21.0	/		1	
	7	21.0	/		0	
	8	22.5	/		0	
	9	22.0	/		0	
	10	21.0	/		0	
	11	22.5	/		0	
	12	19.5	/		1	
	13	22.0	/		0	
	14	21.5	/		0	
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35						

Total Weight (pooled): 1.46g
Number of survivors: 14
Number of deformed/have difficulty swimming: 0/0
Initials: KSL, JAB, KL, EMM
Reviewed by: JAW

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
14 mg/L NO3-N B	1	23.0	/		0	
	2	23.5	/		0	
	3	22.5	/		0	
	4	23.0	/		0	
	5	24.0	/		0	
	6	23.0	/		0	
	7	24.0	/		0	
	8	23.0	/		0	
	9	22.0	/		1	
	10	21.0	/		0	
	11	25.0	/		0	
	12	25.0	/		0	
	13	24.0	/		0	
	14	22.5	/		0	
	15	24.5	/		0	
	16	23.0	/		0	
	17	24.0	/		0	
	18	24.0	/		0	
	19	24.0	/		0	
	20	24.5	/		0	
	21	22.5	/		0	
	22	21.0	/		1	
	23	24.0	/		0	
	24	22.5	/		0	
	25	23.5	/		0	
	26	25.0	/		0	
	27	24.5	/		1	
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 3.42 g
 Number of survivors: 27
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL/AB, KL, CMH
 Reviewed by: JGU

Date Reviewed: Febr. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
14 mg/L NO3-N C	1	18.0		✓	0	Tail deformity	
	2	17.5		✓	0	Tail deformity	
	3	20.5	✓		0		
	4	22.0	✓		1		
	5	21.0	✓		0		
	6	21.0	✓		0		
	7	19.0	✓		1		
	8	20.0	✓		0		
	9	21.5	✓		0		
	10	21.0	✓		0		
	11	20.0	✓		0		
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						
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	33						
	34						
	35						

Total Weight (pooled): 1.14 g

Number of survivors: 11

Number of deformed/have difficulty swimming: 2/2

Initials: KSL, RL, JAB, Emm

Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
14 mg/L NO3-N D	1	23.0	/		0	
	2	21.0	/		0	
	3	20.0	/		0	
	4	22.0	/		0	
	5	23.5	/		0	
	6	23.0	/		0	
	7	23.5	/		0	
	8	22.0	/		0	
	9	22.5	/		0	
	10	21.5	/		0	
	11	24.0	/		0	
	12	23.0	/		0	
	13	23.0	/		0	
	14	23.0	/		0	
	15	22.5	/		0	
	16	24.0	/		0	
	17	22.5	/		0	
	18	22.0	/		0	
	19	22.0	/		0	
	20	22.5	/		0	
	21	23.0	/		0	
	22	21.5	/		0	
	23	20.0	/		0	
	24	24.0	/		0	
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.45 g
 Number of survivors: 24
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, JAB, M, EMM
 Reviewed by: JG

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
20 mg/L NO3-N A	1	22.0	/		0		
	2	22.5	/		0		
	3	22.0	/		0		
	4	20.0	/		0		
	5	21.0	/		1		
	6	21.0	/		0		
	7	22.0	/		0		
	8	22.0	/		0		
	9	21.0	/		0		
	10	22.0	/		1		
	11	20.5	/		0		
	12	22.0	/		0		
	13						
	14						
	15						
	16						
	17						
	18						
	19						
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	21						
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	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 1.27 g
 Number of survivors: 12
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, JAS, KL, EMM
 Reviewed by: JLH

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
20 mg/L NO3-N B	1	24.0	/		0	
	2	24.5	/		1	
	3	25.0	/		0	
	4	25.5	/		0	
	5	24.5	/		0	
	6	24.5	/		0	
	7	24.0	/		1	
	8	25.0	/		0	
	9	26.0	/		0	
	10	25.0	/		0	
	11	23.0	/		1	
	12	24.5	/		0	
	13	25.0	/		0	
	14	24.5	/		0	
	15	24.0	/		0	
	16	24.0	/		0	
	17	24.5	/		0	
	18	23.0	/		1	
	19	24.0	/		0	
	20	22.0	/		0	
	21	24.5	/		0	
	22	25.5	/		1	
	23	24.0	/		0	
	24	24.5	/		0	
25						
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35						

Total Weight (pooled): 3.28 g
 Number of survivors: 24
 Number of deformed/have difficulty swimming: 0/0
 Initials: KJL, JAS, KL, GMM
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
20 mg/L NO3-N C	1	19.0		✓	1	Tail deformity
	2	22.0	/		0	
	3	21.0	/		0	
	4	23.0	/		0	
	5	22.5	✓		0	
	6	21.5	/		0	
	7	w/ 19.5	/		0	
	8	20.0	/		0	
	9	20.5	/		1	
	10	21.0	/		0	
	11	20.5	/		0	
	12	22.0	/		1	
	13	20.5	/		1	
	14	21.0	/		0	
	15	20.5	/		1	
	16	21.0	/		0	
	17	21.0	/		0	
	18	22.0	/		0	
	19	20.5	/		1	
	20	21.0	/		1	
	21	19.5	/		0	
	22	21.5	/		0	
23						
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33						
34						
35						

Total Weight (pooled): 2.54 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 1/1

Initials: KJL, JAB, KL, EMM

Reviewed by: JGK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
20 mg/L NO3-N 0	1	22.5	/		0	
	2	22.0 21.0	/		0	
	3	21.0	/		0	
	4	23.0	/		0	
	5	22.0	/		0	
	6	24.0	/		0	
	7	23.5	/		0	
	8	22.5	/		0	
	9	23.0	/		0	
	10	24.0	/		0	
	11	24.0	/		0	
	12	23.0	/		0	
	13	22.0	/		0	
	14	22.0	/		0	
	15	22.5 23.5	/		0	
	16	23.5	/		0	
	17	24.0	/		0	
	18	23.0	/		0	
	19	20.0	/		0	
	20	20.0	/		0	
	21	20.0 21.0	/		0	
	22	24.0	/		0	
	23	23.0	/		0	
	24	22.5	/		0	
	25	22.5	/		0	
	26	22.5	/		0	
27						
28						
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34						
35						

Total Weight (pooled): 2.70 g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 0/0
 Initials: KJL, JAB, KLEMM
 Reviewed by: Joh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
Sample ID: GH_FR1
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
27 mg/L NO3-N A	1	20.0	/		0	
	2	19.0	/		1	
	3	22.0	/		0	
	4	22.0	/		0	
	5	19.0	/		1	
	6	20.5	/		1	
	7	19.5	/		1	
	8					
	9					
	10					
	11					
	12					
	13					
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	34					
	35					

Total Weight (pooled): 0.75g
Number of survivors: 7
Number of deformed/have difficulty swimming: 0%
Initials: WJ, JAB, H, CMM
Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
27 mg/L NO3-N B	1	24.0	/		0	
	2	25.0	/		1	
	3	25.0	/		0	
	4	25.5	/		0	
	5	25.0	/		1	
	6	23.0	/		1	
	7	24.0	/		1	
	8	23.0	/		0	
	9	23.0	/		0	
	10	23.0	/		1	
	11	24.0	/		1	
	12	24.5	/		0	
	13	23.0	/		0	
	14	23.0	/		1	
	15	22.5	/		0	
	16	25.0	/		0	
	17	23.0	/		1	
	18	24.0	/		1	
	19	24.0	/		1	
	20	26.0	/		0	
	21	25.0	/		0	
	22	24.0	/		0	
	23	23.0	/		0	
	24	24.0	/		0	
	25	24.5	/		0	
	26	25.0	/		0	
	27	23.0	/		0	
	28	25.0	/		0	
	29	24.5	/		0	
		30				
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ~~1.83~~ 3.99 g
 Number of survivors: 29
 Number of deformed/have difficulty swimming: 0 %
 Initials: IGL, JAB, KL, EMM
 Reviewed by: Joh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
27 mg/L NO3-N C	1	20.0	/		0	
	2	19.5	/		1	
	3	20.0	/		0	
	4	21.0	/		0	
	5	20.5	/		0	
	6	22.0	/		0	
	7	22.0	/		1	
	8	21.0	/		0	
	9	22.0	/		0	
	10	22.5	/		0	
	11	20.5	/		0	
	12	23.0	/		1	
	13	22.0	/		0	
	14	21.0	/		0	
	15	22.5	/		0	
	16	22.0	/		0	
	17	21.5	/		0	
	18	22.0	/		0	
	19	18.5	/		1	
	20	18.0	/		2	
	21	21.0	/		1	
	22	18.0			✓	0
23						
24						
25						
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27						
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31						
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33						
34						
35						

Total Weight (pooled): 239 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 2/22 = 11%

Initials: KJL, JAB, KL, EMM

Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
27 mg/L NO3-N D	1	21.0	/		0	
	2	21.5	/		0	
	3	22.0	/		0	
	4	22.0	/		0	
	5	21.0	/		0	
	6	22.5	/		0	
	7	22.0	/		0	
	8	20.5	/		0	
	9	21.0	/		0	
	10	21.0	/		0	
	11	21.0	/		0	
	12	22.0	/		0	
	13	21.5	/		0	
	14	19.5	/		0	
	15	21.0	/		0	
	16	21.0	/		0	
	17	22.0	/		0	
	18	22.0	/		0	
	19					
	20					
	21					
	22					
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	25					
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	27					
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	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 1.69g
 Number of survivors: 18
 Number of deformed/have difficulty swimming: 0/0
 Initials: PSL, JAB, K, EMM
 Reviewed by: JGK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
38 mg/L NO3-N A	1	22.0	/		0		
	2	20.5	/		0		
	3	19.5	/		1		
	4	19.0	/		0		
	5	20.5	/		1		
	6	20.0	/		0		
	7	20.0	/		1		
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
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	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 0.620-0.72g

Number of survivors: 7

Number of deformed/have difficulty swimming: 0/0

Initials: KJL, JAS, VL, EMM

Reviewed by: Jon

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
38 mg/L NO3-N B	1	20.0	/		1	
	2	21.0	/		0	
	3	21.0	/		1	
	4	21.5	/		1	
	5	21.0	/		0	
	6	21.0	/		1	
	7	21.0	/		1	
	8	23.0	/		1	
	9	20.5	/		1	
	10	22.5	/		1	
	11	24.0	/		1	
	12	22.0	/		0	
	13	22.5	/		1	
	14	22.0	/		0	
	15	21.0	nx	/	2	Yolk sac edema
	16	22.0		/	2	Yolk sac edema
	17	21.0		/	2	Yolk sac edema
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 2.08 g
 Number of survivors: 17
 Number of deformed/have difficulty swimming: 3/3
 Initials: KSL, JAB, K, BMM
 Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
38 mg/L NO3-N C	1	16.0		/	1	Tail deformity	
	2	16.0		/	1	Tail deformity	
	3	16.0		/	2	Tail deformity; yolk sac edema	
	4	21.0	/		0		
	5	21.0	/		0		
	6	20.0	/		1		
	7	19.5	/		1		
	8	19.5	/		0		
	9	20.5	/		0		
	10	21.0	/		0		
	11	19.0	/		0		
	12	19.5	/		1		
	13	21.0	/		0		
	14	19.0	/		1		
	15	19.0	/		1		
	16	19.0	/		0		
	17	19.0	/		1		
	18	21.0	/		0		
	19	20.0	/		1		
	20	20.0	/		0		
	21	21.0	/		0		
	22	20.5	/		0		
	23	20.5	/		0		
	24						
	25						
	26						
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	29						
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	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 2.32 g
 Number of survivors: 23
 Number of deformed/have difficulty swimming: n of 313
 Initials: KSL, JAB, KL, EMM
 Reviewed by: JOU

Date Reviewed: Feb. 14/17

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43

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
38 mg/L NO3-N D	1	22.0	/		0	
	2	23.0	/		0	
	3	22.0	/		0	
	4	21.5	/		0	
	5	22.0	/		0	
	6	21.5	/		0	
	7	24.0	/		0	
	8	24.0	/		0	
	9	23.0	/		0	
	10	22.5	/		0	
	11	24.0	/		0	
	12	22.0	/		0	
	13	22.0	/		0	
	14	20.5	/		0	
	15	23.0	/		0	
	16	22.0	/		0	
	17	22.0 22.0	/		0	
	18	22.0	/		0	
	19	23.0	/		0	
	20	22.5	/		0	
	21	23.5	/		0	
	22	22.5	/		0	
23						
24						
25						
26						
27						
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31						
32						
33						
34						
35						

Total Weight (pooled): 215 g

Number of survivors: 22

Number of deformed/have difficulty swimming: 0/0

Initials: BJ, JAS, KL, EMM

Reviewed by: Joh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
54 mg/L NO3-N A	1	16.0		✓	0	Two-headed, Two-bodies	
	2	18.5 19.5	✓		1		
	3	20.5	✓		1		
	4	20.5	✓		0		
	5	21.0	✓		0		
	6						
	7						
	8						
	9						
	10						
	11						
	12						
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	33						
	34						
	35						

Total Weight (pooled): 0.49 g
 Number of survivors: 5
 Number of deformed/have difficulty swimming: 1/1
 Initials: KSL, JAB, HL, EMM
 Reviewed by: Joh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
54 mg/L NO3-N B	1	22.0	/		0	
	2	21.0	/		0	
	3	23.0	/		0	
	4	22.5	/		0	
	5	20.5	/		1	
	6	23.5	/		1	
	7	22.0	/		1	
	8	20.5	/		0	
	9	21.0	/		0	
	10	21.0	/		0	
	11	22.0	/		0	
	12	22.5	/		0	
	13	21.0	/		0	
	14	23.5	/		1	
	15	22.0	/		0	
	16	21.0	/		1	
	17	20.5	/		1	
	18	20.23.0	/		0	
	19	19.5	/		2	
	20	22.0	/		0	
	21	22.0	/		0	
	22	22.0	/		1	
	23	21.0	/		0	
	24	23.5	/		0	
	25	22.0	/		1	
	26	24.5	/		0	
27						
28						
29						
30						
31						
32						
33						
34						
35						

Total Weight (pooled): 2.99 g
 Number of survivors: 26
 Number of deformed/have difficulty swimming: 2 7.7%
 Initials: KJL, JAB, K, EMM
 Reviewed by: JOL

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
54 mg/L NO3-N C	1	20.0	/		1		
	2	21.0	/		0		
	3	21.0	/		0		
	4	18.5	/		1		
	5	19.0	/		1		
	6	20.0 22.5	/		0		
	7	19.0	/		2		
	8	20.0	/		1		
	9	20.0	/		0		
	10	17.0	/		1		
	11	20.0	/		0		
	12	19.5			✓	2	Tail deformity
	13	17.0	/			2	
	14	19.0	/			1	
	15	19.5	/			0	
	16	18.0	/			0	
	17	19.0	/			0	
	18	19.0	/			1	
	19	18.0	/			1	
	20	20.0	/			0	
21							
22							
23							
24							
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31							
32							
33							
34							
35							

Total Weight (pooled): 1.58 g
 Number of survivors: 20
 Number of deformed/have difficulty swimming: 1/1
 Initials: KJ, KL, EMM, JAB
 Reviewed by: Jou

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
54 mg/L NO3-N D	1	18.0		✓	0	Tail deformity	
	2	18.5		✓	0	Tail deformity	
	3	19.0	//		0		
	4	19.5	//		0		
	5	20.0	//		0		
	6	18.0	//		1		
	7	17.5	//		0		
	8	19.0	//		0		
	9	19.0	//		0		
	10	20.5	//		0		
	11	19.0	//		0		
	12	19.5	//		0		
	13	19.5	//		0		
	14	19.5	//		0		
	15	19.5	//		0		
	16	18.0	//		0		
	17						
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	34						
	35						

Total Weight (pooled): 1.29 g

Number of survivors: 16

Number of deformed/have difficulty swimming: 2th 2/2

Initials: KSL, JAB, M, EMM

Reviewed by: JAB

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
75 mg/L NO3-N A	1	21.0	/		1	
	2	20.5	/		1	
	3	20.0	/		1	
	4	20.5	/		0	
	5	20.5	/		1	
	6	21.0	/		0	
	7	20.5	/		1	
	8	20.5	/		1	
	9	20.5	/		1	
	10	22.0	/		0	
	11	22.0	/		1	
	12	22.0	/		0	
	13	21.0	/		0	
	14	22.0	/		1	
	15					
	16					
	17					
	18					
	19					
	20					
	21					
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	32					
	33					
	34					
	35					

Total Weight (pooled): 1.72 g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 0/0

Initials: SL, JAB, KJ, GMM

Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
75 mg/L NO3-N B	1	16.0		✓	1	Fail deformity
	2	18.0		✓	1	Fail deformity
	3	16.0	/		1	
	4	19.0	/		1	
	5	18.0	/		1	
	6	18.0	/		0	
	7	18.0	/		1	
	8	18.0	/		1	
	9	18.0	/		1	
	10	18.0	/		1	
	11	19.0	/		1	
	12	16.5	/		2	
	13	16.5	/		2	
	14	17.0	/		1	
	15	17.5	/		1	
	16	16.5	/		2	
	17					
	18					
	19					
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	35					

Total Weight (pooled): 1.47g

Number of survivors: 16

Number of deformed/have difficulty swimming: 2/2

Initials: KSL, JAB, EMM, JL

Reviewed by: JGU

Date Reviewed: Feb. 14/17

**Alevin Test Data Sheet
Deformities**

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
75 mg/L NO3-N C	1	17.0	✓		2	
	2	16.5	✓		0	
	3					
	4					
	5					
	6					
	7					
	8					
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Total Weight (pooled): 0.13 g

Number of survivors: 2

Number of deformed/have difficulty swimming: 0/0

Initials: KSLJAB, KJ, EMM

Reviewed by: Joh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
75 mg/L NO3-N D	1	18.0	/		0		
	2	17.5	/		1		
	3	21.0	/		0		
	4	20.0	/		0		
	5	20.0	/		0		
	6	20.5	/		0		
	7	19.0	/		0		
	8	19.5	/		1		
	9	19.0	/		1		
	10	19.5	/		0		
	11	19.0	/		0		
	12	20.0	/		0		
	13	19.0	/		0		
	14	20.0	/		0		
	15	18.5	/		0		
	16	19.5	/		0		
	17	18.5	/		0		
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Total Weight (pooled): 1.54 g
 Number of survivors: 17
 Number of deformed/have difficulty swimming: 0/0
 Initials: JGL, XCL, JAB, EMM
 Reviewed by: JGL

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1-HH
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended A	1	21.0	/		1		
	2	21.5	/		0		
	3	23.0	/		1		
	4	22.5	/		0		
	5						
	6						
	7						
	8						
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Total Weight (pooled): 0.48 g
Number of survivors: 4
Number of deformed/have difficulty swimming: 0/0
Initials: BJWAB, KJ, GMM
Reviewed by: Joh

Date Reviewed: Feb. 19/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended B	1	21.0	/		1	
	2	22.0	/		1	
	3	21.0	/		0	
	4	22.0	/		0	
	5	22.0	/		1	
	6	22.5	/		0	
	7	20.0	/		1	
	8	21.0	/		1	
	9	21.0	/		1	
	10					
	11					
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Total Weight (pooled): 1.19g

Number of survivors: 9

Number of deformed/have difficulty swimming: 0/0

Initials: ESL, JAB, JL, EMM

Reviewed by: Joh

Date Reviewed: Feb. 14/17

12/10/16

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1-HH
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
unamended C	1	22.0	/		0		
	2	21.0	/		0		
	3	22.0	/		0		
	4	23.0	/		0		
	5	19.5	/		1		
	6	22.0	/		0		
	7	22.0	/		0		
	8	21.0	/		1		
	9	19.0	/		1		
	10	22.0	/		0		
	11	23.0	/		0		
	12	21.0	/		0		
	13	21.5	/		0		
	14	21.5	/		0		
	15	21.5	/		0		
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Total Weight (pooled): 1.67g
Number of survivors: 15
Number of deformed/have difficulty swimming: 0/0
Initials: KJL, L, GMM, JAB
Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
unamended D	1	19.5	/		0	
	2	22.5	/		0	
	3	22.0	/		0	
	4	23.0	/		0	
	5	23.0	/		0	
	6	22.0	/		0	
	7	23.0	/		0	
	8	23.0	/		0	
	9	23.0	/		0	
	10	21.5	/		0	
	11	21.0	/		0	
	12	24.0	/		0	
	13	22.0	/		0	
	14					
	15					
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	35					

Total Weight (pooled): 1.36 g
 Number of survivors: 13
 Number of deformed/have difficulty swimming: 0/0
 Initials: ESL, JAB, KL, EMM
 Reviewed by: JGK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N A	1	21.0	/		0	
	2	22.0	/		0	
	3	20.5	/		0	
	4	21.0	/		0	
	5	22.0	/		0	
	6	21.5	/		0	
	7	19.5	/		1	
	8	21.0	/		0	
	9	21.5	/		0	
	10	21.5	/		0	
	11	19.5	/		0	
	12	21.0	/		0	
	13	21.0	/		0	
	14	21.0	/		0	
	15					
	16					
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	35					

Total Weight (pooled): 1.43 g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 0 %
 Initials: KJ, JAB, K, EMN
 Reviewed by: Jon

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
15 mg/L NO3-N B	1	16.5	/		0		
	2	20.5	/		1		
	3	21.0	/		1		
	4	20.5	/		0		
	5	20.5	/		0		
	6	19.0 19.0	/		1		
	7	21.0	/		0		
	8	20.0	/		2		
	9	19.5	/		1		
	10	20.0	/		1		
	11	16.5			✓	1	Tail deformity
	12						
	13						
	14						
	15						
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Total Weight (pooled): 1.28g
 Number of survivors: 11
 Number of deformed/have difficulty swimming: 1/1
 Initials: KSL, JAB, PL, EMM
 Reviewed by: JGH

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
15 mg/L NO3-N C	1	24.0	/		0		
	2	24.0	/		1		
	3	21.0	/		1		
	4	22.0	/		1		
	5	21.5	/		1		
	6	23.0	/		0		
	7	22.0	/		1		
	8	21.5	/		1		
	9						
	10						
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Total Weight (pooled): 1.06 g

Number of survivors: 8

Number of deformed/have difficulty swimming: 0/8

Initials: KL, JAB, K, EMM

Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
15 mg/L NO3-N D	1	20.0	-		1	
	2	20.5	-		0	
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
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	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.19 g

Number of survivors: 2

Number of deformed/have difficulty swimming: 0/0

Initials: ESL, JAB, KJ, EMM

Reviewed by: JOB

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
23 mg/L NO3-N A	1	21.0	/		1		
	2	21.0	/		0		
	3	22.5	/		0		
	4	22.0	/		1		
	5	20.5	/		0		
	6	20.5	/		1		
	7	16.0	/		3		
	8	19.5	/		2		
	9	21.0	/		0		
	10	22.20.5	/		1		
	11						
	12						
	13						
	14						
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	33						
	34						
	35						

Total Weight (pooled): 1.14 g
 Number of survivors: 10
 Number of deformed/have difficulty swimming: 0/0
 Initials: KJL, JAB, KL, EMM
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
23 mg/L NO3-N B	1	21.0	/		0		
	2	22.0	/		1		
	3	22.0	/		0		
	4	22.0 18.0	/	✓	1	Two-bodies, Two-heads	
	5	22.0	/		1		
	6	23.0	/		1		
	7	21.0	/		0		
	8	22.0	/		0		
	9						
	10						
	11						
	12						
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Total Weight (pooled): 100 g
 Number of survivors: 8
 Number of deformed/have difficulty swimming: 1/1
 Initials: KS, RL, GMM, JAB
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
23 mg/L NO3-N C	1	22.0	/		0	
	2	19.5	/		0	
	3	19.5	/		0	
	4	21.0	/		0	
	5	20.0	/		1	
	6	20.5	/		0	
	7	19.0	/		0	
	8	20.5	/		0	
	9	20.5	/		0	
	10	21.0	/		0	
	11	20.0	/		0	
	12	19.5	/		0	
	13	19.5	/		0	
	14					
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	35					

Total Weight (pooled): 1.3 1.23 g

Number of survivors: 13

Number of deformed/have difficulty swimming: 0/0

Initials: KJL, JAB, HL, EMM

Reviewed by: JCh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
23 mg/L NO3-N D	1	20.0	—		1		
	2	19.5	—		0		
	3	20.5	—		2		
	4	20.0	—		1		
	5	19.0	—		1		
	6	19.5	—		0		
	7	20.0	—		1		
	8	20.0 18.0	—		1		
	9	18.5	—		0		
	10	17.0			✓	2	Tail deformity
	11						
	12						
	13						
	14						
	15						
	16						
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Total Weight (pooled): 0.96 g
 Number of survivors: 10
 Number of deformed/have difficulty swimming: 1/1
 Initials: KSL, HL, Emm, JAB
 Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet Deformities

Client: Teck
Sample ID: GH_FR1-HH
Work Order No.: 161183

Start Date: November 1, 2016
Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
34 mg/L NO3-N B	1	21.0	/		0	
	2	20.5	/		1	
	3	18.0	/		1	
	4	18.5	/		0	
	5	19.5	/		0	
	6	19.5	/		1	
	7	20.5	/		1	
	8	19.5	/		1	
	9	20.5	/		1	
	10	20.0	/		1	
	11	18.0	/		2	
	12	19.0	/		2	
	13	18.5	/		1	
	14	20.5	/		2	
	15	21.0	/		1	
	16					
	17					
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	33					
	34					
	35					

Total Weight (pooled): 1.56 g
Number of survivors: 15
Number of deformed/have difficulty swimming: 0/0
Initials: KJL, KL, EMM, JAB
Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
34 mg/L NO3-N C	1	20.0	/		0		
	2	17.0	/		1		
	3	20.5	/		0		
	4	18.0	/		1		
	5	18.5	/		0		
	6	19.0	/		1		
	7	17.5	/		2		
	8	15.0	/		3		
	9	19.5	/		1		
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Total Weight (pooled): 0.94 g

Number of survivors: 9

Number of deformed/have difficulty swimming: 0/0

Initials: KSL, JAB, M, EMM

Reviewed by: JBL

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
34 mg/L NO3-N D	1	19.0	/		0	
	2	19.5	/		0	
	3	18.5	/		0	
	4	19.5	/		1	
	5	19.5	/		0	
	6	16.5	/		1	
	7	19.0	/		0	
	8	19.0	/		2	
	9	16.0	/		1	
	10	16.5	/		1	
	11	17.0	/		0	
	12	20.0	/		0	
	13	19.5	/		1	
	14	19.5	/		1	
	15	19.5	/		1	
	16	17.0	/		1	
	17	19.0	/		1	
	18					
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	35					

Total Weight (pooled): 1.47 g
 Number of survivors: 17
 Number of deformed/have difficulty swimming: 0/0
 Initials: SLJAB, KL, CMM
 Reviewed by: JGh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
51 mg/L NO3-N A	1	20.5	/		1		
	2	19.0	/		2		
	3	19.0	/		2		
	4	19.0	/		1		
	5	19.5	/		2		
	6	19.5	/		1		
	7	19.0	/		2		
	8	19.0	/		1		
	9	18.5	/		2		
	10	20.0			✓	1	Scaliosis
	11	19.5	/			2	
	12	19.5	/			1	
	13	19.5	/			1	
	14	19.0	/			1	
	15						
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Total Weight (pooled): 1.46 g
 Number of survivors: 14
 Number of deformed/have difficulty swimming: 1/1
 Initials: KSL, JAB, K. Emm
 Reviewed by: JGK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
51 mg/L NO3-N B	1	16.0	—		2		
	2	19.5	—		1		
	3	17.0	—		1		
	4	18.0	—		1		
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
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	16						
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	31						
	32						
	33						
	34						
	35						

Total Weight (pooled): 0.39g
 Number of survivors: 4
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, JAB, KL, EMM
 Reviewed by: Joh

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
51 mg/L NO3-N C	1	17.0	-		1	
	2	16.0	-		2	
	3	16.5	-		1	
	4	15.0	-		1	
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
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	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.31g
 Number of survivors: 4
 Number of deformed/have difficulty swimming: 0/0
 Initials: WJ, JPB, U, EMM
 Reviewed by: JGU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
51 mg/L NO3-N D	1	18.5	/		1	Fail deformity KJL
	2	19.5	/		0	fail deformity
	3	20.5	/		0	
	4	19.0	/		0	
	5	20.0	/		0	
	6	19.5	/		1	
	7	17.0	/		1	
	8	19.5	/		0	
	9	16.0	/		1	
	10	19.5	/		0	
	11	16.0	/		1	
	12					
	13					
	14					
	15					
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	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): 0.88 g
 Number of survivors: 11
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, JAB, KL, EMM
 Reviewed by: JOK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
76 mg/L NO3-N A	1	21.0	0/	Xu	1	
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
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	32					
	33					
	34					
	35					

Total Weight (pooled): 0.10 g
 Number of survivors: 1
 Number of deformed/have difficulty swimming: 0/6
 Initials: KSL, JAB, M, ZMM
 Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
76 mg/L NO3-N KJC C	1	19.0	/		0	
	2	19.5	/		0	
	3	17.0	/		1	
	4	19.0	/		0	
	5	19.5	/		0	
	6	19.5	/		0	
	7	19.0	/		1	
	8	19.0	/		0	
	9	19.5	/		0	
	10	18.5	/		1	
	11	19.5	/		0	
	12	19.5	/		1	
	13	20.0	/		0	
	14	16.0	/		0	
	15	21.0	/		1	
	16	18.0	/		1	
	17	19.0	/		0	
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Total Weight (pooled): 1.38g
 Number of survivors: 17
 Number of deformed/have difficulty swimming: 0/10
 Initials: KJC, JAB, KL, EMM
 Reviewed by: JGC

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
76 mg/L NO3-N D	1	16.0		✓	1	Tail Deformity	
	2	19.0		✓	1	Tail Deformity	
	3	17.0	/		1		
	4	16.0	/		0		
	5	17.5	/		0		
	6	19.0	/		1		
	7	18.0	/		1		
	8						
	9						
	10						
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Total Weight (pooled): 0.65 g

Number of survivors: 7

Number of deformed/have difficulty swimming: 2/2

Initials: KJL, EMM, JAB

Reviewed by: JCH

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments
114 mg/L NO3-N A	1	17.0	—		1	
	2	18.0 _{em}	—		1	
	3	17.0	—		0	
	4	19.0	—		1	
	5	17.5	—		1	
	6	21.0			X	
	7	18.0			X	
	8	20.0			X	
	9	18.0			X	
	10	19.0			X	
	11	20.0			X	
	12					
	13					
	14					
	15					
	16					
	17					
	18					
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	31					
	32					
	33					
	34					
	35					

Total Weight (pooled): ^{P/L} ~~0.107~~ 0.52 g

Number of survivors: 5

Number of deformed/have difficulty swimming: 0/0

Initials: KL, JAB, KL, EMM

Reviewed by: JGA

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
114 mg/L NO3-N B	1	21.0	/		1		
	2	18.0	/		2		
	3	20.0	/		2		
	4	18.0	/		1		
	5	19.0	/		1		
	6	20.0	/		1		
	7						
	8						
	9						
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	35						

Total Weight (pooled): 0.49 g

Number of survivors: _____

Number of deformed/have difficulty swimming: 0/0

Initials: KSL, JAB, KL, EMM

Reviewed by: JOU

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck
 Sample ID: GH_FR1-HH
 Work Order No.: 161183

Start Date: November 1, 2016
 Termination Date: December 9, 2016

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
114 mg/L NO3-N C	1	19.5	/		0		
	2	18.0	//		0		
	3	19.0	//		1		
	4	19.5	//		0		
	5	19.0	/		1		
	6						
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	35						

Total Weight (pooled): 0.44g
 Number of survivors: 5
 Number of deformed/have difficulty swimming: 0/0
 Initials: KSL, EMM, JAB, JL
 Reviewed by: JGK

Date Reviewed: Feb. 14/17

Alevin Test Data Sheet
Deformities

Client: Teck

Start Date: November 1, 2016

Sample ID: GH_FR1-HH

Termination Date: December 9, 2016

Work Order No.: 161183

Treatment and Replicate	Fish	Length (mm)	Normal	Abnormal	Yolk sac score	Comments	
114 mg/L NO3-N D	1	16.0		✓	1	Growth on yolk sac; scoliosis	
	2	18.0	✓		1		
	3	17.0	✓		1		
	4	16.0	✓		1		
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
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	33						
	34						
	35						

Total Weight (pooled): 0.37g

Number of survivors: 4

Number of deformed/have difficulty swimming: 1/1

Initials: KSL, JAB, KL, EMM

Reviewed by: JGH

Date Reviewed: Feb. 14/17

Rainbow Trout Embryo-Alevin-Swimup Toxicity Test

Client: Teck
WO#: 161183

Test Initiation Date: November 1, 2016
Test Termination Date: December 9, 2016

Test Conc. (mg/L NO3-N)	Rep	Mortality Counts				Total Dead	Alevin	Swimup	Total No. fish	Total No. Exposed	Survival	Swimup					
		Day 1 - 12	Day 13 - 24	Day 25 - 36	Day 37 - 38							Mean	SD	Mean	SD		
Lab Control	Control	1	2	6	2	0	10	3	16	19	29	65.5			84.2		
	2*	0	19	1	0	20	8	0	8	28	28.6			0.0			
	3*	2	0	4	0	6	24	0	24	30	80.0	Mean	SD	0.0	Mean	SD	
	4	0	1	0	1	2	0	28	28	30	93.3	66.9	27.9	100.0	92.1	11.2	
GH_ER2	Unamended	1	1	7	0	0	8	8	14	22	30	73.3			63.6		
		2	0	2	1	0	3	7	19	26	29	89.7			73.1		
		3	0	4	5	0	9	7	13	20	29	69.0	Mean	SD	65.0	Mean	SD
		4	0	3	0	0	3	1	26	27	30	90.0	80.5	10.9	96.3	74.5	15.1
GH_ER2	3	1	1	6	2	0	9	1	18	19	28	67.9			94.7		
		2	0	0	0	0	0	14	16	30	30	100.0			53.3		
		3	3	8	3	0	14	8	8	16	30	53.3	Mean	SD	50.0	Mean	SD
		4	3	5	1	0	9	0	22	22	31	71.0	73.0	19.5	100.0	74.5	26.5
GH_ER2	5	1	14	3	4	0	21	6	4	10	31	32.3			40.0		
		2	1	2	0	1	4	2	24	26	30	86.7			92.3		
		3	3	2	1	0	6	2	23	25	31	80.6	Mean	SD	92.0	Mean	SD
		4	0	10	2	0	12	8	7	15	27	55.6	63.8	25.0	46.7	67.7	28.3
GH_ER2	9	1	2	3	1	0	6	6	19	25	31	80.6			76.0		
		2	0	5	1	2	8	7	15	22	30	73.3			68.2		
		3	2	12	1	0	15	6	8	14	29	48.3	Mean	SD	57.1	Mean	SD
		4	1	2	1	0	4	1	25	26	30	86.7	72.2	16.9	96.2	74.4	16.5
GH_ER2	15	1	2	9	2	0	13	9	8	17	30	56.7			47.1		
		2	0	2	4	3	9	11	9	20	29	69.0			45.0		
		3	0	8	5	0	13	7	9	16	29	55.2	Mean	SD	56.2	Mean	SD
		4	3	4	1	0	8	1	23	24	32	75.0	64.0	9.6	95.8	61.0	23.7
GH_ER2	25	1	0	9	8	7	24	4	8	12	36	33.3			66.7		
		2*	1	5	21	2	29	0	0	0	29	0.0			-		
		3	0	6	8	3	17	10	2	12	29	41.4	Mean	SD	16.7	Mean	SD
		4	2	7	2	4	15	0	15	15	30	50.0	31.2	21.9	100.0	61.1	41.9
GH_ER2	43	1*	0	4	22	1	27	3	0	3	30	10.0			0.0		
		2	0	1	23	5	29	3	1	4	33	12.1			25.0		
		3*	3	3	25	4	35	1	0	1	36	2.8	Mean	SD	0.0	Mean	SD
		4	3	1	17	6	27	0	7	7	34	20.6	11.4	7.3	100.0	62.5	53.0

* omitted from % swimup calculation

JOU
Oct. 30/17

Rainbow Trout Embryo-Alevin-Swimup Toxicity Test

Client: Teck
WO#: 161183

Test Initiation Date: November 1, 2016
Test Termination Date: December 9, 2016

Test Conc. (mg/L NO3-N)	Rep	Mortality Counts				Total Dead	Alevin	Swimup	Total No. fish	Total No. Exposed	Survival	Swimup			
		Day 1 - 12	Day 13 - 24	Day 25 - 36	Day 37 - 38							Mean	SD	Mean	SD
Unamended	1	3	6	1	0	10	3	16	19	29	65.5		84.2		
	2	0	4	0	0	4	4	24	28	32	87.5		85.7		
	3	3	20	0	0	23	0	6	6	29	20.7	Mean	100.0	Mean	SD
	4	0	7	1	0	8	0	19	19	27	70.4	61.0	28.5	100.0	92.5
5	1	0	5	0	0	5	6	19	25	30	83.3		76.0		
	2	0	5	0	0	5	4	21	25	30	83.3		84.0		
	3	0	6	3	0	9	8	13	21	30	70.0	Mean	61.9	Mean	SD
	4	0	3	0	0	3	0	25	25	28	89.3	81.5	8.2	100.0	80.5
9	1	3	15	1	0	19	1	9	10	29	34.5		90.0		
	2	0	0	0	0	0	4	25	29	29	100.0		86.2		
	3	1	7	2	0	10	8	13	21	31	67.7	Mean	61.9	Mean	SD
	4	3	9	1	0	13	0	19	19	32	59.4	65.4	27.0	100.0	84.5
15	1	3	3	7	0	13	4	16	20	33	60.6		80.0		
	2	0	1	1	0	2	12	16	28	30	93.3		57.1		
	3	0	4	3	0	7	6	15	21	28	75.0	Mean	71.4	Mean	SD
	4	0	1	3	0	4	0	26	26	30	86.7	78.9	14.4	100.0	77.1
25	1	0	8	2	0	10	1	19	20	30	66.7		95.0		
	2	0	3	0	0	3	3	24	27	30	90.0		88.9		
	3	1	3	0	0	4	2	24	26	30	86.7	Mean	92.3	Mean	SD
	4	2	10	0	0	12	0	18	18	30	60.0	75.8	14.8	100.0	94.0
43	1	1	10	3	0	14	2	15	17	31	54.8		88.2		
	2	0	2	2	1	5	12	13	25	30	83.3		52.0		
	3	1	4	5	0	10	10	10	20	30	66.7	Mean	50.0	Mean	SD
	4	1	13	0	0	14	0	15	15	29	51.7	64.1	14.3	100.0	72.6
72	1	0	8	18	1	27	1	2	3	30	10.0		66.7		
	2	1	5	2	1	9	6	13	19	28	67.9		68.4		
	3	0	4	2	1	7	12	11	23	30	76.7	Mean	47.8	Mean	SD
	4	0	0	3	2	5	0	23	23	28	82.1	59.2	33.3	100.0	70.7

JBU
Oct. 30/17

Rainbow Trout Embryo-Alevin-Swimup Toxicity Test

Client: Teck
WO#: 161183

Test Initiation Date: November 1, 2016
Test Termination Date: December 9, 2016

GH_FR1	Test Conc. (mg/L NO3-N)	Rep	Mortality Counts				Total Dead	Alevin	Swimup	Total No. fish	Total No. Exposed	Survival	Swimup				
			Day 1 - 12	Day 13 - 24	Day 25 - 36	Day 37 - 38							Mean	SD	Mean	SD	
GH_FR1	Unamended	1	2	16	0	0	18	1	11	12	30	40.0			91.7		
		2	1	8	0	0	9	4	18	22	31	71.0			81.8		
		3	2	6	2	0	10	4	15	19	29	65.5	Mean	SD	78.9	Mean	SD
		4	1	4	1	1	7	0	22	22	29	75.9	63.1	16.0	100.0	88.1	9.6
GH_FR1	14	1	3	10	3	1	17	2	12	14	31	45.2			85.7		
		2	1	2	0	0	3	3	24	27	30	90.0			88.9		
		3	2	14	3	10	29	2	9	11	40	27.5	Mean	SD	81.8	Mean	SD
		4	1	5	0	0	6	0	24	24	30	80.0	60.7	29.3	100.0	89.1	7.8
GH_FR1	20	1	1	16	0	2	19	2	10	12	31	38.7			83.3		
		2	2	4	0	0	6	5	19	24	30	80.0			79.2		
		3	0	9	0	0	9	7	15	22	31	71.0	Mean	SD	68.2	Mean	SD
		4	1	2	0	0	3	0	26	26	29	89.7	69.8	22.1	100.0	82.7	13.2
GH_FR1	27	1	4	11	4	4	23	4	3	7	30	23.3			42.9		
		2	1	0	0	0	1	10	19	29	30	96.7			65.5		
		3	1	6	2	0	9	6	16	22	31	71.0	Mean	SD	72.7	Mean	SD
		4	2	6	1	2	11	0	18	18	29	62.1	63.3	30.4	100.0	70.3	23.6
GH_FR1	38	1	3	19	1	0	23	3	4	7	30	23.3			57.1		
		2	1	5	7	6	19	13	4	17	36	47.2			23.5		
		3	0	4	3	1	8	10	13	23	31	74.2	Mean	SD	56.5	Mean	SD
		4	4	3	0	0	7	0	22	22	29	75.9	55.2	24.9	100.0	59.3	31.3
GH_FR1	54	1	1	13	11	0	25	2	3	5	30	16.7			60.0		
		2	1	1	2	0	4	9	17	26	30	86.7			65.4		
		3	2	3	4	0	9	11	9	20	29	69.0	Mean	SD	45.0	Mean	SD
		4	4	6	1	0	11	1	15	16	27	59.3	57.9	29.7	93.8	66.0	20.4
GH_FR1	75	1	0	0	17	3	20	9	5	14	34	41.2			35.7		
		2	1	5	8	0	14	15	1	16	30	53.3			6.3		
		3	3	13	12	0	28	1	1	2	30	6.7	Mean	SD	50.0	Mean	SD
		4	1	5	4	1	11	3	14	17	28	60.7	40.5	23.9	82.4	43.6	31.6

JOB
Oct 30/17

Rainbow Trout Embryo-Alevin-Swimup Toxicity Test

Client: Teck
WO#: 161183

Test Initiation Date: November 1, 2016
Test Termination Date: December 9, 2016

Test Conc. (mg/L NO3-N)	Rep	Mortality Counts				Total Dead	Alevin	Swimup	Total No. fish	Total No. Exposed	Survival	Swimup				
		Day 1 - 12	Day 13 - 24	Day 25 - 36	Day 37 - 38							Mean	SD	Mean	SD	
GH_FR1-HH Unamended	1	2	24	0	0	26	2	2	4	30	13.3			50.0		
	2	0	21	0	7	28	6	3	9	37	24.3			33.3		
	3	1	11	1	2	15	3	12	15	30	50.0	Mean	SD	80.0	Mean	SD
	4	2	15	0	0	17	0	13	13	30	43.3	32.7	16.9	100.0	65.8	29.9
GH_FR1-HH 15	1	2	11	0	4	17	1	13	14	31	45.2			92.9		
	2	1	12	3	0	16	7	4	11	27	40.7			36.4		
	3	0	15	6	11	32	6	2	8	40	20.0	Mean	SD	25.0	Mean	SD
	4	1	24	1	0	26	1	1	2	28	7.1	28.3	17.8	50.0	51.1	29.7
GH_FR1-HH 23	1	0	18	1	0	19	6	4	10	29	34.5			40.0		
	2	3	18	2	0	23	4	4	8	31	25.8			50.0		
	3	3	13	1	0	17	1	12	13	30	43.3	Mean	SD	92.3	Mean	SD
	4	1	15	4	4	24	7	3	10	34	29.4	33.3	7.6	30.0	53.1	27.4
GH_FR1-HH 34	1*	5	24	1	0	30	0	0	0	30	0.0			-		
	2	1	2	10	4	17	12	3	15	32	46.9			20.0		
	3	1	4	11	0	16	6	3	9	25	36.0	Mean	SD	33.3	Mean	SD
	4	1	11	0	0	12	10	7	17	29	58.6	35.4	25.3	41.2	31.5	10.7
GH_FR1-HH 51	1*	0	4	7	4	15	14	0	14	29	48.3			0.0		
	2*	2	11	13	5	31	4	0	4	35	11.4			0.0		
	3*	2	24	1	0	27	4	0	4	31	12.9	Mean	SD	0.0	Mean	SD
	4	0	15	1	1	17	5	6	11	28	39.3	28.0	18.6	54.5	54.5	-
GH_FR1-HH 76	1*	0	3	23	3	29	1	0	1	30	3.3			0.0		
	2*	6	19	5	0	30	0	0	0	30	0.0			-		
	3	1	10	0	2	13	6	11	17	30	56.7	Mean	SD	64.7	Mean	SD
	4	0	12	9	2	23	5	2	7	30	23.3	20.8	26.0	28.6	46.6	25.6
GH_FR1-HH 114	1	2	12	8	2	24	4	1	5	29	17.2			20.0		
	2*	0	4	18	4	26	6	0	6	32	18.8			0.0		
	3	1	10	17	5	33	2	3	5	38	13.2	Mean	SD	60.0	Mean	SD
	4*	1	8	16	2	27	4	0	4	31	12.9	15.5	2.9	0.0	40.0	28.3

* omitted from % swimup calculation

JGk
Oct 30/17

CETIS Summary Report

Report Date: 06 Apr-17 12:09 (p 1 of 2)
 Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Batch ID: 05-5092-8884 Test Type: Survival-Development-Growth Analyst: Kania Lywe
 Start Date: 01 Nov-16 16:20 Protocol: EC/EPS 1/RM/28 Diluent: Dechlorinated Tap Water
 Ending Date: 09 Dec-16 10:00 Species: Oncorhynchus mykiss Brine:
 Duration: 37d 18h Source: Vancouver Island Trout Hatchery Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

GH FR1-HH is GH FR1 w/ hardness adjusted in-house to ~300µM CaCl₂

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	21.82	19.61	24.03	19.98	23.34	0.6951	1.39	6.37%	0.0%
GH_ER2	4	23.08	21.28	24.88	21.68	24.44	0.5656	1.131	4.9%	-5.79%
EV_ER4	4	23.99	22.9	25.08	23.42	24.98	0.3423	0.6846	2.85%	-9.95%
GH_FR1	4	21.95	20.82	23.07	21.29	22.91	0.3531	0.7063	3.22%	-0.58%
GH_FR1-HH	4	21.72	21.15	22.28	21.39	22.04	0.1765	0.3529	1.63%	0.47%

Mean Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	117.2	82.05	152.4	87.86	141.3	11.06	22.12	18.86%	0.0%
GH_ER2	4	115.6	102.4	128.7	108.5	126.9	4.133	8.265	7.15%	1.42%
EV_ER4	4	127.9	103.5	152.3	108.4	142.5	7.654	15.31	11.97%	-9.09%
GH_FR1	4	109.3	93.43	125.3	99.09	118.9	5	10	9.15%	6.74%
GH_FR1-HH	4	117	98.08	136	104.6	132.2	5.96	11.92	10.18%	0.17%

Proportion Normal Summary (% Swimming)

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	2	0.9211	0	1	0.8421	1	0.07895	0.1116	12.12%	0.0%
GH_ER2	4	0.745	0.5045	0.9855	0.6364	0.963	0.07557	0.1511	20.29%	19.11%
EV_ER4	4	0.9248	0.7863	1	0.8421	1	0.04352	0.08704	9.41%	-0.41%
GH_FR1	4	0.8811	0.728	1	0.7895	1	0.04809	0.09619	10.92%	4.34%
GH_FR1-HH	4	0.9	0	1	0.8	1	0.1	0.1414	15.71%	2.29%

Survival Rate Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
Control	4	0.6686	0.224	1	0.2857	0.9333	0.1397	0.2794	41.79%	0.0%
GH_ER2	4	0.8049	0.6309	0.9788	0.6897	0.9	0.05466	0.1093	13.58%	-20.39%
EV_ER4	4	0.6102	0.1568	1	0.2069	0.875	0.1425	0.2849	46.69%	8.73%
GH_FR1	4	0.6309	0.3769	0.8848	0.4	0.7586	0.0798	0.1596	25.3%	5.64%
GH_FR1-HH	4	0.3275	0.05844	0.5965	0.1333	0.5	0.08454	0.1691	51.63%	51.02%

~~GH FR1-HH is GH FR1 w/ hardness adjusted in-house to ~300µM CaCl₂~~

3 Rep B and C of control is omitted from % Swimming analysis.

2 proportional normal analysis B for % Swimming analysis.

CETIS Summary Report

Swimmg

Report Date: 06 Apr-17 12:09 (p 2 of 2)
 Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	23.34	21.81	19.98	22.14
GH_ER2	22.98	24.44	21.68	23.22
EV_ER4	23.84	24.98	23.42	23.71
GH_FR1	21.58	22.91	21.29	22
GH_FR1-HH	22	21.39	21.43	22.04

Mean Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	117.4	141.3	122.5	87.86
GH_ER2	116.4	126.9	110.5	108.5
EV_ER4	137.4	142.5	123.3	108.4
GH_FR1	102.5	116.8	118.9	99.09
GH_FR1-HH	120	132.2	111.3	104.6

① proportional normal analysis is for % swimmg analysis

① **Proportion Normal Detail**

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.8421			1
GH_ER2	0.6364	0.7308	0.65	0.963
EV_ER4	0.8421	0.8571	1	1
GH_FR1	0.9167	0.8182	0.7895	1
GH_FR1-HH			0.8	1

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.6552	0.2857	0.8	0.9333
GH_ER2	0.7333	0.8966	0.6897	0.9
EV_ER4	0.6552	0.875	0.2069	0.7037
GH_FR1	0.4	0.7097	0.6552	0.7586
GH_FR1-HH	0.1333	0.2432	0.5	0.4333

① **Proportion Normal Binomials**

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	16/19	0/8	0/24	28/28
GH_ER2	14/22	19/26	13/20	26/27
EV_ER4	16/19	24/28	6/6	19/19
GH_FR1	11/12	18/22	15/19	22/22
GH_FR1-HH	2/4	3/9	12/15	13/13

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	19/29	8/28	24/30	28/30
GH_ER2	22/30	26/29	20/29	27/30
EV_ER4	19/29	28/32	6/29	19/27
GH_FR1	12/30	22/31	19/29	22/29
GH_FR1-HH	4/30	9/37	15/30	13/30

CETIS Analytical Report

Report Date: 10 Feb-17 10:46 (p 1 of 2)
 Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 15-8118-6579	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 10:39	Analysis: STP 2x2 Contingency Tables	Official Results: Yes
Batch ID: 05-5092-8884	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Dechlorinated Tap Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	<i>GH FR1-HH is GH FR1 w/ hardness adjusted in-house to ~700 mg/L CaCO₃</i>
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs	Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control		GH_ER2	1	1.0000	Exact	Non-Significant Effect
Control		EV_ER4	0.2062	0.6186	Exact	Non-Significant Effect
Control		GH_FR1	0.2782	0.5563	Exact	Non-Significant Effect
Control		GH_FR1-HH	0	<0.0001	Exact	Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect	
Control	Negative Contr	79	38	117	0.6752	0.3248	0.0%
GH_ER2		95	23	118	0.8051	0.1949	-19.23%
EV_ER4		72	45	117	0.6154	0.3846	8.86%
GH_FR1		75	44	119	0.6303	0.3697	6.66%
GH_FR1-HH		41	86	127	0.3228	0.6772	52.19%

Survival Rate Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	0.6552	0.2857	0.8	0.9333
GH_ER2	0.7333	0.8966	0.6897	0.9
EV_ER4	0.6552	0.875	0.2069	0.7037
GH_FR1	0.4	0.7097	0.6552	0.7586
GH_FR1-HH	0.1333	0.2432	0.5	0.4333

Survival Rate Binomials

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	19/29	8/28	24/30	28/30
GH_ER2	22/30	26/29	20/29	27/30
EV_ER4	19/29	28/32	6/29	19/27
GH_FR1	12/30	22/31	19/29	22/29
GH_FR1-HH	4/30	9/37	15/30	13/30

CETIS Analytical Report

Summary

Report Date: 10 Feb-17 10:46 (p 2 of 2)

Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 15-8118-6579

Endpoint: Survival Rate

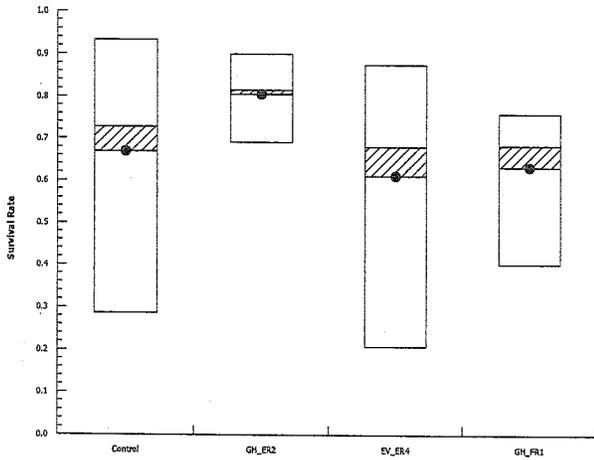
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 10:39

Analysis: STP 2x2 Contingency Tables

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 28 Mar-17 15:02 (p 1 of 2)
 Test Code: 161183NO3-Na | 15-9450-8749

Swimup

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 20-7251-4268	Endpoint: Proportion Normal (<i>% swimup</i>)	CETIS Version: CETISv1.8.7
Analyzed: 28 Mar-17 15:02	Analysis: STP 2x2 Contingency Tables	Official Results: Yes
Batch ID: 05-5092-8884	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Dechlorinated Tap Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		
① GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

GH_FR1-HH is GH_FR1 w hardness adjusted in-house to ~700µg/L CaCO3

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
① GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	Test Result
Untransformed		C > T	NA	NA	

Fisher Exact/Bonferroni-Holm Test

Sample	vs Sample	Test Stat	P-Value	P-Type	Decision(α:5%)
Control	GH_ER2	0.006587	0.0263	Exact	Significant Effect
Control	EV_ER4	0.3888	0.3888	Exact	Non-Significant Effect
Control	GH_FR1	0.2457	0.4914	Exact	Non-Significant Effect
Control	① GH_FR1-HH	0.009427	0.0283	Exact	Significant Effect

Data Summary

Sample Code	NR	R	NR + R	Prop NR	Prop R	%Effect
Control Negative Contr	44	3	47	0.9362	0.06383	0.0%
GH_ER2	72	23	95	0.7579	0.2421	19.04%
EV_ER4	65	7	72	0.9028	0.09722	3.57%
GH_FR1	66	9	75	0.88	0.12	6.0%
① GH_FR1-HH	30	11	41	0.7317	0.2683	21.84%

Proportion Normal Detail *LN*

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
② Control	0.8421	1		
GH_ER2	0.6364	0.7308	0.65	0.963
EV_ER4	0.8421	0.8571	1	1
GH_FR1	0.9167	0.8182	0.7895	1
① GH_FR1-HH	0.5	0.3333	0.8	1

② Rep B and C of Control is omitted from % swimup analysis

Proportion Normal Binomials *(# swimup)*

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
② Control	16/19	28/28		
GH_ER2	14/22	19/26	13/20	26/27
EV_ER4	16/19	24/28	6/6	19/19
GH_FR1	11/12	18/22	15/19	22/22
① GH_FR1-HH	2/4	3/9	12/15	13/13

CETIS Analytical Report

Swimup

Report Date: 28 Mar-17 15:02 (p 2 of 2)

Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 20-7251-4268

Endpoint: Proportion Normal (% *Swimup*)

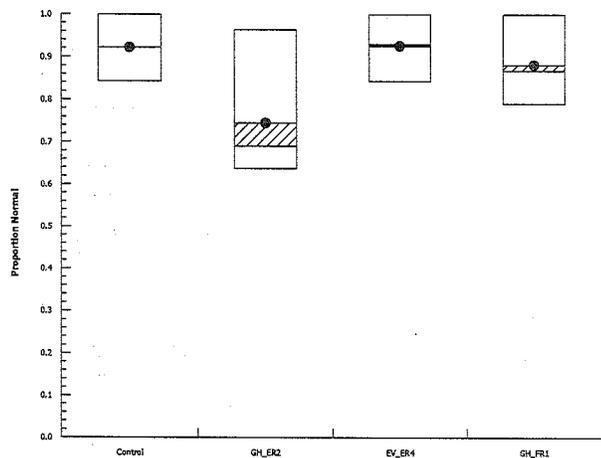
CETIS Version: CETISv1.8.7

Analyzed: 28 Mar-17 15:02

Analysis: STP 2x2 Contingency Tables

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 10 Feb-17 10:46 (p 1 of 2)
 Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 10-7450-8904	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 10:39	Analysis: Parametric-Control vs Treatments	Official Results: Yes
Batch ID: 05-5092-8884	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Dechlorinated Tap Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

GH_FR1-HH is GH_FR1 w/ hardness adjusted in-house to ~700mg/L CaCO₃.

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	7.09%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		GH_ER2	-1.924	2.356	1.546	6	0.9979	CDF	Non-Significant Effect
		EV_ER4	-3.307	2.356	1.546	6	1.0000	CDF	Non-Significant Effect
		GH_FR1	-0.1943	2.356	1.546	6	0.8567	CDF	Non-Significant Effect
		GH_FR1-HH	0.1562	2.356	1.546	6	0.7457	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	15.75483	3.938707	4	4.575	0.0129	Significant Effect
Error	12.91375	0.8609167	15			
Total	28.66858		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	4.982	13.28	0.2892	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9591	0.866	0.5257	Normal Distribution

Length-mm Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	21.82	19.61	24.03	21.97	19.98	23.34	0.6951	6.37%	0.0%
GH_ER2	4	23.08	21.28	24.88	23.1	21.68	24.44	0.5656	4.9%	-5.79%
EV_ER4	4	23.99	22.9	25.08	23.77	23.42	24.98	0.3423	2.85%	-9.95%
GH_FR1	4	21.95	20.82	23.07	21.79	21.29	22.91	0.3531	3.22%	-0.58%
GH_FR1-HH	4	21.72	21.15	22.28	21.72	21.39	22.04	0.1765	1.63%	0.47%

Length-mm Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	23.34	21.81	19.98	22.14
GH_ER2	22.98	24.44	21.68	23.22
EV_ER4	23.84	24.98	23.42	23.71
GH_FR1	21.58	22.91	21.29	22
GH_FR1-HH	22	21.39	21.43	22.04

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 10-7450-8904

Endpoint: Length-mm

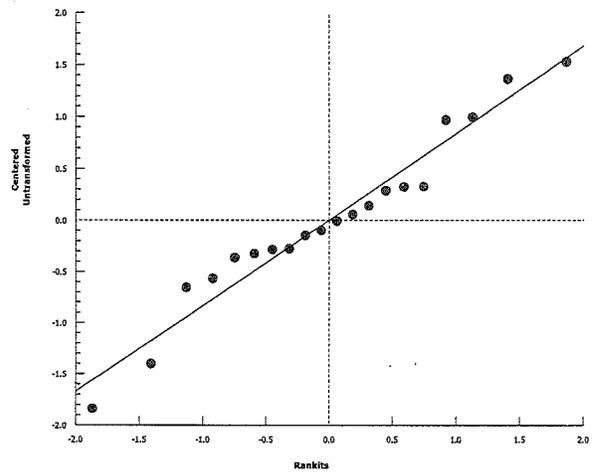
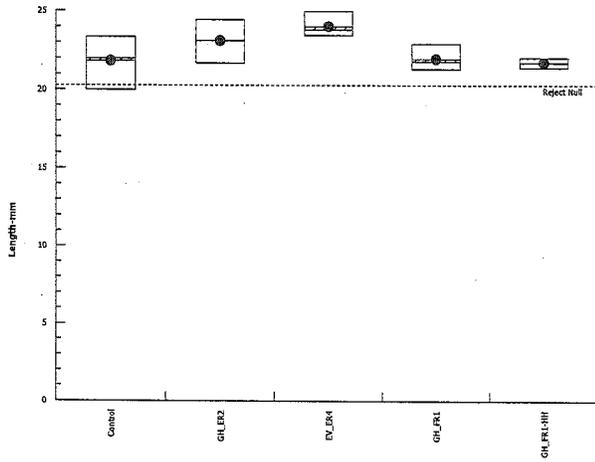
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 10:39

Analysis: Parametric-Control vs Treatments

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 10 Feb-17 10:47 (p 1 of 2)
 Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 09-2102-2468	Endpoint: Mean ⁱⁿ Dry Weight-mg	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 10:39	Analysis: Parametric-Control vs Treatments	Official Results: Yes
Batch ID: 05-5092-8884	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Dechlorinated Tap Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:

Sample Code	Sample ID	Sample Date	Receive Date	Sample Age	Client Name	Project
Control	02-9690-3355	25 Oct-16	26 Oct-16	7d 16h (14 °C)	Teck Coal	
GH_ER2	04-3354-5447	25 Oct-16 12:00	26 Oct-16 08:44	7d 4h (4.2 °C)		
EV_ER4	06-6901-7584	25 Oct-16 08:35	26 Oct-16 08:44	7d 8h (4.2 °C)		
GH_FR1	02-0044-4943	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		
GH_FR1-HH	03-6653-4885	25 Oct-16 10:30	26 Oct-16 08:44	7d 6h (4.2 °C)		

*GH_FR1-HH is GH_FR1 w/ hardness adjusted
increase to ~700µg/L CaCO₃.*

Sample Code	Material Type	Sample Source	Station Location	Latitude	Longitude
Control	Water Sample	Teck Coal	Control		
GH_ER2	Water Sample	Teck Coal	GH_ER2_WS_2016-10-25_N		
EV_ER4	Water Sample	Teck Coal	EV_ER4_WS_2016-10-25_N		
GH_FR1	Water Sample	Teck Coal	GH_FR1_WS_2016-10-25_N		
GH_FR1-HH	Water Sample	Teck Coal	GH_FR1-HH_WS_2016-10-25_N		

Data Transform	Zeta	Alt Hyp	Trials	Seed	PMSD	Test Result
Untransformed	NA	C > T	NA	NA	20.4%	

Dunnett Multiple Comparison Test

Sample Code	vs	Sample Code	Test Stat	Critical	MSD	DF	P-Value	P-Type	Decision(α:5%)
Control		GH_ER2	0.164	2.356	23.96	6	0.7428	CDF	Non-Significant Effect
		EV_ER4	-1.049	2.356	23.96	6	0.9779	CDF	Non-Significant Effect
		GH_FR1	0.7774	2.356	23.96	6	0.4801	CDF	Non-Significant Effect
		GH_FR1-HH	0.01978	2.356	23.96	6	0.7935	CDF	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	715.2927	178.8232	4	0.8648	0.5073	Non-Significant Effect
Error	3101.815	206.7876	15			
Total	3817.107		19			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance	3.238	13.28	0.5189	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9832	0.866	0.9688	Normal Distribution

Mean ⁱⁿ Dry Weight-mg Summary

Sample Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
Control	4	117.2	82.05	152.4	119.9	87.86	141.3	11.06	18.86%	0.0%
GH_ER2	4	115.6	102.4	128.7	113.4	108.5	126.9	4.133	7.15%	1.42%
EV_ER4	4	127.9	103.5	152.3	130.4	108.4	142.5	7.654	11.97%	-9.09%
GH_FR1	4	109.3	93.43	125.3	109.7	99.09	118.9	5	9.15%	6.74%
GH_FR1-HH	4	117	98.08	136	115.7	104.6	132.2	5.96	10.18%	0.17%

Mean ⁱⁿ Dry Weight-mg Detail

Sample Code	Rep 1	Rep 2	Rep 3	Rep 4
Control	117.4	141.3	122.5	87.86
GH_ER2	116.4	126.9	110.5	108.5
EV_ER4	137.4	142.5	123.3	108.4
GH_FR1	102.5	116.8	118.9	99.09
GH_FR1-HH	120	132.2	111.3	104.6

CETIS Analytical Report

in swimming

Report Date: 10 Feb-17 10:47 (p 2 of 2)

Test Code: 161183NO3-Na | 15-9450-8749

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 09-2102-2468

Endpoint: Mean Dry Weight-mg

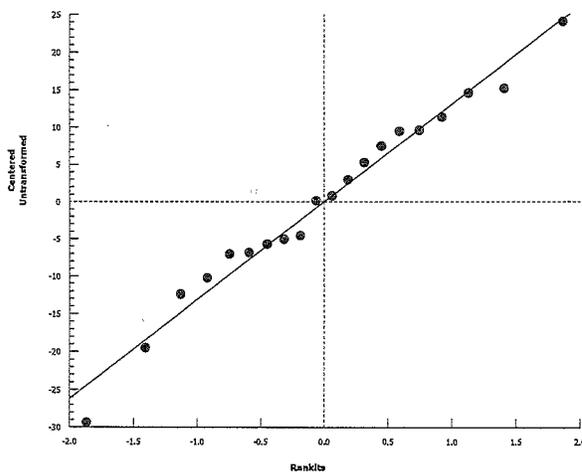
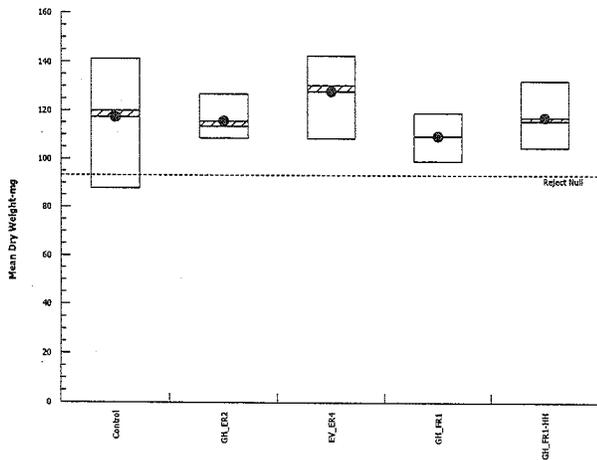
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 10:39

Analysis: Parametric-Control vs Treatments

Official Results: Yes

Graphics



CETIS Analytical Report

Summary

Report Date: 10 Feb-17 11:24 (p 1 of 3)
 Test Code: 161183NO3-Nb | 21-2879-9812

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 13-7970-5285	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 11:21	Analysis: Linear Regression (MLE)	Official Results: Yes
Batch ID: 15-8260-7200	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample <i>(WS)</i>	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	<i>GH_ER2 & dilution water (see notes)</i>
Sample Age: 7d 4h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Linear Regression Options

Model Function	Threshold Option	Threshold	Optimized	Pooled	Het Corr	Weighted
Log-Angle [Asin(P ^{0.5})=A+B*log(X)]	Control Threshold	0.1949152	Yes	No	Yes	Yes

Regression Summary

Iters	LL	AICc	BIC	Mu	Sigma	Adj R2	F Stat	Critical	P-Value	Decision(α:5%)
10	-483	973.1	976.1	0.9058		0.6005	0.6574	2.84	0.6283	Non-Significant Lack of Fit

Point Estimates

Level	mg/L	95% LCL	95% UCL
EC5	11.17	3.308	16.82
EC10	12.85	4.416	18.55
EC15	14.35	5.539	20.07
EC20	15.79	6.734	21.53
EC25	17.22	8.03	22.98
EC40	21.77	12.72	27.72
EC50	25.19	16.68	31.71

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
Threshold	0.2728	0.04336	0.1835	0.3621	6.292	<0.0001	Significant Parameter
Slope	1.585	0.4056	0.7498	2.421	3.908	0.0006	Significant Parameter
Intercept	-1.436	0.6039	-2.68	-0.1922	-2.378	0.0254	Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	173.1376	173.1376	1	42.59	<0.0001	Significant
Lack of Fit	11.31018	2.827545	4	0.6574	0.6283	Non-Significant
Pure Error	90.32159	4.301028	21			
Residual	101.6318	4.06527	25			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Goodness-of-Fit	Pearson Chi-Sq GOF	101.6	37.65	<0.0001	Significant Heterogeneity
	Likelihood Ratio GOF	116.3	37.65	<0.0001	Significant Heterogeneity
Variances	Bartlett Equality of Variance	4.318	12.59	0.6337	Equal Variances
	Mod Levene Equality of Variance	0.6904	2.573	0.6598	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9469	0.9264	0.1651	Normal Distribution
	Anderson-Darling A2 Normality	0.59	2.492	0.1276	Normal Distribution

CETIS Analytical Report

Report Date: 10 Feb-17 11:24 (p 2 of 3)

Test Code: 161183NO3-Nb | 21-2879-9812

Swimup

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 13-7970-5285

Endpoint: Survival Rate

CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 11:21

Analysis: Linear Regression (MLE)

Official Results: Yes

Survival Rate Summary

Calculated Variate(A/B)

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0.09	Dilution Water	4	0.8049	0.6897	0.9	0.05466	0.1093	13.58%	0.0%	95	118
3.12		4	0.7304	0.5333	1	0.09774	0.1955	26.76%	9.26%	87	119
5.1		4	0.6378	0.3226	0.8667	0.1248	0.2496	39.14%	20.76%	76	119
8.9		4	0.7223	0.4828	0.8667	0.08437	0.1687	23.36%	10.26%	87	120
14.44		4	0.6395	0.5517	0.75	0.04808	0.09615	15.04%	20.55%	77	120
25.85		4	0.3118	0	0.5	0.1094	0.2187	70.15%	61.26%	39	124
45.05		4	0.1137	0.02778	0.2059	0.03666	0.07331	64.47%	85.87%	15	133

Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.09	Dilution Water	0.7333	0.8966	0.6897	0.9
3.12		0.6786	1	0.5333	0.7097
5.1		0.3226	0.8667	0.8065	0.5556
8.9		0.8065	0.7333	0.4828	0.8667
14.44		0.5667	0.6897	0.5517	0.75
25.85		0.3333	0	0.4138	0.5
45.05		0.1	0.1212	0.02778	0.2059

at-EP2 is dilution water (5% water)

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.09	Dilution Water	22/30	26/29	20/29	27/30
3.12		19/28	30/30	16/30	22/31
5.1		10/31	26/30	25/31	15/27
8.9		25/31	22/30	14/29	26/30
14.44		17/30	20/29	16/29	24/32
25.85		12/36	12/29	15/30	
45.05		3/30	4/33	1/36	7/34

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

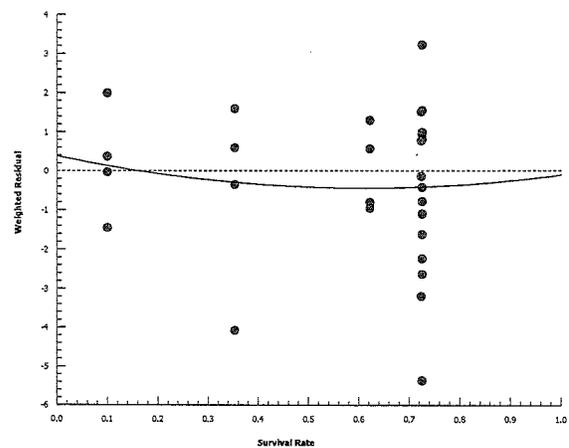
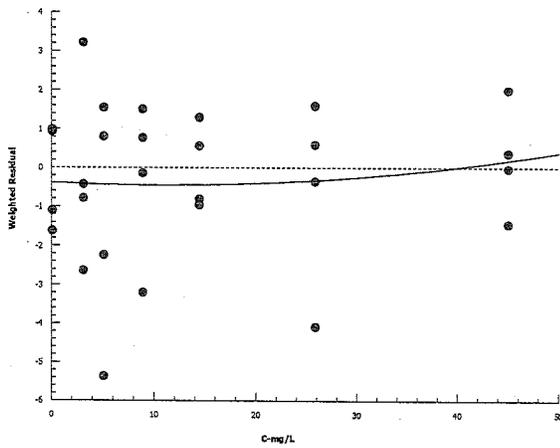
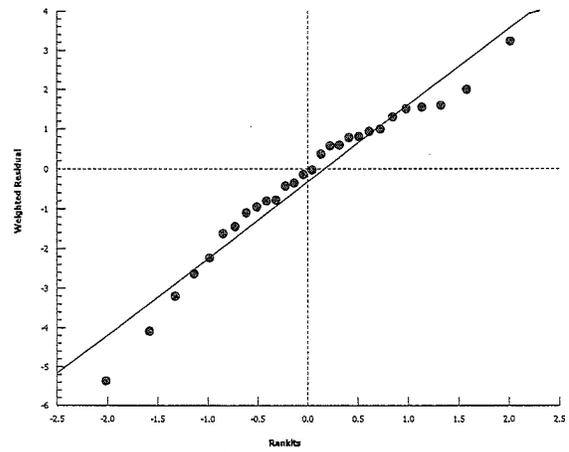
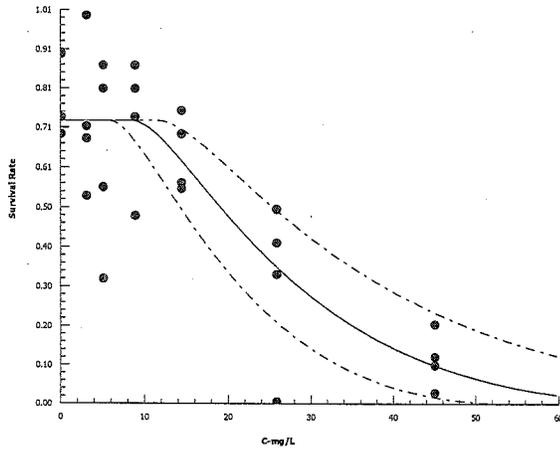
Analysis ID: 13-7970-5285
Analyzed: 10 Feb-17 11:21

Endpoint: Survival Rate
Analysis: Linear Regression (MLE)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics

Log-Angle [Asin(P^0.5)=A+B*log(X)]



CETIS Analytical Report

Report Date: 28 Mar-17 14:53 (p 1 of 2)
 Test Code: 161183NO3-Nb | 21-2879-9812

Swimup
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 07-2089-8945 **Endpoint:** Proportion Normal (*% Swimup*) **CETIS Version:** CETISv1.8.7
 Analyzed: 28 Mar-17 14:53 **Analysis:** Linear Interpolation (ICPIN) **Official Results:** Yes

Batch ID: 15-8260-7200 **Test Type:** Survival-Development-Growth **Analyst:** Kania Lywe
 Start Date: 01 Nov-16 16:20 **Protocol:** EC/EPS 1/RM/28 **Diluent:** Site Water
 Ending Date: 09 Dec-16 10:00 **Species:** Oncorhynchus mykiss **Brine:**
 Duration: 37d 18h **Source:** Vancouver Island Trout Hatchery **Age:**

Sample ID: 04-3354-5447 **Code:** GH_ER2 **Client:** Teck Coal
 Sample Date: 25 Oct-16 12:00 **Material:** ~~Water Sample~~ *(NO₃-N)* **Project:**
 Receive Date: 26 Oct-16 08:44 **Source:** Teck Coal (TECK COAL)
 Sample Age: 7d 4h (4.2 °C) **Station:** GH_ER2_WS_2016-10-25_N *GH_ER2 is dilution water (site water)*

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	712731	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L <i>NO₃-N</i>	95% LCL	95% UCL
EC5	10.89	N/A	N/A
EC10	13.4	N/A	N/A
EC15	>45.05	N/A	N/A
EC20	>45.05	N/A	N/A
EC25	>45.05	N/A	N/A
EC40	>45.05	N/A	N/A
EC50	>45.05	N/A	N/A

Proportion Normal Summary

C-mg/L <i>NO₃-N</i>	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0.09	Dilution Water	4	0.745	0.6364	0.963	0.07557	0.1511	20.29%	0.0%	72	95
3.12		4	0.7452	0.5	1	0.1325	0.2651	35.57%	-0.02%	64	87
5.1		4	0.6774	0.4	0.9231	0.1416	0.2832	41.8%	9.07%	58	76
8.9		4	0.7437	0.5714	0.9615	0.08227	0.1645	22.13%	0.18%	67	87
14.44		4	0.6104	0.45	0.9583	0.1185	0.2371	38.84%	18.08%	49	77
25.85		3	0.6111	0.1667	1	0.2422	0.4194	68.63%	17.97%	25	39
45.05		2	0.625	0.25	1	0.375	0.5303	84.85%	16.11%	8	11

Proportion Normal Detail

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.09	Dilution Water	0.6364	0.7308	0.65	0.963
3.12		0.9474	0.5333	0.5	1
5.1		0.4	0.9231	0.92	0.4667
8.9		0.76	0.6818	0.5714	0.9615
14.44		0.4706	0.45	0.5625	0.9583
25.85		0.6667	0.1667	1	
45.05		0.25	1		

← Rep B's omitted from analysis
← Rep A and C are omitted from analysis

Proportion Normal Binomials

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.09	Dilution Water	14/22	19/26	13/20	26/27
3.12		18/19	16/30	8/16	22/22
5.1		4/10	24/26	23/25	7/15
8.9		19/25	15/22	8/14	25/26
14.44		8/17	9/20	9/16	23/24
25.85		8/12	2/12	15/15	
45.05		1/4	7/7		

CETIS Analytical Report

Report Date: 28 Mar-17 14:53 (p 2 of 2)
Test Code: 161183NO3-Nb | 21-2879-9812

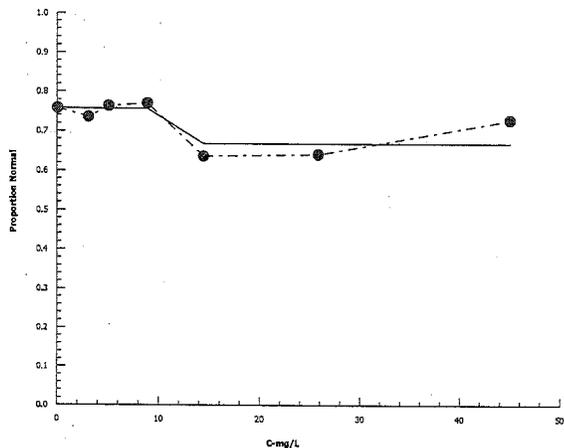
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 07-2089-8945 Endpoint: Proportion Normal (Swim) *(Swim)*
Analyzed: 28 Mar-17 14:53 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 10 Feb-17 11:24 (p 1 of 2)
 Test Code: 161183NO3-Nb | 21-2879-9812

in swimming

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 02-7443-2631	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 11:21	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 15-8260-7200	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample <i>(NO₃)⁻ (NO₃-N)</i>	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	<i>GH_ER2 is dilution water (site water)</i>
Sample Age: 7d 4h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	241623	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L <i>(NO₃)⁻</i>	95% LCL	95% UCL
IC5	7.649	N/A	13.56
IC10	12.97	2.769	35.71
IC15	24.27	7.593	N/A
IC20	>45.05	N/A	N/A
IC25	>45.05	N/A	N/A
IC40	>45.05	N/A	N/A
IC50	>45.05	N/A	N/A

Length-mm Summary

C-mg/L <i>(NO₃)⁻</i>	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0.09	Dilution Water	4	23.08	21.68	24.44	0.5656	1.131	4.9%	0.0%
3.12		4	22.31	20.81	23.22	0.5334	1.067	4.78%	3.34%
5.1		4	22.54	20.93	25.19	0.9397	1.879	8.34%	2.33%
8.9		4	21.73	19.71	23.86	0.8565	1.713	7.88%	5.84%
14.44		4	20.49	19.71	21.5	0.3977	0.7953	3.88%	11.21%
25.85		3	19.51	17.75	20.53	0.8837	1.531	7.85%	15.47%
45.05		4	18.65	16.63	20.29	0.8922	1.784	9.57%	19.2%

Length-mm Detail

C-mg/L <i>(NO₃)⁻</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.09	Dilution Water	22.98	24.44	21.68	23.22
3.12		22.32	23.22	20.81	22.89
5.1		21.55	25.19	22.5	20.93
8.9		21.98	23.86	19.71	21.38
14.44		19.71	21.5	20.03	20.73
25.85		20.25	17.75	20.53	
45.05		17.67	16.63	20	20.29

← Rep 3 is outlier

CETIS Analytical Report

Report Date: 10 Feb-17 11:24 (p 2 of 2)
Test Code: 161183NO3-Nb | 21-2879-9812

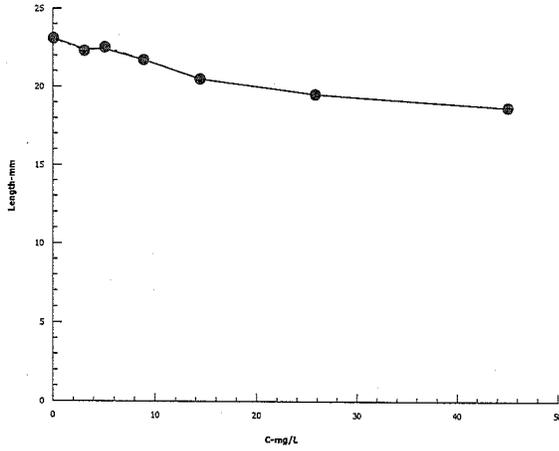
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 02-7443-2631 Endpoint: Length-mm
Analyzed: 10 Feb-17 11:21 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 10 Feb-17 11:24 (p 1 of 2)
 Test Code: 161183NO3-Nb | 21-2879-9812

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 18-6399-5929	Endpoint: Mean ^{dry} Weight-mg	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 11:21	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 15-8260-7200	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 04-3354-5447	Code: GH_ER2	Client: Teck Coal
Sample Date: 25 Oct-16 12:00	Material: Water Sample ^(NO₃-N) (NO ₃ -N)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	GH_ER2 is dilution water (site water)
Sample Age: 7d 4h (4.2 °C)	Station: GH_ER2_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	897623	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L ^{NO₃-N}	95% LCL	95% UCL
IC5	6.404	N/A	19.16
IC10	13.57	N/A	23.88
IC15	18.55	N/A	N/A
IC20	24.49	11.47	N/A
IC25	>45.05	N/A	N/A
IC40	>45.05	N/A	N/A
IC50	>45.05	N/A	N/A

Mean Dry Weight-mg Summary

Calculated Variate

C-mg/L ^{NO₃-N}	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0.09	Dilution Water	4	115.6	108.5	126.9	4.133	8.265	7.15%	0.0%
3.12		4	110	93.64	121	6.343	12.69	11.54%	4.86%
5.1		4	111.7	100.8	131.5	6.792	13.58	12.16%	3.38%
8.9		4	108.3	83.46	133.6	10.75	21.5	19.86%	6.32%
14.44		4	103.4	95.83	113.5	3.698	7.396	7.15%	10.55%
25.85		3	91.33	80.83	99.17	5.458	9.453	10.35%	20.98%
45.05		4	90.61	77.5	104	5.971	11.94	13.18%	21.6%

Mean Dry Weight-mg Detail

C-mg/L ^{NO₃-N}	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
0.09	Dilution Water	116.4	126.9	110.5	108.5
3.12		118.9	121	106.3	93.64
5.1		107	131.5	100.8	107.3
8.9		116	133.6	100	83.46
14.44		102.9	113.5	101.3	95.83
25.85		99.17	80.83	94	
45.05		96.67	77.5	104	84.29

CETIS Analytical Report

Swim

Report Date: 10 Feb-17 11:24 (p 2 of 2)

Test Code: 161183NO3-Nb | 21-2879-9812

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 18-6399-5929

Endpoint: Mean Dry Weight-mg

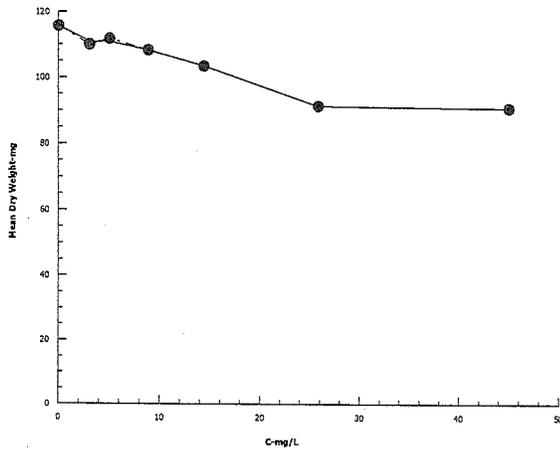
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 11:21

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Swimcup

Report Date: 06 Apr-17 13:07 (p 1 of 2)
 Test Code: 161183NO3-Nc | 05-1785-2047

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 14-9179-7779	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 06 Apr-17 13:05	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 12-2894-4420	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample (W _{3-N})	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 8h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	<i>EV-ER4 is site water (dilution water)</i>

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1051390	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L <i>NO_{3-N}</i>	95% LCL	95% UCL
EC5	31.87	N/A	N/A
EC10	39.93	N/A	N/A
EC15	53.32	N/A	N/A
EC20	>69.29	N/A	N/A
EC25	>69.29	N/A	N/A
EC40	>69.29	N/A	N/A
EC50	>69.29	N/A	N/A

Survival Rate Summary

Calculated Variate(A/B)

C-mg/L <i>NO_{3-N}</i>	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
2.92	Dilution Water	4	0.6102	0.2069	0.875	0.1425	0.2849	46.69%	0.0%	72	117
5.09		4	0.8149	0.7	0.8929	0.04078	0.08157	10.01%	-33.54%	96	118
8.96		4	0.654	0.3448	1	0.1352	0.2705	41.36%	-7.18%	79	121
14.71		4	0.789	0.6061	0.9333	0.07179	0.1436	18.2%	-29.31%	95	121
25.4		4	0.7583	0.6	0.9	0.07376	0.1475	19.45%	-24.28%	91	120
42.71		4	0.6414	0.5172	0.8333	0.07161	0.1432	22.33%	-5.12%	76	120
69.29		4	0.5917	0.1	0.8214	0.1665	0.333	56.28%	3.04%	68	116

Survival Rate Detail

C-mg/L <i>NO_{3-N}</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
2.92	Dilution Water	0.6552	0.875	0.2069	0.7037
5.09		0.8333	0.8333	0.7	0.8929
8.96		0.3448	1	0.6774	0.5938
14.71		0.6061	0.9333	0.75	0.8667
25.4		0.6667	0.9	0.8667	0.6
42.71		0.5484	0.8333	0.6667	0.5172
69.29		0.1	0.6786	0.7667	0.8214

Survival Rate Binomials

C-mg/L <i>NO_{3-N}</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
2.92	Dilution Water	19/29	28/32	6/29	19/27
5.09		25/30	25/30	21/30	25/28
8.96		10/29	29/29	21/31	19/32
14.71		20/33	28/30	21/28	26/30
25.4		20/30	27/30	26/30	18/30
42.71		17/31	25/30	20/30	15/29
69.29		3/30	19/28	23/30	23/28

CETIS Analytical Report

Report Date: 06 Apr-17 13:07 (p 1 of 2)
 Test Code: 161183NO3-Nc | 05-1785-2047

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 04-0272-9595	Endpoint: Proportion Normal <i>of L₅₀ (% Survival)</i>	CETIS Version: CETISv1.8.7
Analyzed: 06 Apr-17 13:06	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 12-2894-4420	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample <i>(NO₃-N)</i>	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 8h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	<i>EV_ER4 is site water (dilution water)</i>

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	195657	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L <i>NO₃-N</i>	95% LCL	95% UCL
EC5	4.319	2.969	71.36
EC10	28.03	N/A	N/A
EC15	33.44	N/A	N/A
EC20	39.87	20.54	N/A
EC25	>69.29	N/A	N/A
EC40	>69.29	N/A	N/A
EC50	>69.29	N/A	N/A

Proportion Normal Summary

C-mg/L <i>NO₃-N</i>	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
2.92	Dilution Water	4	0.9248	0.8421	1	0.04352	0.08704	9.41%	0.0%	65	72
5.09		4	0.8048	0.619	1	0.07951	0.159	19.76%	12.98%	78	96
8.96		4	0.8453	0.619	1	0.08083	0.1617	19.12%	8.6%	66	79
14.71		4	0.7714	0.5714	1	0.08959	0.1792	23.23%	16.59%	73	95
25.4		4	0.9405	0.8889	1	0.02345	0.0469	4.99%	-1.7%	85	91
42.71		4	0.7256	0.5	1	0.1268	0.2537	34.96%	21.54%	53	77
69.29		4	0.7073	0.4783	1	0.1081	0.2163	30.58%	23.52%	49	68

Proportion Normal Detail

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
2.92	Dilution Water	0.8421	0.8571	1	1
5.09		0.76	0.84	0.619	1
8.96		0.9	0.8621	0.619	1
14.71		0.8	0.5714	0.7143	1
25.4		0.95	0.8889	0.9231	1
42.71		0.8824	0.52	0.5	1
69.29		0.6667	0.6842	0.4783	1

Proportion Normal Binomials

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
2.92	Dilution Water	16/19	24/28	6/6	19/19
5.09		19/25	21/25	13/21	25/25
8.96		9/10	25/29	13/21	19/19
14.71		16/20	16/28	15/21	26/26
25.4		19/20	24/27	24/26	18/18
42.71		15/17	13/25	10/20	15/15
69.29		2/3	13/19	11/23	23/23

CETIS Analytical Report

Report Date: 06 Apr-17 13:07 (p 2 of 2)
Test Code: 161183NO3-Nc | 05-1785-2047

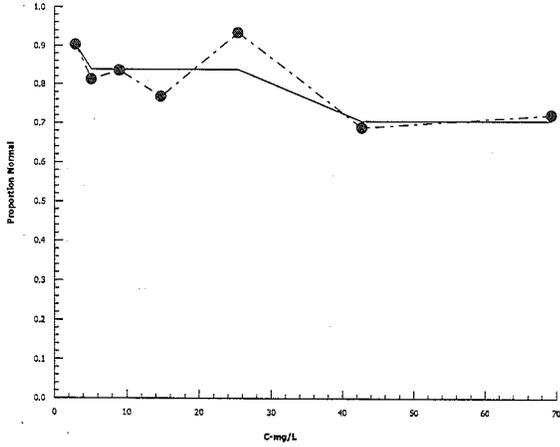
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 04-0272-9595 Endpoint: Proportion Normal (*% Swimmng*)
Analyzed: 06 Apr-17 13:06 Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Swimming

Report Date: 10 Feb-17 11:44 (p 1 of 2)

Test Code: 161183NO3-Nc | 05-1785-2047

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 14-7407-4991	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 11:42	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 12-2894-4420	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 06-6901-7584	Code: EV_ER4	Client: Teck Coal
Sample Date: 25 Oct-16 08:35	Material: Water Sample (<i>NO₃-N</i>)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	<i>EV_ER4 is dilution water (site water)</i>
Sample Age: 7d 8h (4.2 °C)	Station: EV_ER4_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1646287	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L <i>NO₃-N</i>	95% LCL	95% UCL
IC5	12.07	0.1519	47.14
IC10	39.54	19.28	72.72
IC15	68.44	23.89	N/A
IC20	>69.29	N/A	N/A
IC25	>69.29	N/A	N/A
IC40	>69.29	N/A	N/A
IC50	>69.29	N/A	N/A

Length-mm Summary

C-mg/L <i>NO₃-N</i>	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
2.92	Dilution Water	4	23.99	23.42	24.98	0.3423	0.6846	2.85%	0.0%
5.09		4	23.23	22.16	24.54	0.5176	1.035	4.46%	3.15%
8.96		4	23.12	21.67	24.79	0.7105	1.421	6.15%	3.63%
14.71		4	22.41	20.62	23.56	0.6598	1.32	5.89%	6.56%
25.4		4	22.72	21.63	23.94	0.5739	1.148	5.05%	5.31%
42.71		4	21.42	19.8	22.86	0.6678	1.336	6.24%	10.71%
69.29		4	20.36	18.5	22.34	0.8444	1.689	8.29%	15.11%

Length-mm Detail

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
2.92	Dilution Water	23.84	24.98	23.42	23.71
5.09		22.16	24.54	22.71	23.52
8.96		22.25	24.79	21.67	23.76
14.71		22.25	23.23	20.62	23.56
25.4		21.85	23.94	21.63	23.44
42.71		20.94	22.86	19.8	22.07
69.29		18.5	22.34	19.54	21.07

CETIS Analytical Report

SWIMM

Report Date: 10 Feb-17 11:44 (p 2 of 2)

Test Code: 161183NO3-Nc | 05-1785-2047

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 14-7407-4991

Endpoint: Length-mm

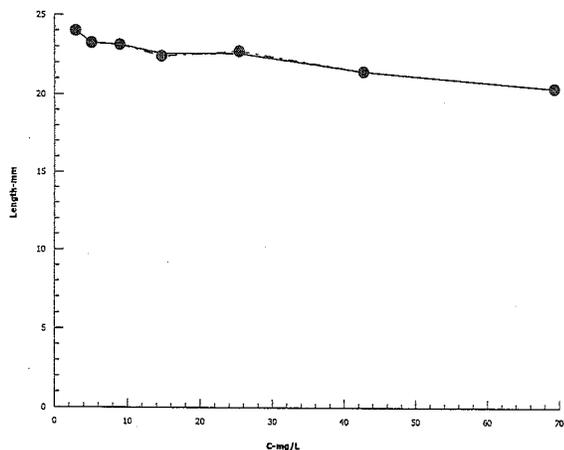
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 11:42

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 06 Apr-17 13:07 (p 1 of 2)
 Test Code: 161183NO3-Nc | 05-1785-2047

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 02-7701-7247 **Endpoint:** Mean Dry Weight-mg **CETIS Version:** CETISv1.8.7
 Analyzed: 06 Apr-17 13:06 **Analysis:** Linear Interpolation (ICPIN) **Official Results:** Yes

Batch ID: 12-2894-4420 **Test Type:** Survival-Development-Growth **Analyst:** Kania Lywe
 Start Date: 01 Nov-16 16:20 **Protocol:** EC/EPS 1/RM/28 **Diluent:** Site Water
 Ending Date: 09 Dec-16 10:00 **Species:** Oncorhynchus mykiss **Brine:**
 Duration: 37d 18h **Source:** Vancouver Island Trout Hatchery **Age:**

Sample ID: 06-6901-7584 **Code:** EV_ER4 **Client:** Teck Coal
 Sample Date: 25 Oct-16 08:35 **Material:** Water Sample (NO₃-N) **Project:**
 Receive Date: 26 Oct-16 08:44 **Source:** Teck Coal (TECK COAL)
 Sample Age: 7d 8h (4.2 °C) **Station:** EV_ER4_WS_2016-10-25_N *EV-ER4 B Site water (dilution water)*

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1738400	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L NO ₃ -N	95% LCL	95% UCL
IC5	7.817	1.198	72.49
IC10	33.78	N/A	N/A
IC15	50.67	N/A	N/A
IC20	>69.29	N/A	N/A
IC25	>69.29	N/A	N/A
IC40	>69.29	N/A	N/A
IC50	>69.29	N/A	N/A

Mean Dry Weight-mg Summary

C-mg/L NO ₃ -N	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
2.92	Dilution Water	4	127.9	108.4	142.5	7.654	15.31	11.97%	0.0%
5.09		4	124	111.2	134.8	4.933	9.866	7.96%	3.04%
8.96		4	118.4	110	133.1	5.136	10.27	8.67%	7.41%
14.71		4	119.7	110.5	134.3	5.64	11.28	9.42%	6.39%
25.4		4	123.9	115.6	140	5.504	11.01	8.89%	3.13%
42.71		4	110.5	99.33	128.4	6.524	13.05	11.81%	13.61%
69.29		4	105.4	97.83	125.3	6.621	13.24	12.56%	17.56%

Mean Dry Weight-mg Detail

C-mg/L NO ₃ -N	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
2.92	Dilution Water	137.4 ✓	142.5	123.3	108.4 ✓
5.09		127.2 ✓	134.8	122.9 ✓	111.2
8.96		113	133.1	117.6	110
14.71		123	134.3	110.5	111.2
25.4		118.5 ✓	140	121.5	115.6
42.71		111.8	128.4	102.5	99.33
69.29		100	125.3 ✓	97.83 ✓	98.7

CETIS Analytical Report

Report Date: 06 Apr-17 13:07 (p 2 of 2)

Test Code: 161183NO3-Nc | 05-1785-2047

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

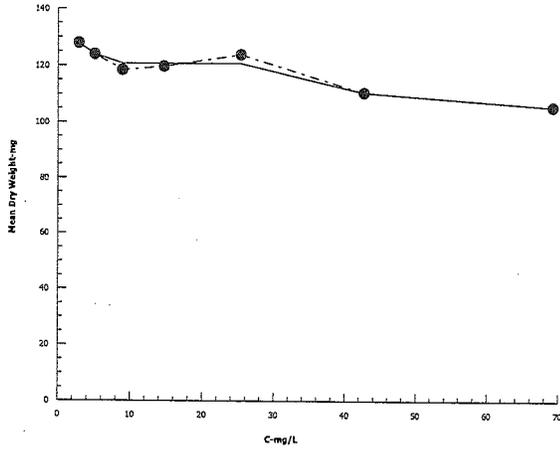
Nautilus Environmental

Analysis ID: 02-7701-7247
Analyzed: 06 Apr-17 13:06

Endpoint: Mean Dry Weight-mg
Analysis: Linear Interpolation (ICPIN)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 10 Feb-17 11:58 (p 1 of 2)
 Test Code: 161183NO3-Nd | 14-8717-3518

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 13-3412-8806	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 11:55	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 16-7220-4923	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (NO ₃ -N)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	GH_FR1 is dilution water (site water)
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1850751	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L (NO ₃ -N)	95% LCL	95% UCL
EC5	31.71	N/A	73.05
EC10	36.8	N/A	77.47
EC15	56.15	N/A	74.59
EC20	59.93	N/A	N/A
EC25	63.96	1.934	N/A
EC40	>74.5	N/A	N/A
EC50	>74.5	N/A	N/A

Survival Rate Summary

C-mg/L (NO ₃ -N)	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
10.19	Dilution Water	4	0.6309	0.4	0.7586	0.0798	0.1596	25.3%	0.0%	75	119
14.14		4	0.6067	0.275	0.9	0.1465	0.293	48.29%	3.84%	76	131
20.18		4	0.6983	0.3871	0.8966	0.1105	0.2211	31.66%	-10.69%	84	121
27.5		4	0.6326	0.2333	0.9667	0.152	0.3039	48.04%	-0.27%	76	120
38.35		4	0.5515	0.2333	0.7586	0.1247	0.2495	45.23%	12.58%	69	126
53.56		4	0.5789	0.1667	0.8667	0.1487	0.2973	51.36%	8.24%	67	116
74.5		4	0.4047	0.06667	0.6071	0.1197	0.2393	59.14%	35.85%	49	122

Survival Rate Detail

C-mg/L (NO ₃ -N)	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.19	Dilution Water	0.4	0.7097	0.6552	0.7586
14.14		0.4516	0.9	0.275	0.8
20.18		0.3871	0.8	0.7097	0.8966
27.5		0.2333	0.9667	0.7097	0.6207
38.35		0.2333	0.4722	0.7419	0.7586
53.56		0.1667	0.8667	0.6897	0.5926
74.5		0.4118	0.5333	0.06667	0.6071

Survival Rate Binomials

C-mg/L (NO ₃ -N)	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.19	Dilution Water	12/30	22/31	19/29	22/29
14.14		14/31	27/30	11/40	24/30
20.18		12/31	24/30	22/31	26/29
27.5		7/30	29/30	22/31	18/29
38.35		7/30	17/36	23/31	22/29
53.56		5/30	26/30	20/29	16/27
74.5		14/34	16/30	2/30	17/28

CETIS Analytical Report

to Survival

Report Date: 10 Feb-17 11:58 (p 2 of 2)

Test Code: 161183NO3-Nd | 14-8717-3518

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 13-3412-8806

Endpoint: Survival Rate

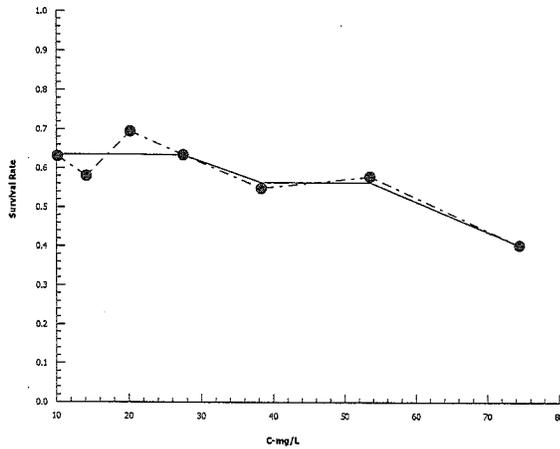
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 11:55

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 28 Mar-17 14:39 (p 1 of 3)

Test Code: 161183NO3-Nd | 14-8717-3518

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 18-2791-9139	Endpoint: Proportion Normal (% Survival)	CETIS Version: CETISv1.8.7
Analyzed: 28 Mar-17 14:39	Analysis: Linear Regression (MLE)	Official Results: Yes
Batch ID: 16-7220-4923	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (lab, N)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	GH_FR1 & site water (dilution water)

Linear Regression Options

Model Function	Threshold Option	Threshold	Optimized	Pooled	Het Corr	Weighted
Log-Angle [Asin(P^0.5)=A+B*log(X)]	Control Threshold	0.12	Yes	No	Yes	Yes

Regression Summary

Iters	LL	AICc	BIC	Mu	Sigma	Adj R2	F Stat	Critical	P-Value	Decision(α:5%)
16	-256.9	520.9	523.9	0.9981		0.3368	0.3416	2.84	0.8468	Non-Significant Lack of Fit

Point Estimates

Level	mg/L NO ₃ -N	95% LCL	95% UCL
EC5	17.94	0.03706	32.67
EC10	23.06	0.2039	38.93
EC15	28.12	0.7659	45.71
EC20	33.4	2.336	54.36
EC25	39.06	6.06	67.62
EC40	59.48	32.65	292.4
EC50	77.36	47.77	1429

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
Threshold	0.1058	0.06194	-0.02175	0.2334	1.708	0.1000	Non-Significant Parameter
Slope	0.882	0.3666	0.127	1.637	2.406	0.0239	Significant Parameter
Intercept	-0.8803	0.5881	-2.092	0.331	-1.497	0.1470	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	55.85728	55.85728	1	15.71	0.0005	Significant
Lack of Fit	5.429241	1.35731	4	0.3416	0.8468	Non-Significant
Pure Error	83.44785	3.973707	21			
Residual	88.87709	3.555084	25			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Goodness-of-Fit	Pearson Chi-Sq GOF	88.88	37.65	<0.0001	Significant Heterogeneity
	Likelihood Ratio GOF	111	37.65	<0.0001	Significant Heterogeneity
Variances	Bartlett Equality of Variance	3.563	12.59	0.7356	Equal Variances
	Mod Levene Equality of Variance	0.4184	2.573	0.8585	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.9633	0.9264	0.4163	Normal Distribution
	Anderson-Darling A2 Normality	0.4883	2.492	0.2269	Normal Distribution

CETIS Analytical Report

Report Date: 28 Mar-17 14:39 (p 2 of 3)

Test Code: 161183NO3-Nd | 14-8717-3518

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 18-2791-9139 *Swimup* Endpoint: Proportion Normal (*% Swimup*) CETIS Version: CETISv1.8.7
 Analyzed: 28 Mar-17 14:39 Analysis: Linear Regression (MLE) Official Results: Yes

Proportion Normal Summary

Calculated Variate(A/B)

C-mg/L <i>NO₃-N</i>	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
10.19	Dilution Water	4	0.8811	0.7895	1	0.04809	0.09619	10.92%	0.0%	66	75
14.14		4	0.8911	0.8182	1	0.03909	0.07818	8.77%	-1.13%	69	76
20.18		4	0.8267	0.6818	1	0.06601	0.132	15.97%	6.17%	70	84
27.5		4	0.7028	0.4286	1	0.1178	0.2355	33.51%	20.24%	56	76
38.35		4	0.593	0.2353	1	0.1567	0.3135	52.87%	32.7%	43	69
53.56		4	0.6603	0.45	0.9375	0.102	0.2039	30.88%	25.05%	44	67
74.5		4	0.4358	0.0625	0.8235	0.1581	0.3162	72.56%	50.54%	21	49

Proportion Normal Detail

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.19	Dilution Water	0.9167	0.8182	0.7895	1
14.14		0.8571	0.8889	0.8182	1
20.18		0.8333	0.7917	0.6818	1
27.5		0.4286	0.6552	0.7273	1
38.35		0.5714	0.2353	0.5652	1
53.56		0.6	0.6538	0.45	0.9375
74.5		0.3571	0.0625	0.5	0.8235

Proportion Normal Binomials

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.19	Dilution Water	11/12	18/22	15/19	22/22
14.14		12/14	24/27	9/11	24/24
20.18		10/12	19/24	15/22	26/26
27.5		3/7	19/29	16/22	18/18
38.35		4/7	4/17	13/23	22/22
53.56		3/5	17/26	9/20	15/16
74.5		5/14	1/16	1/2	14/17

CETIS Analytical Report

Report Date: 28 Mar-17 14:39 (p 3 of 3)

Test Code: 161183NO3-Nd | 14-8717-3518

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

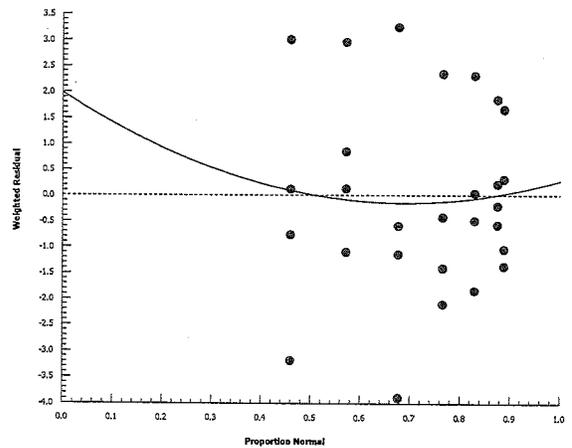
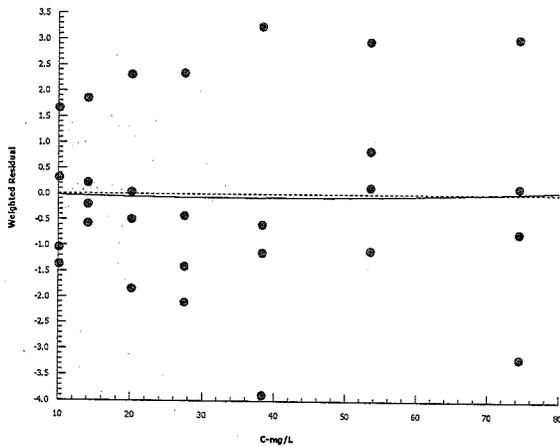
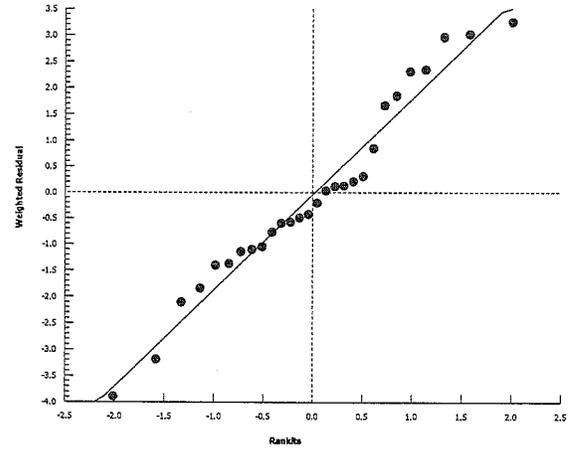
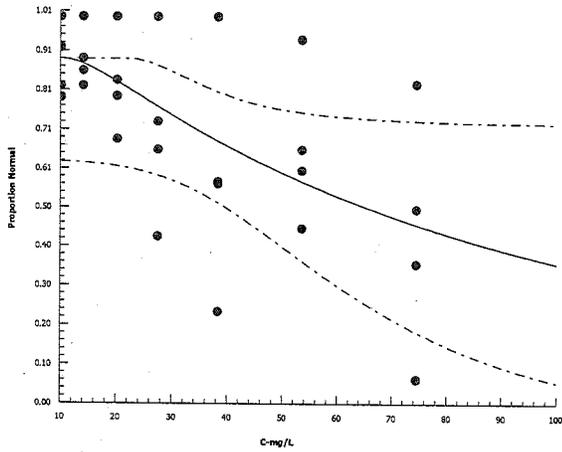
Analysis ID: 18-2791-9139
Analyzed: 28 Mar-17 14:39

Endpoint: Proportion Normal (60 Swimming)
Analysis: Linear Regression (MLE)

CETIS Version: CETISv1.8.7
Official Results: Yes

Graphics

$$\text{Log-Angle [Asin}(P^{0.5})=A+B*\log(X)]$$



CETIS Analytical Report

Report Date: 10 Feb-17 11:58 (p 1 of 2)
 Test Code: 161183NO3-Nd | 14-8717-3518

Swimming
Salmonid Embryo-Alevin-Fry Survival Development and Growth Test **Nautilus Environmental**

Analysis ID: 15-0379-4262	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 11:56	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
<hr/>		
Batch ID: 16-7220-4923	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
<hr/>		
Sample ID: 02-0044-4943	Code: GH_FR1	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (W ₃ -N)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1_WS_2016-10-25_N	<i>GH_FR1 is dilution water (Site water)</i>

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	937784	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L <i>(W₃-N)</i>	95% LCL	95% UCL
IC5	38.34	14.73	62.9
IC10	54.7	26.64	N/A
IC15	73.99	40.93	N/A
IC20	>74.5	N/A	N/A
IC25	>74.5	N/A	N/A
IC40	>74.5	N/A	N/A
IC50	>74.5	N/A	N/A

Length-mm Summary

C-mg/L <i>(W₃-N)</i>	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
10.19	Dilution Water	4	21.95	21.29	22.91	0.3531	0.7063	3.22%	0.0%
14.14		4	21.86	20.14	23.43	0.7052	1.41	6.45%	0.36%
20.18		4	22.35	20.95	24.38	0.7657	1.531	6.85%	-1.85%
27.5		4	21.67	20.29	24.05	0.8256	1.651	7.62%	1.24%
38.35		4	20.95	19.52	22.48	0.6673	1.335	6.37%	4.53%
53.56		4	19.93	19	21.85	0.6502	1.3	6.53%	9.21%
74.5		4	18.72	16.75	21	0.925	1.85	9.88%	14.7%

Length-mm Detail

C-mg/L <i>(W₃-N)</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.19	Dilution Water	21.58	22.91	21.29	22
14.14		21.43	23.43	20.14	22.46
20.18		21.42	24.38	20.95	22.65
27.5		20.29	24.05	20.93	21.42
38.35		20.21	21.59	19.52	22.48
53.56		19.5	21.85	19.35	19
74.5		21	17.81	16.75	19.32

CETIS Analytical Report

Swamp

Report Date: 10 Feb-17 11:58 (p 2 of 2)

Test Code: 161183NO3-Nd | 14-8717-3518

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 15-0379-4262

Endpoint: Length-mm

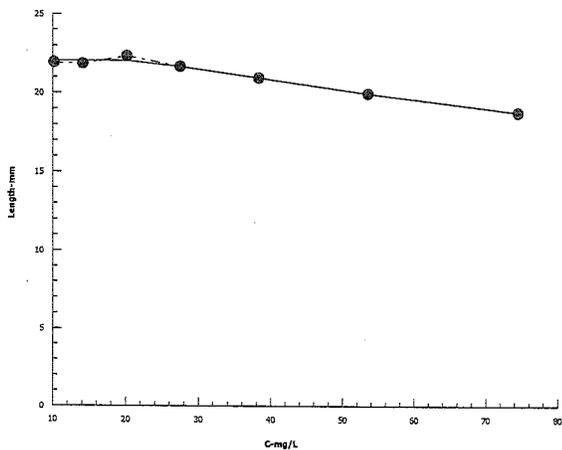
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 11:56

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 10 Feb-17 11:58 (p 1 of 2)
 Test Code: 161183NO3-Nd | 14-8717-3518

Swimup

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 20-0299-8353 **Endpoint:** Mean ^{Wet} Dry Weight-mg **CETIS Version:** CETISv1.8.7
 Analyzed: 10 Feb-17 11:56 **Analysis:** Linear Interpolation (ICPIN) **Official Results:** Yes

Batch ID: 16-7220-4923 **Test Type:** Survival-Development-Growth **Analyst:** Kania Lywe
 Start Date: 01 Nov-16 16:20 **Protocol:** EC/EPS 1/RM/28 **Diluent:** Site Water
 Ending Date: 09 Dec-16 10:00 **Species:** Oncorhynchus mykiss **Brine:**
 Duration: 37d 18h **Source:** Vancouver Island Trout Hatchery **Age:**

Sample ID: 02-0044-4943 **Code:** GH_FR1 **Client:** Teck Coal
 Sample Date: 25 Oct-16 10:30 **Material:** Water Sample (W_{3-N}) **Project:**
 Receive Date: 26 Oct-16 08:44 **Source:** Teck Coal (TECK COAL)
 Sample Age: 7d 6h (4.2 °C) **Station:** GH_FR1_WS_2016-10-25_N *GH FR1 B dilution water (Site water)*

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1081439	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L (W _{3-N})	95% LCL	95% UCL
IC5	38.47	N/A	73.66
IC10	47.27	13.65	N/A
IC15	63.26	29.38	N/A
IC20	>74.5	N/A	N/A
IC25	>74.5	N/A	N/A
IC40	>74.5	N/A	N/A
IC50	>74.5	N/A	N/A

Mean Dry Weight-mg Summary

C-mg/L (W _{3-N})	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
10.19	Dilution Water	4	109.3	99.09	118.9	5	10	9.15%	0.0%
14.14		4	109.2	102.1	126.7	5.851	11.7	10.72%	0.16%
20.18		4	115.5	103.8	136.7	7.513	15.03	13.01%	-5.59%
27.5		4	111.8	93.89	137.6	9.208	18.42	16.47%	-2.26%
38.35		4	106	97.73	122.4	5.568	11.14	10.51%	3.1%
53.56		4	96.91	80.63	115	7.083	14.17	14.62%	11.37%
74.5		4	92.58	65	122.9	11.84	23.68	25.57%	15.33%

Mean Dry Weight-mg Detail

C-mg/L (W _{3-N})	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.19	Dilution Water	102.5	116.8	118.9	99.09
14.14		104.3	126.7	103.6	102.1
20.18		105.8	136.7	115.5	103.8
27.5		107.1	137.6	108.6	93.89
38.35		102.9	122.4	100.9	97.73
53.56		98	115	94	80.63
74.5		122.9	91.88	65	90.59

CETIS Analytical Report

Swimup

Report Date: 10 Feb-17 11:58 (p 2 of 2)

Test Code: 161183NO3-Nd | 14-8717-3518

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 20-0299-8353

Endpoint: Mean ~~Dry~~ ^{Wet} Weight-mg

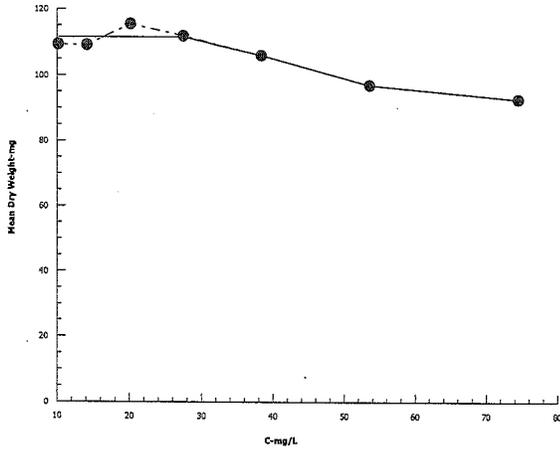
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 11:56

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 06 Apr-17 15:08 (p 1 of 3)
 Test Code: 161183NO3-Ne | 10-3594-2080

Summary

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test Nautilus Environmental

Analysis ID: 15-6782-3513	Endpoint: Survival Rate	CETIS Version: CETISv1.8.7
Analyzed: 06 Apr-17 15:07	Analysis: Linear Regression (MLE)	Official Results: Yes
Batch ID: 07-9825-9650	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (NO ₃ -N)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	<i>GH FR1-HH is GH FR1 w/ hardness adjusted in-house to ~900µg/L Ca</i>
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	<i>GH FR1-HH is site water (dilution water)</i>

Linear Regression Options

Model Function	Threshold Option	Threshold	Optimized	Pooled	Het Corr	Weighted
Log-Normal [NED=A+B*log(X)]	Control Threshold	0.6771653	Yes	No	Yes	Yes

Regression Summary

Iters	LL	AICc	BIC	Mu	Sigma	Adj R2	F Stat	Critical	P-Value	Decision(α:5%)
29	-498.5	1004	1007	2.015	0.2777	0.06643	0.05883	2.84	0.9931	Non-Significant Lack of Fit

Point Estimates

Level	mg/L NO ₃ -N	95% LCL	95% UCL
EC5	36.14	N/A	N/A
EC10	45.59	N/A	N/A
EC15	53.32	N/A	N/A
EC20	60.39	N/A	N/A
EC25	67.21	N/A	N/A
EC40	87.97	N/A	N/A
EC50	103.4	N/A	N/A

Regression Parameters

Parameter	Estimate	Std Error	95% LCL	95% UCL	t Stat	P-Value	Decision(α:5%)
Threshold	0.6807	0.05177	0.574	0.7873	13.15	<0.0001	Significant Parameter
Slope	3.601	3.568	-3.746	10.95	1.009	0.3224	Non-Significant Parameter
Intercept	-7.255	6.971	-21.61	7.102	-1.041	0.3079	Non-Significant Parameter

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Model	17.04723	17.04723	1	3.921	0.0588	Non-Significant
Lack of Fit	1.204517	0.3011293	4	0.05883	0.9931	Non-Significant
Pure Error	107.4833	5.11825	21			
Residual	108.6878	4.347511	25			

Residual Analysis

Attribute	Method	Test Stat	Critical	P-Value	Decision(α:5%)
Goodness-of-Fit	Pearson Chi-Sq GOF	108.7	37.65	<0.0001	Significant Heterogeneity
	Likelihood Ratio GOF	125	37.65	<0.0001	Significant Heterogeneity
Variances	Bartlett Equality of Variance	10.3	12.59	0.1126	Equal Variances
	Mod Levene Equality of Variance	1.697	2.573	0.1712	Equal Variances
Distribution	Shapiro-Wilk W Normality	0.982	0.9264	0.8948	Normal Distribution
	Anderson-Darling A2 Normality	0.2227	2.492	0.8608	Normal Distribution

CETIS Analytical Report

Report Date: 06 Apr-17 15:08 (p 2 of 3)
 Test Code: 161183NO3-Ne | 10-3594-2080

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 15-6782-3513 Endpoint: Survival Rate CETIS Version: CETISv1.8.7
 Analyzed: 06 Apr-17 15:07 Analysis: Linear Regression (MLE) Official Results: Yes

Survival Rate Summary

Calculated Variate(A/B)

C-mg/L	Control Type	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
10.2	Dilution Water	4	0.3275	0.1333	0.5	0.08454	0.1691	51.63%	0.0%	41	127
14.94		4	0.2826	0.07143	0.4516	0.08924	0.1785	63.15%	13.7%	35	126
22.3		4	0.3326	0.2581	0.4333	0.03801	0.07601	22.85%	-1.56%	41	124
34.7		4	0.3537	0	0.5862	0.1266	0.2533	71.6%	-8.02%	41	116
49.26		4	0.2797	0.1143	0.4828	0.09314	0.1863	66.59%	14.58%	33	123
72.91		4	0.2083	0	0.5667	0.1301	0.2602	124.9%	36.38%	25	120
110.62		4	0.1551	0.129	0.1875	0.01467	0.02934	18.91%	52.63%	20	130

Survival Rate Detail

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.2	Dilution Water	0.1333	0.2432	0.5	0.4333
14.94		0.4516	0.4074	0.2	0.07143
22.3		0.3448	0.2581	0.4333	0.2941
34.7		0	0.4688	0.36	0.5862
49.26		0.4828	0.1143	0.129	0.3929
72.91		0.03333	0	0.5667	0.2333
110.62		0.1724	0.1875	0.1316	0.129

Survival Rate Binomials

C-mg/L	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.2	Dilution Water	4/30	9/37	15/30	13/30
14.94		14/31	11/27	8/40	2/28
22.3		10/29	8/31	13/30	10/34
34.7		0/30	15/32	9/25	17/29
49.26		14/29	4/35	4/31	11/28
72.91		1/30	0/30	17/30	7/30
110.62		5/29	6/32	5/38	4/31

Swi

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 15-6782-3513

Endpoint: Survival Rate

CETIS Version: CETISv1.8.7

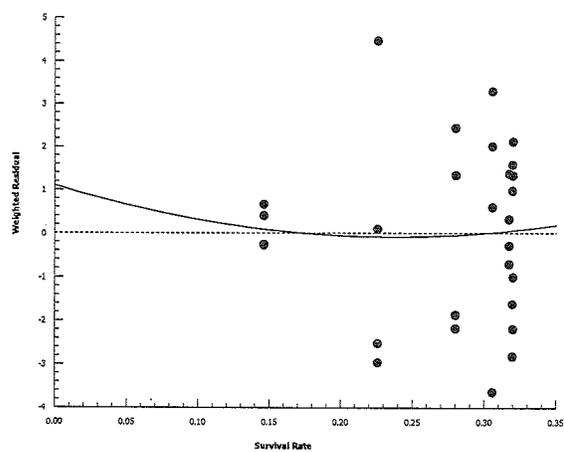
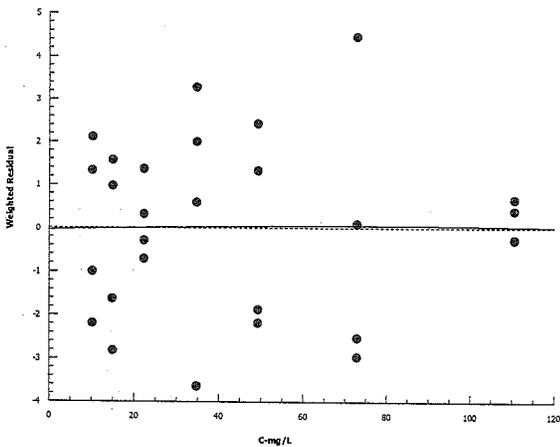
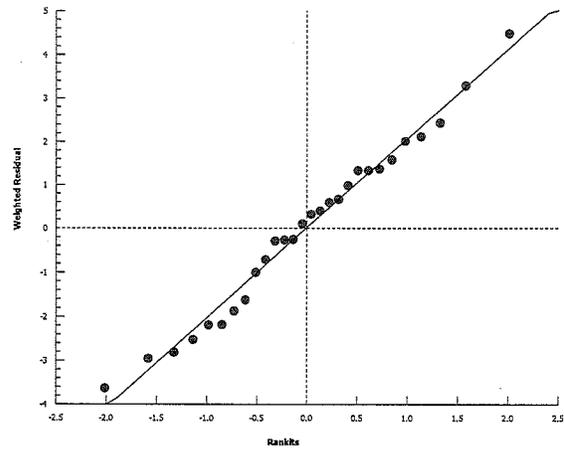
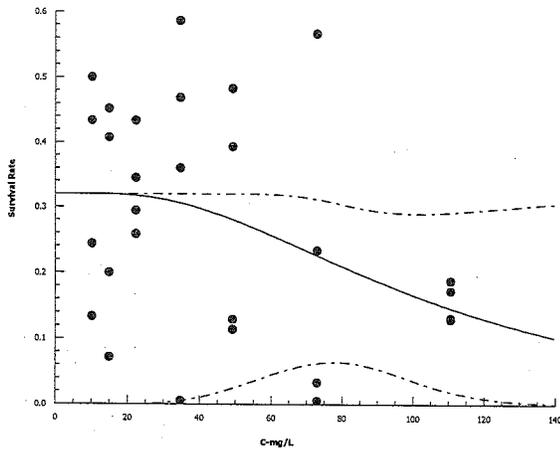
Analyzed: 06 Apr-17 15:07

Analysis: Linear Regression (MLE)

Official Results: Yes

Graphics

Log-Normal [NED=A+B*log(X)]



CETIS Analytical Report

Report Date: 06 Apr-17 15:11 (p 1 of 2)
 Test Code: 161183NO3-Ne | 10-3594-2080

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 14-2613-5581	Endpoint: Proportion Normal (% Swimming)	CETIS Version: CETISv1.8.7
Analyzed: 06 Apr-17 15:10	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 07-9825-9650	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (NO ₃ -N)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	<i>at GH_FR1-HH is GH_FR1 w/ hardness adjusted in house to ~700µg/L CaCO₃</i>
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	<i>GH_FR1-HH is dilution water (site water)</i>

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1647700	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L NO ₃ -N	95% LCL	95% UCL
EC5	11.14	10.3	46.24
EC10	12.16	10.37	122.9
EC15	13.26	10.42	145.3
EC20	14.46	10.44	N/A
EC25	23.64	5.693	N/A
EC40	87.12	N/A	N/A
EC50	>110.6	N/A	N/A

Proportion Normal Summary

C-mg/L NO ₃ -N	Control Type	Count	Calculated Variate(A/B)								
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
10.2	Dilution Water	4	0.6583	0.3333	1	0.1493	0.2986	45.36%	0.0%	30	41
14.94		4	0.5106	0.25	0.9286	0.1484	0.2968	58.14%	22.45%	20	35
22.3		4	0.5308	0.3	0.9231	0.137	0.274	51.62%	19.38%	23	41
34.7		3	0.315	0.2	0.4118	0.06181	0.1071	33.98%	52.15%	13	41
49.26		1	0.5455	0.5455	0.5455	0	0	0.0%	17.15%	6	11
72.91		2	0.4664	0.2857	0.6471	0.1807	0.2555	54.78%	29.16%	13	24
110.62		2	0.4	0.2	0.6	0.2	0.2828	70.71%	39.24%	4	10

Proportion Normal Detail

C-mg/L NO ₃ -N	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.2	Dilution Water	0.5	0.3333	0.8	1
14.94		0.9286	0.3636	0.25	0.5
22.3		0.4	0.5	0.9231	0.3
34.7		0.2	0.3333	0.4118	
49.26		0.5455			
72.91		0.6471	0.2857		
110.62		0.2	0.6		

← Rep A B omitted from % swimming analysis
← Reps A, B and C are omitted from % swimming analysis
← Reps A and B are omitted from % swimming analysis
← Reps B and D are omitted from % swimming analysis.

Proportion Normal Binomials

C-mg/L NO ₃ -N	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.2	Dilution Water	2/4	3/9	12/15	13/13
14.94		13/14	4/11	2/8	1/2
22.3		4/10	4/8	12/13	3/10
34.7		3/15	3/9	7/17	
49.26		6/11			
72.91		11/17	2/7		
110.62		1/5	3/5		

CETIS Analytical Report

Swimup

Report Date: 06 Apr-17 15:11 (p 2 of 2)

Test Code: 161183NO3-Ne | 10-3594-2080

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 14-2613-5581

Endpoint: Proportion Normal (*% Swimup*)

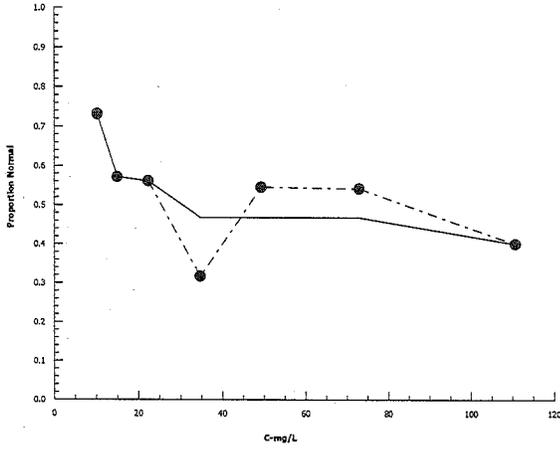
CETIS Version: CETISv1.8.7

Analyzed: 06 Apr-17 15:10

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Report Date: 10 Feb-17 12:16 (p 1 of 2)
 Test Code: 161183NO3-Ne | 10-3594-2080

Swimup

Salmonid Embryo-Alevin Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 14-8282-1669	Endpoint: Length-mm	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 12:14	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 07-9825-9650	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (NO_3-N)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2097408	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L NO_3-N	95% LCL	95% UCL
IC5	17.07	10.41	28.5
IC10	27.95	17.25	36.87
IC15	46.21	25.65	N/A
IC20	>110.6	N/A	N/A
IC25	>110.6	N/A	N/A
IC40	>110.6	N/A	N/A
IC50	>110.6	N/A	N/A

*GH_FR1-HH is GH_FR1 w/ hardness adjusted in-house to ~700mg/L $CaCO_3$.
 GH_FR1-HH is dilution water (site water)*

Length-mm Summary

C-mg/L NO_3-N	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
10.2	Dilution Water	4	21.72	21.39	22.04	0.1765	0.3529	1.63%	0.0%
14.94		4	20.79	19.55	22.38	0.6056	1.211	5.83%	4.24%
22.3		4	20.29	19.2	21.38	0.447	0.8941	4.41%	6.55%
34.7		3	18.82	18.33	19.63	0.408	0.7066	3.76%	13.33%
49.26		4	17.93	16.13	19.32	0.6932	1.386	7.73%	17.43%
72.91		3	18.82	17.5	20	0.7254	1.256	6.68%	13.32%
110.62		4	18.2	16.75	19.33	0.5965	1.193	6.56%	16.21%

Length-mm Detail

C-mg/L NO_3-N	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.2	Dilution Water	22	21.39	21.43	22.04
14.94		21	19.55	22.38	20.25
22.3		20.4	21.38	20.19	19.2
34.7		19.63	18.33	18.5	
49.26		19.32	17.63	16.13	18.64
72.91		20	18.97	17.5	
110.62		17.7	19.33	19	16.75

CETIS Analytical Report

Swim up

Report Date: 10 Feb-17 12:16 (p 2 of 2)

Test Code: 161183NO3-Ne | 10-3594-2080

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 14-8282-1669

Endpoint: Length-mm

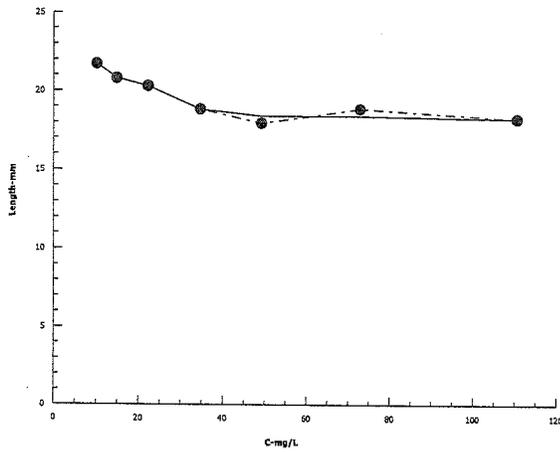
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 12:14

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



CETIS Analytical Report

Swimm

Report Date: 10 Feb-17 12:16 (p 1 of 2)

Test Code: 161183NO3-Ne | 10-3594-2080

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 05-1015-9292	Endpoint: Mean ^{dry} Weight-mg	CETIS Version: CETISv1.8.7
Analyzed: 10 Feb-17 12:14	Analysis: Linear Interpolation (ICPIN)	Official Results: Yes
Batch ID: 07-9825-9650	Test Type: Survival-Development-Growth	Analyst: Kania Lywe
Start Date: 01 Nov-16 16:20	Protocol: EC/EPS 1/RM/28	Diluent: Site Water
Ending Date: 09 Dec-16 10:00	Species: Oncorhynchus mykiss	Brine:
Duration: 37d 18h	Source: Vancouver Island Trout Hatchery	Age:
Sample ID: 03-6653-4885	Code: GH_FR1-HH	Client: Teck Coal
Sample Date: 25 Oct-16 10:30	Material: Water Sample (<i>NO₃-N</i>)	Project:
Receive Date: 26 Oct-16 08:44	Source: Teck Coal (TECK COAL)	
Sample Age: 7d 6h (4.2 °C)	Station: GH_FR1-HH_WS_2016-10-25_N	

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	2086873	200	Yes	Two-Point Interpolation

Point Estimates

Level	mg/L <i>NO₃-N</i>	95% LCL	95% UCL
IC5	15.41	9.435	33.09
IC10	24.67	6.546	44.06
IC15	32.78	8.504	98.47
IC20	43.3	18.63	N/A
IC25	>110.6	N/A	N/A
IC40	>110.6	N/A	N/A
IC50	>110.6	N/A	N/A

*GH-FR1-HH B GH-FR1 w hardness adjusted ⁱⁿ in-house to ~70mg/L CaCl₂
GH-FR1-HH B dilution water (site water)*

Mean ^{dry} Weight-mg Summary

C-mg/L <i>NO₃-N</i>	Control Type	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
10.2	Dilution Water	4	117	104.6	132.2	5.96	11.92	10.18%	0.0%
14.94		4	111.5	95	132.5	8.289	16.58	14.87%	4.73%
22.3		4	107.4	94.62	125	7.341	14.68	13.67%	8.24%
34.7		3	98.31	86.47	104.4	5.919	10.25	10.43%	16.01%
49.26		4	89.82	77.5	104.3	6.56	13.12	14.61%	23.26%
72.91		3	91.34	81.18	100	5.486	9.502	10.4%	21.96%
110.62		4	91.54	81.67	104	4.71	9.42	10.29%	21.79%

Mean ^{dry} Weight-mg Detail

C-mg/L <i>NO₃-N</i>	Control Type	Rep 1	Rep 2	Rep 3	Rep 4
10.2	Dilution Water	120	132.2	111.3	104.6
14.94		102.1	116.4	132.5	95
22.3		114	125	94.62	96
34.7		104	104.4	86.47	
49.26		104.3	97.5	77.5	80
72.91		100	81.18	92.86	
110.62		104	81.67	88	92.5

CETIS Analytical Report

Swimming

Report Date: 10 Feb-17 12:16 (p 2 of 2)

Test Code: 161183NO3-Ne | 10-3594-2080

Salmonid Embryo-Alevin-Fry Survival Development and Growth Test

Nautilus Environmental

Analysis ID: 05-1015-9292

Endpoint: Mean Dry Weight-mg

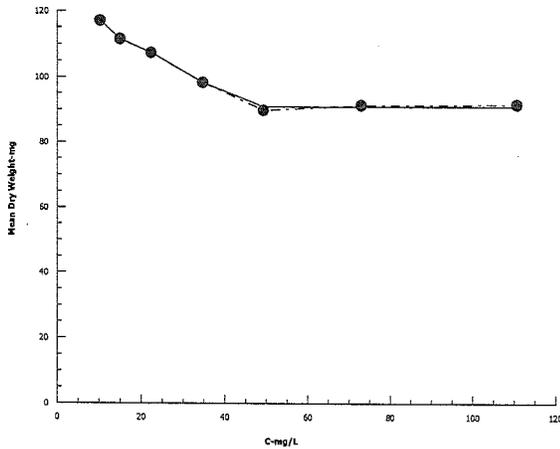
CETIS Version: CETISv1.8.7

Analyzed: 10 Feb-17 12:14

Analysis: Linear Interpolation (ICPIN)

Official Results: Yes

Graphics



APPENDIX D – Analytical Chemistry



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

Date Received: 26-OCT-16
Report Date: 28-OCT-16 17:31 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1848912
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1848912-1 Water 26-OCT-16 10:00 GH_FR1	L1848912-2 Water 26-OCT-16 10:00 GH_ER2	L1848912-3 Water 26-OCT-16 10:00 GH_ER4	
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	577	202	305	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	193	147	163	
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0147	<0.0050	
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}	<0.50	2.02	
	Nitrate (as N) (mg/L)	9.76	0.0712	2.91	
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}	<0.0010	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0069	0.0063	0.0038	
	Sulfate (SO4) (mg/L)	226	23.3	77.3	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0106	0.0085	0.0099	
	Antimony (Sb)-Total (mg/L)	0.00017	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.00018	0.00015	0.00025	
	Barium (Ba)-Total (mg/L)	0.103	0.0468	0.0689	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000149	0.0000071	0.0000103	
	Calcium (Ca)-Total (mg/L)	102	48.3	65.2	
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Total (mg/L)	0.00013	0.00026	0.00029	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Total (mg/L)	0.014	0.010	0.013	
	Lead (Pb)-Total (mg/L)	0.000050	<0.000050	0.000087	
	Lithium (Li)-Total (mg/L)	0.0175	0.0015	0.0089	
	Magnesium (Mg)-Total (mg/L)	49.5	11.9	21.6	
	Manganese (Mn)-Total (mg/L)	0.00134	0.00169	0.00103	
	Molybdenum (Mo)-Total (mg/L)	0.00106	0.00102	0.00113	
	Nickel (Ni)-Total (mg/L)	0.00268	<0.00050	0.00053	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	1.29	0.358	0.650	
	Rubidium (Rb)-Total (mg/L)	0.00064	<0.00020	0.00036	
	Selenium (Se)-Total (mg/L)	0.0452	0.000899	0.0104	
	Silicon (Si)-Total (mg/L)	2.19	1.82	1.99	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	1.98	0.677	2.20	
	Strontium (Sr)-Total (mg/L)	0.150	0.233	0.243	
	Sulfur (S)-Total (mg/L)	77.6	8.25	27.0	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1848912-1	L1848912-2	L1848912-3
		Description	Water	Water	Water
		Sampled Date	26-OCT-16	26-OCT-16	26-OCT-16
		Sampled Time	10:00	10:00	10:00
		Client ID	GH_FR1	GH_ER2	GH_ER4
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)		<0.00020	<0.00020	<0.00020
	Thallium (Tl)-Total (mg/L)		<0.000010	<0.000010	<0.000010
	Thorium (Th)-Total (mg/L)		<0.00010	<0.00010	<0.00010
	Tin (Sn)-Total (mg/L)		<0.00010	<0.00010	<0.00010
	Titanium (Ti)-Total (mg/L)		<0.00030	<0.00030	<0.00030
	Tungsten (W)-Total (mg/L)		<0.00010	<0.00010	<0.00010
	Uranium (U)-Total (mg/L)		0.00244	0.000796	0.00124
	Vanadium (V)-Total (mg/L)		<0.00050	<0.00050	<0.00050
	Zinc (Zn)-Total (mg/L)		0.0032	0.0178	0.0186
	Zirconium (Zr)-Total (mg/L)		<0.00030	<0.00030	<0.00030
Dissolved Metals	Dissolved Metals Filtration Location		LAB	LAB	LAB
	Aluminum (Al)-Dissolved (mg/L)		0.0012	0.0016	0.0013
	Antimony (Sb)-Dissolved (mg/L)		0.00016	<0.00010	<0.00010
	Arsenic (As)-Dissolved (mg/L)		<0.00010	<0.00010	0.00014
	Barium (Ba)-Dissolved (mg/L)		0.101	0.0456	0.0674
	Beryllium (Be)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050
	Boron (B)-Dissolved (mg/L)		<0.010	<0.010	<0.010
	Cadmium (Cd)-Dissolved (mg/L)		0.0000140	<0.0000050	0.0000112
	Calcium (Ca)-Dissolved (mg/L)		99.9	47.1	63.7
	Cesium (Cs)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Dissolved (mg/L)		0.00011	0.00023	0.00021
	Cobalt (Co)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010
	Copper (Cu)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020
	Iron (Fe)-Dissolved (mg/L)		<0.010	<0.010	<0.010
	Lead (Pb)-Dissolved (mg/L)		<0.000050	<0.000050	<0.000050
	Lithium (Li)-Dissolved (mg/L)		0.0166	0.0014	0.0085
	Magnesium (Mg)-Dissolved (mg/L)		48.5	11.7	20.9
	Manganese (Mn)-Dissolved (mg/L)		0.00104	0.00133	0.00066
	Molybdenum (Mo)-Dissolved (mg/L)		0.00104	0.000969	0.00109
	Nickel (Ni)-Dissolved (mg/L)		0.00253	<0.00050	<0.00050
	Phosphorus (P)-Dissolved (mg/L)		<0.050	<0.050	<0.050
	Potassium (K)-Dissolved (mg/L)		1.28	0.347	0.624
	Rubidium (Rb)-Dissolved (mg/L)		0.00061	<0.00020	0.00034
	Selenium (Se)-Dissolved (mg/L)		0.0460	0.000876	0.0106
	Silicon (Si)-Dissolved (mg/L)		2.06	1.66	1.88
	Silver (Ag)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1848912-1	L1848912-2	L1848912-3		
		Description	Water	Water	Water		
		Sampled Date	26-OCT-16	26-OCT-16	26-OCT-16		
		Sampled Time	10:00	10:00	10:00		
		Client ID	GH_FR1	GH_ER2	GH_ER4		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		1.97	0.686	2.12		
	Strontium (Sr)-Dissolved (mg/L)		0.146	0.227	0.237		
	Sulfur (S)-Dissolved (mg/L)		72.4	7.61	25.8		
	Tellurium (Te)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Thorium (Th)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)		0.00241	0.000767	0.00120		
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0029	0.0159	0.0074		
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		

* 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	Barium (Ba)-Total	MS-B	L1848912-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L1848912-1, -2, -3
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1848912-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L1848912-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L1848912-1, -2, -3
Matrix Spike	Sulfate (SO4)	MS-B	L1848912-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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
----------------------------	---------------------

Reference Information

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
ATTN: Bonnie Lo
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 02-NOV-16
Report Date: 04-NOV-16 13:25 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1852463
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1852463-1 Water 02-NOV-16 11:30 GH_FR1-RD2	L1852463-2 Water 02-NOV-16 11:30 GH_ER2-RD2	L1852463-3 Water 02-NOV-16 11:30 EV_ER4-RD2	
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	552	172	293	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	192	146	162	
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0185	<0.0050	
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}	<0.50	1.92	
	Nitrate (as N) (mg/L)	9.87	0.0811	2.89	
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}	<0.0010	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0028	0.0032	0.0053	
	Sulfate (SO4) (mg/L)	225	22.9	75.5	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0210	0.0141	0.0106	
	Antimony (Sb)-Total (mg/L)	0.00029	<0.00010	0.00012	
	Arsenic (As)-Total (mg/L)	0.00013	0.00011	0.00017	
	Barium (Ba)-Total (mg/L)	0.104	0.0464	0.0696	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000192	0.0000072	0.0000171	
	Calcium (Ca)-Total (mg/L)	104	50.8	68.9	
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Total (mg/L)	0.00018	0.00027	0.00025	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Total (mg/L)	0.025	0.016	0.010	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Total (mg/L)	0.0166	0.0014	0.0085	
	Magnesium (Mg)-Total (mg/L)	47.3	11.3	20.5	
	Manganese (Mn)-Total (mg/L)	0.00181	0.00192	0.00108	
	Molybdenum (Mo)-Total (mg/L)	0.00112	0.00102	0.00119	
	Nickel (Ni)-Total (mg/L)	0.00289	<0.00050	0.00072	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	1.29	0.358	0.635	
	Rubidium (Rb)-Total (mg/L)	0.00062	<0.00020	0.00032	
	Selenium (Se)-Total (mg/L)	0.0467	0.000924	0.0109	
	Silicon (Si)-Total (mg/L)	2.30	1.83	2.04	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	2.11	0.726	2.26	
	Strontium (Sr)-Total (mg/L)	0.148	0.235	0.242	
	Sulfur (S)-Total (mg/L)	80.8	8.27	27.7	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1852463-1 Water 02-NOV-16 11:30 GH_FR1-RD2	L1852463-2 Water 02-NOV-16 11:30 GH_ER2-RD2	L1852463-3 Water 02-NOV-16 11:30 EV_ER4-RD2	
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020	
	Thallium (Tl)-Total (mg/L)	0.000016	<0.000010	<0.000010	
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Total (mg/L)	0.00063	<0.00030	<0.00030	
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Uranium (U)-Total (mg/L)	0.00246	0.000793	0.00124	
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0141	<0.0030	
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location	LAB	LAB	LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.0014	0.0020	0.0017	
	Antimony (Sb)-Dissolved (mg/L)	0.00019	<0.00010	<0.00010	
	Arsenic (As)-Dissolved (mg/L)	0.00011	0.00010	0.00016	
	Barium (Ba)-Dissolved (mg/L)	0.103	0.0457	0.0685	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000090	<0.0000050	0.0000116	
	Calcium (Ca)-Dissolved (mg/L)	102	49.4	68.4	
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Dissolved (mg/L)	0.00011	0.00021	0.00017	
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00022	0.00026	0.00036	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0156	0.0013	0.0082	
	Magnesium (Mg)-Dissolved (mg/L)	44.3	10.9	19.8	
	Manganese (Mn)-Dissolved (mg/L)	0.00122	0.00120	0.00066	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00105	0.000952	0.00111	
	Nickel (Ni)-Dissolved (mg/L)	0.00275	<0.00050	0.00060	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	1.21	0.334	0.639	
	Rubidium (Rb)-Dissolved (mg/L)	0.00057	<0.00020	0.00032	
	Selenium (Se)-Dissolved (mg/L)	0.0466	0.000935	0.0105	
	Silicon (Si)-Dissolved (mg/L)	2.08	1.71	1.93	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1852463-1	L1852463-2	L1852463-3		
		Description	Water	Water	Water		
		Sampled Date	02-NOV-16	02-NOV-16	02-NOV-16		
		Sampled Time	11:30	11:30	11:30		
		Client ID	GH_FR1-RD2	GH_ER2-RD2	EV_ER4-RD2		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		2.01	0.723	2.23		
	Strontium (Sr)-Dissolved (mg/L)		0.143	0.223	0.234		
	Sulfur (S)-Dissolved (mg/L)		74.5	7.69	25.0		
	Tellurium (Te)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Thorium (Th)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)		0.00232	0.000747	0.00120		
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0014	0.0126	0.0013		
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		

* 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)
Qualifiers for Individual Parameters Listed:			
Qualifier	Description		
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.		

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-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
		Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.	
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
		Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.	
		Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.	
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
		Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.	
		Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.	
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
		This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.	
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
		This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.	
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
		This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.	
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
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:

Reference Information

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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com



COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																											
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																											
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input checked="" type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																											
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																											
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																											
		Email 1 or Fax bonnie@nautilusenvironmental.ca			Specify Date Required for E2,E or P: <u>Nov 4 / 2016 (Friday)</u>																											
		Email 2			Analysis Request																											
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																											
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			P																											
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax bonnie@nautilusenvironmental.ca																														
Company: Nautilus Environmental		Email 2 lise@nautilusenvironmental.ca																														
Contact: Bonnie Lo																																
Project Information		Oil and Gas Required Fields (client use)																														
ALS Quote #:		Approver ID:																														
Job #:		Cost Center:																														
PO / AFE:		GL Account:																														
LSD:		Routing Code:																														
		Activity Code:																														
		Location:																														
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler:																											
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)		Time (hh:mm)		Sample Type		Total metals, low level (preserved)		Dissolved metals-low level		Chloride		Sulphate		Alkalinity		Nitrate		Nitrite		Ammonia		Phosphorus		Total Dissolved Solids		Number of Containers	
		GH-ER1-Rd2			02-Nov-16		1130		Water		✓		✓		✓		✓		✓		✓		✓		✓		✓		3			
		GH-ER2-Rd2			02-Nov-16		1130		Water		✓		✓		✓		✓		✓		✓		✓		✓		✓		3			
		EV-ER4-Rd2			02-Nov-16		1130		Water		✓		✓		✓		✓		✓		✓		✓		✓		✓		3			



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

Date Received: 09-NOV-16
Report Date: 10-NOV-16 19:23 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1855744
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID			
	L1855744-1 WATER 09-NOV-16 10:30 GH_FR1_RD3	L1855744-2 WATER 09-NOV-16 10:30 GH_ER2_RD3	L1855744-3 WATER 09-NOV-16 10:30 EV_ER4_RD3	
Grouping	Analyte			
WATER				
Physical Tests	Total Dissolved Solids (mg/L)	575	181	298
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	204	149	167
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0149	<0.0050
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}	<0.50	1.97
	Nitrate (as N) (mg/L)	9.92	0.0776	3.00
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}	<0.0010	<0.0010
	Phosphorus (P)-Total (mg/L)	<0.0020	0.0021	0.0036
	Sulfate (SO4) (mg/L)	218	22.5	76.4
Total Metals	Aluminum (Al)-Total (mg/L)	0.0170	0.0089	0.0071
	Antimony (Sb)-Total (mg/L)	0.00017	<0.00010	<0.00010
	Arsenic (As)-Total (mg/L)	0.00013	0.00013	0.00020
	Barium (Ba)-Total (mg/L)	0.0995	0.0481	0.0662
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000190	0.0000058	0.0000159
	Calcium (Ca)-Total (mg/L)	104	48.8	65.4
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	<0.000010
	Chromium (Cr)-Total (mg/L)	0.00017	0.00029	0.00024
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050
	Iron (Fe)-Total (mg/L)	0.029	0.012	<0.010
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050
	Lithium (Li)-Total (mg/L)	0.0195	0.0021	0.0098
	Magnesium (Mg)-Total (mg/L)	47.6	12.2	21.3
	Manganese (Mn)-Total (mg/L)	0.00192	0.00153	0.00087
	Molybdenum (Mo)-Total (mg/L)	0.00111	0.00103	0.00117
	Nickel (Ni)-Total (mg/L)	0.00300	<0.00050	0.00084
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050
	Potassium (K)-Total (mg/L)	1.27	0.377	0.652
	Rubidium (Rb)-Total (mg/L)	0.00067	<0.00020	0.00032
	Selenium (Se)-Total (mg/L)	0.0474	0.00163	0.0110
	Silicon (Si)-Total (mg/L)	2.33	1.86	2.02
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010
	Sodium (Na)-Total (mg/L)	1.93	0.718	2.19
	Strontium (Sr)-Total (mg/L)	0.154	0.235	0.245
	Sulfur (S)-Total (mg/L)	80.4	9.31	27.9

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855744-1	L1855744-2	L1855744-3
		Description	WATER	WATER	WATER
		Sampled Date	09-NOV-16	09-NOV-16	09-NOV-16
		Sampled Time	10:30	10:30	10:30
		Client ID	GH_FR1_RD3	GH_ER2_RD3	EV_ER4_RD3
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020	
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Uranium (U)-Total (mg/L)	0.00264	0.000881	0.00135	
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Total (mg/L)	<0.0030	0.0175	<0.0030	
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location	LAB	LAB	LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.0013	0.0017	0.0014	
	Antimony (Sb)-Dissolved (mg/L)	0.00016	<0.00010	<0.00010	
	Arsenic (As)-Dissolved (mg/L)	<0.00010	<0.00010	0.00014	
	Barium (Ba)-Dissolved (mg/L)	0.0968	0.0437	0.0632	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000147	0.0000054	0.0000117	
	Calcium (Ca)-Dissolved (mg/L)	99.7	47.0	65.4	
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	0.00022	0.00019	
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00022	<0.00020	<0.00020	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0182	0.0018	0.0096	
	Magnesium (Mg)-Dissolved (mg/L)	46.0	12.2	21.8	
	Manganese (Mn)-Dissolved (mg/L)	0.00120	0.00119	0.00065	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00108	0.000987	0.00113	
	Nickel (Ni)-Dissolved (mg/L)	0.00282	<0.00050	0.00068	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	1.24	0.369	0.700	
	Rubidium (Rb)-Dissolved (mg/L)	0.00055	<0.00020	0.00033	
	Selenium (Se)-Dissolved (mg/L)	0.0468	0.00125	0.0110	
	Silicon (Si)-Dissolved (mg/L)	2.09	1.67	2.00	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855744-1	L1855744-2	L1855744-3		
		Description	WATER	WATER	WATER		
		Sampled Date	09-NOV-16	09-NOV-16	09-NOV-16		
		Sampled Time	10:30	10:30	10:30		
		Client ID	GH_FR1_RD3	GH_ER2_RD3	EV_ER4_RD3		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		1.87	0.725	2.22		
	Strontium (Sr)-Dissolved (mg/L)		0.148	0.228	0.245		
	Sulfur (S)-Dissolved (mg/L)		72.9	7.73	26.3		
	Tellurium (Te)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Thorium (Th)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)		0.00256	0.000861	0.00134		
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0012	0.0158	0.0011		
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		

* 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	Barium (Ba)-Total	MS-B	L1855744-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855744-1, -2, -3
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1855744-1, -2, -3
Matrix Spike	Manganese (Mn)-Total	MS-B	L1855744-1, -2, -3
Matrix Spike	Potassium (K)-Total	MS-B	L1855744-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L1855744-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L1855744-1, -2, -3
Matrix Spike	Phosphorus (P)-Total	MS-B	L1855744-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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			

Reference Information

(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.



Chain of Custody (COC) / Analytical Request Form



COC Number: 14 -

Canada Toll Free: 1 800 668 9878

L1855744-COFC

Page 1 of 1

www.alsglobal.com

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8864 Commerce Court Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input checked="" type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:																																																											
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																											
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		Cost Center: Routing Code: ALS Contact: Heather McKenzie Sampler: JS		<table border="1"> <thead> <tr> <th>Total metals, low level (preserved)</th> <th>Dissolved metals-low level</th> <th>Chloride</th> <th>Sulphate</th> <th>Alkalinity</th> <th>Nitrate</th> <th>Nitrite</th> <th>Ammonia</th> <th>Phosphorus</th> <th>Total Dissolved Solids</th> <th>Calcium & Magnesium</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td><input checked="" type="checkbox"/></td> <td>3</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>3</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>3</td> </tr> </tbody> </table>										Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers	<input checked="" type="checkbox"/>	3	<input checked="" type="checkbox"/>	3	<input checked="" type="checkbox"/>	3																														
Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers																																																				
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ALS Lab Work Order # (lab use only)		ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)		Time (hh:mm)		Sample Type																																																					
				GH-FR1-Rd3		09-11-09		10:30		Water																																																					
				GH-ER2-Rd3		09-11-09		10:30		Water																																																					
				ER-ER4-Rd3		09-11-09		10:30		Water																																																					
<h1>RUSH</h1> <p>Priority processing</p>																																																															
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No				Special Instructions / Specify Criteria to add on report (client Use) For metals (total & dissolved)-low level analysis please <i>Results by Thurs NOV, 10th please</i>				SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 10°C																																																							
SHIPMENT RELEASE (client use) Released by: <i>[Signature]</i> Date: Nov 9/16 Time: 1040				INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____				FINAL SHIPMENT RECEPTION (lab use only) Received by: <i>[Signature]</i> Date: 11/09 Time: 11:55																																																							

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY

YELLOW - CLIENT COPY

NA-FM 0126 v09 Fourth January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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

Date Received: 16-NOV-16
Report Date: 18-NOV-16 16:27 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1858716
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1858716-1 Water 16-NOV-16 14:11 GH_FR1	L1858716-2 Water 16-NOV-16 14:11 GH_ER2	L1858716-3 Water 16-NOV-16 14:11 EV_ER4		
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	563	177	289	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	197	144	162	
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0093	<0.0050	
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}	<0.50	1.96	
	Nitrate (as N) (mg/L)	9.84	0.0823	2.93	
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}	<0.0010	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0036	<0.0020	0.0023	
	Sulfate (SO4) (mg/L)	221	22.4	75.9	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0090	0.0087	0.0109	
	Antimony (Sb)-Total (mg/L)	0.00055	0.00030	0.00027	
	Arsenic (As)-Total (mg/L)	0.00012	0.00011	0.00016	
	Barium (Ba)-Total (mg/L)	0.0959	0.0464	0.0660	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000161	0.0000096	0.0000159	
	Calcium (Ca)-Total (mg/L)	103	47.2	64.6	
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Total (mg/L)	0.00021	0.00028	0.00033	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Total (mg/L)	0.018	<0.010	0.014	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	0.000052	
	Lithium (Li)-Total (mg/L)	0.0188	0.0015	0.0098	
	Magnesium (Mg)-Total (mg/L)	50.8	11.8	22.0	
	Manganese (Mn)-Total (mg/L)	0.00140	0.00146	0.00102	
	Molybdenum (Mo)-Total (mg/L)	0.00116	0.00103	0.00123	
	Nickel (Ni)-Total (mg/L)	0.00289	<0.00050	0.00061	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	1.40	0.368	0.690	
	Rubidium (Rb)-Total (mg/L)	0.00063	<0.00020	0.00038	
	Selenium (Se)-Total (mg/L)	0.0462	0.000932	0.0102	
	Silicon (Si)-Total (mg/L)	2.31	1.82	1.97	
	Silver (Ag)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	2.26	0.731	2.45	
	Strontium (Sr)-Total (mg/L)	0.157	0.237	0.247	
	Sulfur (S)-Total (mg/L)	78.4	7.91	26.4	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1858716-1 Water 16-NOV-16 14:11 GH_FR1	L1858716-2 Water 16-NOV-16 14:11 GH_ER2	L1858716-3 Water 16-NOV-16 14:11 EV_ER4		
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Total (mg/L)	<0.000010	<0.000010	<0.000010		
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	0.00040		
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010		
	Uranium (U)-Total (mg/L)	0.00265	0.000839	0.00137		
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Total (mg/L)	0.0231	0.0098	0.0364		
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030		
Dissolved Metals	Dissolved Metals Filtration Location	LAB	LAB	LAB		
	Aluminum (Al)-Dissolved (mg/L)	<0.0010	0.0017	0.0017		
	Antimony (Sb)-Dissolved (mg/L)	0.00019	<0.00010	<0.00010		
	Arsenic (As)-Dissolved (mg/L)	0.00010	<0.00010	0.00016		
	Barium (Ba)-Dissolved (mg/L)	0.0967	0.0428	0.0648		
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Cadmium (Cd)-Dissolved (mg/L)	0.0000159	<0.0000050	0.0000104		
	Calcium (Ca)-Dissolved (mg/L)	101	45.4	62.7		
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		
	Chromium (Cr)-Dissolved (mg/L)	0.00013	0.00023	0.00023		
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010		
	Copper (Cu)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020		
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010		
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050		
	Lithium (Li)-Dissolved (mg/L)	0.0181	0.0016	0.0095		
	Magnesium (Mg)-Dissolved (mg/L)	48.9	11.6	21.8		
	Manganese (Mn)-Dissolved (mg/L)	0.00111	0.00110	0.00061		
	Molybdenum (Mo)-Dissolved (mg/L)	0.00112	0.000987	0.00113		
	Nickel (Ni)-Dissolved (mg/L)	0.00273	<0.00050	0.00055		
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050		
	Potassium (K)-Dissolved (mg/L)	1.37	0.364	0.704		
	Rubidium (Rb)-Dissolved (mg/L)	0.00061	<0.00020	0.00032		
	Selenium (Se)-Dissolved (mg/L)	0.0476	0.000924	0.0105		
	Silicon (Si)-Dissolved (mg/L)	2.08	1.67	1.89		
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1858716-1	L1858716-2	L1858716-3		
		Description	Water	Water	Water		
		Sampled Date	16-NOV-16	16-NOV-16	16-NOV-16		
		Sampled Time	14:11	14:11	14:11		
		Client ID	GH_FR1	GH_ER2	EV_ER4		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		2.12	0.742	2.41		
	Strontium (Sr)-Dissolved (mg/L)		0.151	0.225	0.236		
	Sulfur (S)-Dissolved (mg/L)		72.7	7.34	25.5		
	Tellurium (Te)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Thorium (Th)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	0.00011		
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)		0.00256	0.000797	0.00130		
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0033	0.0087	0.0067		
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		

* 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)
Qualifiers for Individual Parameters Listed:			
Qualifier	Description		
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.		

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-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
		Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.	
		Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.	
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
		Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.	
		Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.	
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
		This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.	
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
		This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.	
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
		This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.	
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
		Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	
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:

Reference Information

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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1858716-COFC

COC Number: 14 -

Page 1 of 1

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Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input checked="" type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P: Friday Nov 18	
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		Total Metals, low level (green dot) Dissolved Metals - low level Chloride Sulphate Alkalinity Nitrate Nitrite Ammonia Phosphorus Total Dissolved Solids Number of Containers	
ALS Lab Work Order # (lab use only)		ALS Contact:		Sampler: Eric Cheung	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	(Grid for analysis results)
	GH-FR1	16-Nov-16	14:11	Water	(Grid with checkmarks)
	GH-ER2	16-Nov-16	14:11	Water	(Grid with checkmarks)
	EV-ER4	16-Nov-16	14:11	Water	(Grid with checkmarks)
REJSH Priority processing					
Drinking Water (DW) Samples (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) For metals (total & dissolved) - low level analysis please Results by Friday, Nov 18/16 please		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Cooling Initiated <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C: 9	
SHIPMENT RELEASE (client use) Released by: Eric Cheung Date: Nov 16/16 Time: 14:11		INITIAL SHIPMENT RECEPTION (lab use only) Received by: Date: Time:		FINAL SHIPMENT RECEPTION (lab use only) Received by: JC Date: NOV 16 2016 Time: 14:45	



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

Date Received: 23-NOV-16
Report Date: 25-NOV-16 13:42 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1861625
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1861625-1 WATER 23-NOV-16 GH_FR1_RD5	L1861625-2 WATER 23-NOV-16 GH_ER2_RD5	L1861625-3 WATER 23-NOV-16 EV_ER4_RD5	
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	580	181	289	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	195	146	162	
	Ammonia, Total (as N) (mg/L)	<0.0050	0.0121	<0.0050	
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}	<0.50	2.00	
	Nitrate (as N) (mg/L)	10.3	0.0812	2.88	
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}	<0.0010	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0046	0.0032	<0.0020	
	Sulfate (SO4) (mg/L)	223	22.6	76.6	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0114	0.0077	0.0065	
	Antimony (Sb)-Total (mg/L)	0.00021	<0.00010	<0.00010	
	Arsenic (As)-Total (mg/L)	0.00018	0.00013	0.00021	
	Barium (Ba)-Total (mg/L)	0.109	0.0472	0.0697	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000219	0.0000084	0.0000175	
	Calcium (Ca)-Total (mg/L)	109	51.2	69.3	
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Total (mg/L)	0.00021	0.00029	0.00034	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Total (mg/L)	0.021	0.010	0.010	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Total (mg/L)	0.0191	0.0020	0.0098	
	Magnesium (Mg)-Total (mg/L)	51.0	12.2	22.2	
	Manganese (Mn)-Total (mg/L)	0.00199	0.00141	0.00090	
	Molybdenum (Mo)-Total (mg/L)	0.00106	0.00106	0.00124	
	Nickel (Ni)-Total (mg/L)	0.00307	<0.00050	0.00071	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	1.32	0.365	0.663	
	Rubidium (Rb)-Total (mg/L)	0.00063	<0.00020	0.00035	
	Selenium (Se)-Total (mg/L)	0.0491	0.000910	0.0113	
	Silicon (Si)-Total (mg/L)	2.29	1.83	2.10	
	Silver (Ag)-Total (mg/L)	0.000033	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	2.07	0.715	2.35	
	Strontium (Sr)-Total (mg/L)	0.154	0.238	0.249	
	Sulfur (S)-Total (mg/L)	83.4	8.52	29.7	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1861625-1 WATER 23-NOV-16 GH_FR1_RD5	L1861625-2 WATER 23-NOV-16 GH_ER2_RD5	L1861625-3 WATER 23-NOV-16 EV_ER4_RD5	
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	0.00055	0.00036	0.00038	
	Thallium (Tl)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Uranium (U)-Total (mg/L)	0.00243	0.000797	0.00125	
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Total (mg/L)	0.0558	0.0139	0.0046	
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location	LAB	LAB	LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.0011	0.0019	0.0011	
	Antimony (Sb)-Dissolved (mg/L)	0.00016	<0.00010	<0.00010	
	Arsenic (As)-Dissolved (mg/L)	<0.00010	0.00010	0.00015	
	Barium (Ba)-Dissolved (mg/L)	0.103	0.0462	0.0678	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000164	0.0000060	0.0000129	
	Calcium (Ca)-Dissolved (mg/L)	104	48.1	66.5	
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Dissolved (mg/L)	<0.00010	0.00022	0.00027	
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0178	0.0017	0.0092	
	Magnesium (Mg)-Dissolved (mg/L)	48.1	11.8	21.5	
	Manganese (Mn)-Dissolved (mg/L)	0.00119	0.00105	0.00054	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00103	0.000963	0.00114	
	Nickel (Ni)-Dissolved (mg/L)	0.00278	<0.00050	0.00057	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	1.26	0.342	0.644	
	Rubidium (Rb)-Dissolved (mg/L)	0.00058	<0.00020	0.00034	
	Selenium (Se)-Dissolved (mg/L)	0.0500	0.000942	0.0108	
	Silicon (Si)-Dissolved (mg/L)	2.09	1.71	1.88	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1861625-1	L1861625-2	L1861625-3		
		Description	WATER	WATER	WATER		
		Sampled Date	23-NOV-16	23-NOV-16	23-NOV-16		
		Sampled Time					
		Client ID	GH_FR1_RD5	GH_ER2_RD5	EV_ER4_RD5		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		1.93	0.680	2.30		
	Strontium (Sr)-Dissolved (mg/L)		0.147	0.225	0.238		
	Sulfur (S)-Dissolved (mg/L)		75.0	7.81	26.3		
	Tellurium (Te)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)		<0.000010	<0.000010	<0.000010		
	Thorium (Th)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)		0.00229	0.000746	0.00119		
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0020	0.0126	0.0036		
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		

* 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	Barium (Ba)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Boron (B)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Calcium (Ca)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Nickel (Ni)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Strontium (Sr)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Sulfur (S)-Total	MS-B	L1861625-1, -2, -3
Matrix Spike	Uranium (U)-Total	MS-B	L1861625-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.

Reference Information

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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com



L1861625-COFC

COC Number: 14 -

Page 1 of 1

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input checked="" type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2,E or P: Nov 25/16																																													
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																													
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		<table border="1"> <thead> <tr> <th>Total metals, low level (preserved)</th> <th>Dissolved metals-low level</th> <th>Chloride</th> <th>Sulphate</th> <th>Alkalinity</th> <th>Nitrate</th> <th>Nitrite</th> <th>Ammonia</th> <th>Phosphorus</th> <th>Total Dissolved Solids</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>3</td> </tr> <tr> <td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>3</td> </tr> <tr> <td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>3</td> </tr> </tbody> </table>		Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Number of Containers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3
Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Number of Containers																																							
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3																																							
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3																																							
✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3																																							
ALS Lab Work Order # (lab use only):		ALS Contact: Heather McKenzie Sampler: JS																																															
ALS Sample # (lab use only):	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																													
	GH_FRI_Rd5	23-11-16	1200h	Water																																													
	GH_ER2_Rd5	23-11-16	1200h	Water																																													
	EV_ER4_Rd5	23-11-16	1200h	Water																																													

RUSH

(B) Priority processing

Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) For metals (total & dissolved)-low level analysis please <i>Results by Friday Nov 25/16, p/s</i>		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Custody seal intact Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 80	
SHIPMENT RELEASE (client use) Released by: <i>[Signature]</i> Date: Nov 23/16 Time: 1200h		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____		FINAL SHIPMENT RECEPTION (lab use only) Received by: HMC Date: Nov 23/16 Time: 13:20	



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

Date Received: 30-NOV-16
Report Date: 06-DEC-16 14:27 (MT)
Version: FINAL REV. 2

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1864606
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1864606-1 Water 30-NOV-16 12:00 GH-ER2_RD6	L1864606-2 Water 30-NOV-16 12:00 GH-FR1_RD6	L1864606-3 Water 30-NOV-16 12:00 EV-ER4_RD6	
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	186	583	299	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	149	199	164	
	Ammonia, Total (as N) (mg/L)	0.0078	<0.0050	<0.0050	
	Chloride (Cl) (mg/L)	<0.50	<2.5 ^{DLDS}	2.00	
	Nitrate (as N) (mg/L)	0.0867	10.9	2.88	
	Nitrite (as N) (mg/L)	<0.0010	<0.0050 ^{DLDS}	<0.0010	
	Phosphorus (P)-Total (mg/L)	0.0044	0.0041	0.0044	
	Sulfate (SO4) (mg/L)	22.4	212	76.4	
Total Metals	Aluminum (Al)-Total (mg/L)	0.0057	0.0093	0.0110	
	Antimony (Sb)-Total (mg/L)	<0.00010	0.00014	<0.00010	
	Arsenic (As)-Total (mg/L)	<0.00010	0.00011	0.00018	
	Barium (Ba)-Total (mg/L)	0.0458	0.107	0.0684	
	Beryllium (Be)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Total (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000050	0.0000171	0.0000147	
	Calcium (Ca)-Total (mg/L)	47.1	101	64.9	
	Cesium (Cs)-Total (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Total (mg/L)	0.00025	0.00015	0.00025	
	Cobalt (Co)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Iron (Fe)-Total (mg/L)	<0.010	0.019	<0.010	
	Lead (Pb)-Total (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Total (mg/L)	0.0016	0.0195	0.0098	
	Magnesium (Mg)-Total (mg/L)	11.1	44.9	20.8	
	Manganese (Mn)-Total (mg/L)	0.00120	0.00179	0.00088	
	Molybdenum (Mo)-Total (mg/L)	0.00105	0.000986	0.00118	
	Nickel (Ni)-Total (mg/L)	<0.00050	0.00191	0.00058	
	Phosphorus (P)-Total (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Total (mg/L)	0.351	1.31	0.699	
	Rubidium (Rb)-Total (mg/L)	<0.00020	0.00056	0.00030	
	Selenium (Se)-Total (mg/L)	0.000898	0.0528	0.0103	
	Silicon (Si)-Total (mg/L)	1.83	2.33	2.11	
	Silver (Ag)-Total (mg/L)	0.000013	<0.000010	<0.000010	
	Sodium (Na)-Total (mg/L)	0.726	2.12	2.64	
	Strontium (Sr)-Total (mg/L)	0.227	0.148	0.242	
	Sulfur (S)-Total (mg/L)	8.16	71.4	27.4	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1864606-1 Water 30-NOV-16 12:00 GH-ER2_RD6	L1864606-2 Water 30-NOV-16 12:00 GH-FR1_RD6	L1864606-3 Water 30-NOV-16 12:00 EV-ER4_RD6	
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	0.00043	0.00040	<0.00020	
	Thallium (Tl)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Thorium (Th)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Tin (Sn)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Titanium (Ti)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
	Tungsten (W)-Total (mg/L)	<0.00010	<0.00010	<0.00010	
	Uranium (U)-Total (mg/L)	0.000834	0.00242	0.00129	
	Vanadium (V)-Total (mg/L)	<0.00050	<0.00050	<0.00050	
	Zinc (Zn)-Total (mg/L)	0.0082	0.0072	<0.0030	
	Zirconium (Zr)-Total (mg/L)	<0.00030	<0.00030	<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location	LAB	LAB	LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.0010	<0.0010	0.0022	
	Antimony (Sb)-Dissolved (mg/L)	<0.00010	0.00013	<0.00010	
	Arsenic (As)-Dissolved (mg/L)	<0.00010	<0.00010	0.00016	
	Barium (Ba)-Dissolved (mg/L)	0.0452	0.104	0.0670	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Boron (B)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000057	0.0000155	0.0000102	
	Calcium (Ca)-Dissolved (mg/L)	46.0	99.9	63.9	
	Cesium (Cs)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	
	Chromium (Cr)-Dissolved (mg/L)	0.00022	<0.00010	0.00020	
	Cobalt (Co)-Dissolved (mg/L)	<0.00010	<0.00010	<0.00010	
	Copper (Cu)-Dissolved (mg/L)	<0.00020	<0.00020	<0.00020	
	Iron (Fe)-Dissolved (mg/L)	<0.010	<0.010	<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050	<0.000050	<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0016	0.0195	0.0097	
	Magnesium (Mg)-Dissolved (mg/L)	10.9	43.1	19.7	
	Manganese (Mn)-Dissolved (mg/L)	0.00107	0.00155	0.00058	
	Molybdenum (Mo)-Dissolved (mg/L)	0.000971	0.000944	0.00114	
	Nickel (Ni)-Dissolved (mg/L)	<0.00050	0.00186	<0.00050	
	Phosphorus (P)-Dissolved (mg/L)	<0.050	<0.050	<0.050	
	Potassium (K)-Dissolved (mg/L)	0.367	1.32	0.670	
	Rubidium (Rb)-Dissolved (mg/L)	<0.00020	0.00056	0.00033	
	Selenium (Se)-Dissolved (mg/L)	0.000881	0.0454	0.0101	
	Silicon (Si)-Dissolved (mg/L)	1.70	2.19	1.95	
	Silver (Ag)-Dissolved (mg/L)	<0.000010	<0.000010	<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1864606-1	L1864606-2	L1864606-3		
		Description	Water	Water	Water		
		Sampled Date	30-NOV-16	30-NOV-16	30-NOV-16		
		Sampled Time	12:00	12:00	12:00		
		Client ID	GH-ER2_RD6	GH-FR1_RD6	EV-ER4_RD6		
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		0.710	2.05	2.38		
	Strontium (Sr)-Dissolved (mg/L)		0.219	0.146	0.237		
	Sulfur (S)-Dissolved (mg/L)		7.14	69.2	24.8		
	Tellurium (Te)-Dissolved (mg/L)		<0.00020	<0.00020	<0.00020		
	Thallium (Tl)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Thorium (Th)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Tin (Sn)-Dissolved (mg/L)		<0.00010	<0.00010	0.00014		
	Titanium (Ti)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		
	Tungsten (W)-Dissolved (mg/L)		<0.00010	<0.00010	<0.00010		
	Uranium (U)-Dissolved (mg/L)		0.000812	0.00233	0.00127		
	Vanadium (V)-Dissolved (mg/L)		<0.00050	<0.00050	<0.00050		
	Zinc (Zn)-Dissolved (mg/L)		0.0068	0.0066	0.0015		
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030	<0.00030	<0.00030		

* 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	Barium (Ba)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Boron (B)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Manganese (Mn)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Molybdenum (Mo)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1864606-1, -2, -3
Matrix Spike	Copper (Cu)-Total	MS-B	L1864606-1, -2, -3
Matrix Spike	Sodium (Na)-Total	MS-B	L1864606-1, -2, -3

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

Reference Information

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.

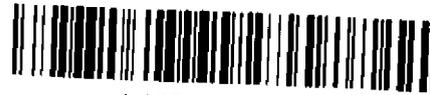
D.L. - The reported Detection Limit, also known as the Limit of Reporting (LOR).

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.



L1864606-COFC

COC Number: 14 -

Page 1 of 1

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																											
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																											
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input checked="" type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																											
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																											
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																											
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P: <u>Friday Dec 2/16</u>																											
		Email 2:			Analysis Request																											
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																											
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			P																											
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca																														
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca																														
Contact: Bonnie Lo																																
Project Information		Oil and Gas Required Fields (client use)																														
ALS Quote #:		Approver ID:																														
Job #:		GL Account:																														
PO / AFE:		Routing Code:																														
LSD:		Activity Code:																														
		Location:																														
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler:																											
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mm-yy)		Time (hh:mm)		Sample Type		Total metals, low level (preserved)		Dissolved metals-low level		Chloride		Sulphate		Alkalinity		Nitrate		Nitrite		Ammonia		Phosphorus		Total Dissolved Solids		Number of Containers	
		GH-ER2-Rd6			30-11-16		1200h		Water		X X		X X		X X		X X		X X		X X		X X		X X		X X		3			
		GH-FR1-Rd6			↓		↓		Water		X X		X X		X X		X X		X X		X X		X X		X X		X X		3			
		EV-ER4-Rd6			↓		↓		Water		X X		X X		X X		X X		X X		X X		X X		X X		X X		3			

Short Holding Time

Rush Processing

RUSH

Priority processing

Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)									
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		For metals (total & dissolved)-low level analysis please Results by Friday, <u>Dec 2/16, p/s</u>			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>									
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>									
					Cooling Initiated <input type="checkbox"/>									
					INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C				
										20C				
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)									
Released by: <u>[Signature]</u>		Received by: <u>[Signature]</u>			Received by: <u>D)</u>									
Date: <u>Nov 30/16</u>		Date: <u>Nov 30/16</u>			Date: <u>Nov 13/16</u>									
Time: <u>1300h</u>		Time: <u>1300h</u>			Time: <u>13:30</u>									



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

Date Received: 03-NOV-16
Report Date: 17-NOV-16 19:35 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1853449
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1853449-1	L1853449-2	L1853449-3	L1853449-4	L1853449-5
					Water	Water	Water	Water	Water
					01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16
					13:30	13:30	13:30	13:30	13:30
					CD_EV_ER4_5NO 3_AR1	CD_EV_ER4_8NO 3_AR1	CD_EV_ER4_12N O3_AR1	CD_EV_ER4_20N O3_AR1	CD_EV_ER4_31N O3_AR1
Grouping	Analyte								
WATER									
Anions and Nutrients	Nitrate (as N) (mg/L)				5.19	8.17	12.1	19.5	31.2 ^{HTD}

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853449-6 Water 01-NOV-16 13:30 CD_EV_ER4_50N O3_AR1	L1853449-7 Water 01-NOV-16 13:30 CD_GH_FR1_14N O3_AR1	L1853449-8 Water 01-NOV-16 13:30 CD_GH_FR1_20N O3_AR1	L1853449-9 Water 01-NOV-16 13:30 CD_GH_FR1_27N O3_AR1	L1853449-10 Water 01-NOV-16 13:30 CD_GH_FR1_38N O3_AR1
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	51.1	14.4	21.1	28.6	39.2

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1853449-11	L1853449-12	L1853449-13	L1853449-14	L1853449-15
		Description	Water	Water	Water	Water	Water
		Sampled Date	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16
		Sampled Time	13:30	13:30	13:30	13:30	13:30
		Client ID	CD_GH_FR1_54N O3_AR1	CD_GH_FR1_75N O3_AR1	CD_GH_FR1HH_1 4NO3_AR1	CD_GH_FR1HH_2 0NO3_AR1	CD_GH_FR1HH_2 7NO3_AR1
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	54.6	73.0	14.3	20.4	26.7	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1853449-16	L1853449-17	L1853449-18	L1853449-19	L1853449-20
		Description	Water	Water	Water	Water	Water
		Sampled Date	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16
		Sampled Time	13:30	13:30	13:30	13:30	13:30
		Client ID	CD_GH_FR1HH_3 8NO3_AR1	CD_GH_FR1HH_5 4NO3_AR1	CD_GH_FR1HH_7 5NO3_AR1	CD_GH_ER2_3NO 3_AR1	CD_GH_ER2_5NO 3_AR1
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	38.4	54.1	76.5	3.18	5.27	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID				
L1853449-21	Water	01-NOV-16	13:30	CD_GH_ER2_9NO3_AR1				
L1853449-22	Water	01-NOV-16	13:30	CD_GH_ER2_15NO3_AR1				
L1853449-23	Water	01-NOV-16	13:30	CD_GH_ER2_25NO3_AR1				
L1853449-24	Water	01-NOV-16	13:30	CD_GH_ER2_43NO3_AR1				
Grouping	Analyte							
WATER								
Anions and Nutrients	Nitrate (as N) (mg/L)				9.11	15.2	23.8	44.5 ^{HTD}

* 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	Nitrate (as N)	MS-B	L1853449-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -3, -4, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1853449-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -3, -4, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1853449-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -3, -4, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Affix ALS barcode label here (lab use only)

COC Number: 14 -

Page 1 of 3

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: _____ Email 2: _____		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2,E or P: _____		
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		
Project Information ALS Quote #: _____ Job #: _____ PO / AFE: _____ LSD: _____		Oil and Gas Required Fields (client use) Approver ID: _____ Cost Center: _____ GL Account: _____ Routing Code: _____ Activity Code: _____ Location: _____		<div style="text-align: center;">  L1853449-COFC </div> <div style="position: absolute; top: 50px; right: 50px; border: 2px solid black; padding: 5px; transform: rotate(90deg); font-weight: bold; font-size: 1.2em;"> Short Holding Time Rush Processing </div>		
ALS Lab Work Order # (lab use only): _____		ALS Contact: Heather McKenzie Sampler: EMU/JS				
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Nitrate	Number of Containers
	██████████	██████████	12:30	water	✓	1
	Cd_EV_ER4_5NO3_AR1	Nov 1 2016	8:45	water	✓	1
	Cd_EV_ER4_8 NO3_AR1	Nov 1 2016		water	✓	1
	Cd_EV_ER4_12NO3_AR1	Nov 1 2016		water	✓	1
	Cd_EV_ER4_20NO3_AR1	Nov 1 2016		water	✓	1
	Cd_EV_ER4_31NO3_AR1	Nov 1 2016		water	✓	1
	Cd_EV_ER4_50 NO3_AR1	Nov 1 2016		water	✓	1
	██████████	██████████		water	✓	1
	Cd_GH_FR1_14 NO3_AR1	Nov 1 2016		water	✓	1
	Cd_GH_FR1_20NO3_AR1	Nov 1 2016		water	✓	1
	Cd_GH_FR1_27NO3_AR1	Nov 1 2016		water	✓	1
	Cd_GH_FR1_38NO3_AR1	Nov 1 2016		water	✓	1
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) _____		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 9/9.0		
SHIPMENT RELEASE (client use) Released by: <i>[Signature]</i> Date: Nov 3/16 Time: 17:45		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____		FINAL SHIPMENT RECEPTION (lab use only) Received by: <i>[Signature]</i> Date: Nov 3 Time: 6:55 PM		

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM0326-001 Rev 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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

Date Received: 08-NOV-16
Report Date: 23-NOV-16 16:52 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1855268
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1855268-1 Water 07-NOV-16 16:00 CD_EV_ER4_UNN O3_TERM	L1855268-2 Water 07-NOV-16 16:00 CD_EV_ER4_5NO 3_TERM	L1855268-3 Water 07-NOV-16 16:00 CD_EV_ER4_8NO 3_TERM	L1855268-4 Water 07-NOV-16 16:00 CD_EV_ER4_12N O3_TERM	L1855268-5 Water 07-NOV-16 16:00 CD_EV_ER4_20N O3_TERM
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	291	301	320	346	392
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	163	165	165	164	162
	Ammonia, Total (as N) (mg/L)	0.0614	0.0521	0.0625	0.0575	0.0483
	Chloride (Cl) (mg/L)	3.28	2.97	3.06	2.89	2.90
	Nitrate (as N) (mg/L)	2.95	5.26	8.12	12.1	19.6
	Nitrite (as N) (mg/L)	0.0060	0.0048	0.0050	0.0047	0.0055
	Phosphorus (P)-Total (mg/L)	0.0346	0.0404	0.0345	0.0199	0.0363
	Sulfate (SO4) (mg/L)	77.9	78.5	78.1	78.2	78.1
Total Metals	Aluminum (Al)-Total (mg/L)				0.0154	
	Antimony (Sb)-Total (mg/L)				<0.00010	
	Arsenic (As)-Total (mg/L)				0.00019	
	Barium (Ba)-Total (mg/L)				0.0734	
	Beryllium (Be)-Total (mg/L)				<0.00010	
	Bismuth (Bi)-Total (mg/L)				<0.000050	
	Boron (B)-Total (mg/L)				0.017	
	Cadmium (Cd)-Total (mg/L)				0.0000108	
	Calcium (Ca)-Total (mg/L)	67.2	68.5	68.3	70.6	68.8
	Cesium (Cs)-Total (mg/L)				<0.000010	
	Chromium (Cr)-Total (mg/L)				0.00030	
	Cobalt (Co)-Total (mg/L)				<0.00010	
	Copper (Cu)-Total (mg/L)				<0.00050	
	Iron (Fe)-Total (mg/L)				0.011	
	Lead (Pb)-Total (mg/L)				0.000058	
	Lithium (Li)-Total (mg/L)				0.0088	
	Magnesium (Mg)-Total (mg/L)	20.3	20.3	20.5	23.1	20.4
	Manganese (Mn)-Total (mg/L)				0.00077	
	Molybdenum (Mo)-Total (mg/L)				0.00125	
	Nickel (Ni)-Total (mg/L)				0.00052	
	Phosphorus (P)-Total (mg/L)				<0.050	
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	0.888	<2.0
	Rubidium (Rb)-Total (mg/L)				0.00045	
	Selenium (Se)-Total (mg/L)				0.0113	
	Silicon (Si)-Total (mg/L)				2.17	
	Silver (Ag)-Total (mg/L)				<0.000010	
	Sodium (Na)-Total (mg/L)	3.3	7.0	12.2	20.7	31.0
	Strontium (Sr)-Total (mg/L)				0.260	
	Sulfur (S)-Total (mg/L)				29.8	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1855268-6 Water 07-NOV-16 16:00 CD_EV_ER4_31N O3_TERM	L1855268-7 Water 07-NOV-16 16:00 CD_EV_ER4_50N O3_TERM	L1855268-8 Water 07-NOV-16 16:00 CD_GH_FR1_UNN O3_TERM	L1855268-9 Water 07-NOV-16 16:00 CD_GH_FR1_14N O3_TERM	L1855268-10 Water 07-NOV-16 16:00 CD_GH_FR1_20N O3_TERM
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	452	555	558	597	619
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	163	163	183	185	190
	Ammonia, Total (as N) (mg/L)	0.0504	0.0731	0.106	0.0879	0.0751
	Chloride (Cl) (mg/L)	3.89	3.3	<2.5 ^{DLDS}	<2.5 ^{DLDS}	<2.5 ^{DLDS}
	Nitrate (as N) (mg/L)	30.6 ^{HTD}	47.9	9.81	14.2	20.1
	Nitrite (as N) (mg/L)	0.0058	0.0056	0.0095	0.0054	0.0070
	Phosphorus (P)-Total (mg/L)	0.0363	0.0364	0.0681	0.0358	0.0227
	Sulfate (SO4) (mg/L)	78.3	78.4	224	224	220
Total Metals	Aluminum (Al)-Total (mg/L)		0.0136			
	Antimony (Sb)-Total (mg/L)		<0.00010			
	Arsenic (As)-Total (mg/L)		0.00020			
	Barium (Ba)-Total (mg/L)		0.0661			
	Beryllium (Be)-Total (mg/L)		<0.00010			
	Bismuth (Bi)-Total (mg/L)		<0.000050			
	Boron (B)-Total (mg/L)		0.016			
	Cadmium (Cd)-Total (mg/L)		0.0000187			
	Calcium (Ca)-Total (mg/L)	66.3	62.6	97.1	96.6	96.0
	Cesium (Cs)-Total (mg/L)		<0.000010			
	Chromium (Cr)-Total (mg/L)		0.00034			
	Cobalt (Co)-Total (mg/L)		0.00011			
	Copper (Cu)-Total (mg/L)		0.00094			
	Iron (Fe)-Total (mg/L)		0.012			
	Lead (Pb)-Total (mg/L)		0.000115			
	Lithium (Li)-Total (mg/L)		0.0081			
	Magnesium (Mg)-Total (mg/L)	20.6	19.7	48.6	48.3	48.2
	Manganese (Mn)-Total (mg/L)		0.00076			
	Molybdenum (Mo)-Total (mg/L)		0.00124			
	Nickel (Ni)-Total (mg/L)		0.00054			
	Phosphorus (P)-Total (mg/L)		<0.050			
	Potassium (K)-Total (mg/L)	<2.0	0.842	<2.0	<2.0	<2.0
	Rubidium (Rb)-Total (mg/L)		0.00046			
	Selenium (Se)-Total (mg/L)		0.0103			
	Silicon (Si)-Total (mg/L)		2.07			
	Silver (Ag)-Total (mg/L)		<0.000010			
	Sodium (Na)-Total (mg/L)	51.8	72.9	3.3	10.6	21.7
	Strontium (Sr)-Total (mg/L)		0.240			
	Sulfur (S)-Total (mg/L)		27.9			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-11 Water 07-NOV-16 16:00 CD_GH_FR1_27N O3_TERM	L1855268-12 Water 07-NOV-16 16:00 CD_GH_FR1_38N O3_TERM	L1855268-13 Water 07-NOV-16 16:00 CD_GH_FR1_54N O3_TERM	L1855268-14 Water 07-NOV-16 16:00 CD_GH_FR1_75N O3_TERM	L1855268-15 Water 07-NOV-16 16:00 CD_GH_FR1HH_U NNO3_TERM
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	631	725	810	931	929
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	185	185	190	188	177
	Ammonia, Total (as N) (mg/L)	0.0829	0.0736	0.0742	0.0666	0.112
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}				
	Nitrate (as N) (mg/L)	22.2	37.0	53.1	73.8	10.8
	Nitrite (as N) (mg/L)	0.0063	0.0062	0.0099	0.0084	0.0077
	Phosphorus (P)-Total (mg/L)	0.0272	0.0263	0.0270	0.0312	0.0173
	Sulfate (SO4) (mg/L)	219	218	223	226	477
Total Metals	Aluminum (Al)-Total (mg/L)	0.0150			0.0095	
	Antimony (Sb)-Total (mg/L)	0.00019			0.00017	
	Arsenic (As)-Total (mg/L)	0.00011			<0.00010	
	Barium (Ba)-Total (mg/L)	0.0990			0.100	
	Beryllium (Be)-Total (mg/L)	<0.00010			<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050			<0.000050	
	Boron (B)-Total (mg/L)	0.020			0.019	
	Cadmium (Cd)-Total (mg/L)	0.0000120			0.0000137	
	Calcium (Ca)-Total (mg/L)	94.3	94.4	97.6	96.7	153
	Cesium (Cs)-Total (mg/L)	<0.000010			<0.000010	
	Chromium (Cr)-Total (mg/L)	0.00018			0.00017	
	Cobalt (Co)-Total (mg/L)	<0.00010			<0.00010	
	Copper (Cu)-Total (mg/L)	0.00075			0.00068	
	Iron (Fe)-Total (mg/L)	0.012			0.012	
	Lead (Pb)-Total (mg/L)	<0.000050			<0.000050	
	Lithium (Li)-Total (mg/L)	0.0167			0.0169	
	Magnesium (Mg)-Total (mg/L)	44.4	47.0	47.9	44.6	71.7
	Manganese (Mn)-Total (mg/L)	0.00071			0.00092	
	Molybdenum (Mo)-Total (mg/L)	0.00113			0.00113	
	Nickel (Ni)-Total (mg/L)	0.00247			0.00297	
	Phosphorus (P)-Total (mg/L)	<0.050			<0.050	
	Potassium (K)-Total (mg/L)	1.44	<2.0	<2.0	1.46	<2.0
	Rubidium (Rb)-Total (mg/L)	0.00067			0.00064	
	Selenium (Se)-Total (mg/L)	0.0437			0.0441	
	Silicon (Si)-Total (mg/L)	2.21			2.34	
	Silver (Ag)-Total (mg/L)	0.000010			<0.000010	
	Sodium (Na)-Total (mg/L)	22.9	50.9	76.9	104	4.8
	Strontium (Sr)-Total (mg/L)	0.145			0.146	
	Sulfur (S)-Total (mg/L)	76.9			80.8	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1855268-16 Water 07-NOV-16 16:00 CD_GH_FR1HH_1 4NO3_TERM	L1855268-17 Water 07-NOV-16 16:00 CD_GH_FR1HH_2 0NO3_TERM	L1855268-18 Water 07-NOV-16 16:00 CD_GH_FR1HH_2 7NO3_TERM	L1855268-19 Water 07-NOV-16 16:00 CD_GH_FR1HH_3 8NO3_TERM	L1855268-20 Water 07-NOV-16 16:00 CD_GH_FR1HH_5 4NO3_TERM
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	943	976	1010	1080	1150
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	184	182	182	186	183
	Ammonia, Total (as N) (mg/L)	0.111	0.148	0.130	0.106	0.104
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}				
	Nitrate (as N) (mg/L)	14.4	20.4	27.6	37.9	50.6
	Nitrite (as N) (mg/L)	0.0068	0.0086	0.0096	0.0078	0.0093
	Phosphorus (P)-Total (mg/L)	0.0622	0.0386	0.0408	0.0530	0.0310
	Sulfate (SO4) (mg/L)	480	481	479	475	460
Total Metals	Aluminum (Al)-Total (mg/L)			0.0070		
	Antimony (Sb)-Total (mg/L)			0.00018		
	Arsenic (As)-Total (mg/L)			0.00012		
	Barium (Ba)-Total (mg/L)			0.0999		
	Beryllium (Be)-Total (mg/L)			<0.00010		
	Bismuth (Bi)-Total (mg/L)			<0.000050		
	Boron (B)-Total (mg/L)			0.014		
	Cadmium (Cd)-Total (mg/L)			0.0000133		
	Calcium (Ca)-Total (mg/L)	156	155	156	154	156
	Cesium (Cs)-Total (mg/L)			<0.000010		
	Chromium (Cr)-Total (mg/L)			0.00015		
	Cobalt (Co)-Total (mg/L)			<0.00010		
	Copper (Cu)-Total (mg/L)			0.00083		
	Iron (Fe)-Total (mg/L)			0.012		
	Lead (Pb)-Total (mg/L)			0.000089		
	Lithium (Li)-Total (mg/L)			0.0170		
	Magnesium (Mg)-Total (mg/L)	73.1	71.9	68.3	72.6	71.6
	Manganese (Mn)-Total (mg/L)			0.00057		
	Molybdenum (Mo)-Total (mg/L)			0.00114		
	Nickel (Ni)-Total (mg/L)			0.00280		
	Phosphorus (P)-Total (mg/L)			0.064		
	Potassium (K)-Total (mg/L)	<2.0	<2.0	1.68	<2.0	<2.0
	Rubidium (Rb)-Total (mg/L)			0.00082		
	Selenium (Se)-Total (mg/L)			0.0460		
	Silicon (Si)-Total (mg/L)			2.28		
	Silver (Ag)-Total (mg/L)			<0.000010		
	Sodium (Na)-Total (mg/L)	11.2	22.2	31.3	52.8	77.8
	Strontium (Sr)-Total (mg/L)			0.178		
	Sulfur (S)-Total (mg/L)			178		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855268-21	L1855268-22	L1855268-23	L1855268-24	L1855268-25
		Description	Water	Water	Water	Water	Water
		Sampled Date	07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16
		Sampled Time	16:00	16:00	16:00	16:00	16:00
		Client ID	CD_GH_FR1HH_7 5NO3_TERM	CD_GH_ER2_UNN O3_TERM	CD_GH_ER2_3NO 3_TERM	CD_GH_ER2_5NO 3_TERM	CD_GH_ER2_9NO 3_TERM
Grouping	Analyte						
WATER							
Physical Tests	Total Dissolved Solids (mg/L)		1260	183	204	217	234
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)		186	146	146	147	142
	Ammonia, Total (as N) (mg/L)		0.103	0.110	0.115	0.0973	0.0909
	Chloride (Cl) (mg/L)		<2.5 ^{DLDS}	0.92	1.08	0.85	0.91
	Nitrate (as N) (mg/L)		71.3	0.216	3.71	5.19	9.00
	Nitrite (as N) (mg/L)		0.0108	0.0031	0.0038	0.0047	0.0043
	Phosphorus (P)-Total (mg/L)		0.0427	0.0295	0.0347	0.0405	0.0385
	Sulfate (SO4) (mg/L)		471	24.6	24.0	23.8	23.2
Total Metals	Aluminum (Al)-Total (mg/L)		0.0075				
	Antimony (Sb)-Total (mg/L)		0.00022				
	Arsenic (As)-Total (mg/L)		0.00012				
	Barium (Ba)-Total (mg/L)		0.0994				
	Beryllium (Be)-Total (mg/L)		<0.00010				
	Bismuth (Bi)-Total (mg/L)		<0.000050				
	Boron (B)-Total (mg/L)		0.013				
	Cadmium (Cd)-Total (mg/L)		0.0000192				
	Calcium (Ca)-Total (mg/L)		161	48.5	47.7	48.4	
	Cesium (Cs)-Total (mg/L)		<0.000010				
	Chromium (Cr)-Total (mg/L)		0.00017				
	Cobalt (Co)-Total (mg/L)		<0.00010				
	Copper (Cu)-Total (mg/L)		0.00135				
	Iron (Fe)-Total (mg/L)		0.011				
	Lead (Pb)-Total (mg/L)		0.000181				
	Lithium (Li)-Total (mg/L)		0.0173				
	Magnesium (Mg)-Total (mg/L)		67.1	11.3	11.0	11.2	
	Manganese (Mn)-Total (mg/L)		0.00079				
	Molybdenum (Mo)-Total (mg/L)		0.00116				
	Nickel (Ni)-Total (mg/L)		0.00280				
	Phosphorus (P)-Total (mg/L)		0.059				
	Potassium (K)-Total (mg/L)		1.63	<2.0	<2.0	<2.0	0.547
	Rubidium (Rb)-Total (mg/L)		0.00076				
	Selenium (Se)-Total (mg/L)		0.0465				
	Silicon (Si)-Total (mg/L)		2.39				
	Silver (Ag)-Total (mg/L)		<0.000010				
	Sodium (Na)-Total (mg/L)		103	<2.0	7.8	10.7	15.6
	Strontium (Sr)-Total (mg/L)		0.180				
	Sulfur (S)-Total (mg/L)		185				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-26 Water 07-NOV-16 16:00 CD_GH_ER2_15N O3_TERM	L1855268-27 Water 07-NOV-16 16:00 CD_GH_ER2_25N O3_TERM	L1855268-28 Water 07-NOV-16 16:00 CD_GH_ER2_43N O3_TERM	
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	267	323	436	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	149	146	148	
	Ammonia, Total (as N) (mg/L)	0.0877	0.0920	0.104	
	Chloride (Cl) (mg/L)	1.14	0.82	0.96	
	Nitrate (as N) (mg/L)	15.0	24.3	43.2 ^{HTD}	
	Nitrite (as N) (mg/L)	0.0046	0.0042	0.0059	
	Phosphorus (P)-Total (mg/L)	0.0160	0.0257	0.0188	
	Sulfate (SO4) (mg/L)	23.7	23.6	23.7	
Total Metals	Aluminum (Al)-Total (mg/L)				
	Antimony (Sb)-Total (mg/L)				
	Arsenic (As)-Total (mg/L)				
	Barium (Ba)-Total (mg/L)				
	Beryllium (Be)-Total (mg/L)				
	Bismuth (Bi)-Total (mg/L)				
	Boron (B)-Total (mg/L)				
	Cadmium (Cd)-Total (mg/L)				
	Calcium (Ca)-Total (mg/L)	47.6	47.8		
	Cesium (Cs)-Total (mg/L)				
	Chromium (Cr)-Total (mg/L)				
	Cobalt (Co)-Total (mg/L)				
	Copper (Cu)-Total (mg/L)				
	Iron (Fe)-Total (mg/L)				
	Lead (Pb)-Total (mg/L)				
	Lithium (Li)-Total (mg/L)				
	Magnesium (Mg)-Total (mg/L)	10.8	10.8		
	Manganese (Mn)-Total (mg/L)				
	Molybdenum (Mo)-Total (mg/L)				
	Nickel (Ni)-Total (mg/L)				
	Phosphorus (P)-Total (mg/L)				
	Potassium (K)-Total (mg/L)	<2.0	<2.0	0.529	
	Rubidium (Rb)-Total (mg/L)				
	Selenium (Se)-Total (mg/L)				
	Silicon (Si)-Total (mg/L)				
	Silver (Ag)-Total (mg/L)				
	Sodium (Na)-Total (mg/L)	28.0	45.5	69.5	
	Strontium (Sr)-Total (mg/L)				
	Sulfur (S)-Total (mg/L)				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-1 Water 07-NOV-16 16:00 CD_EV_ER4_UNN O3_TERM	L1855268-2 Water 07-NOV-16 16:00 CD_EV_ER4_5NO 3_TERM	L1855268-3 Water 07-NOV-16 16:00 CD_EV_ER4_8NO 3_TERM	L1855268-4 Water 07-NOV-16 16:00 CD_EV_ER4_12N O3_TERM	L1855268-5 Water 07-NOV-16 16:00 CD_EV_ER4_20N O3_TERM
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)				<0.00020	
	Thallium (Tl)-Total (mg/L)				<0.000010	
	Thorium (Th)-Total (mg/L)				<0.00010	
	Tin (Sn)-Total (mg/L)				0.00388	
	Titanium (Ti)-Total (mg/L)				<0.00030	
	Tungsten (W)-Total (mg/L)				<0.00010	
	Uranium (U)-Total (mg/L)				0.00123	
	Vanadium (V)-Total (mg/L)				<0.00050	
	Zinc (Zn)-Total (mg/L)				0.0038	
	Zirconium (Zr)-Total (mg/L)				<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location				LAB	
	Aluminum (Al)-Dissolved (mg/L)				0.0104	
	Antimony (Sb)-Dissolved (mg/L)				<0.00010	
	Arsenic (As)-Dissolved (mg/L)				0.00016	
	Barium (Ba)-Dissolved (mg/L)				0.0676	
	Beryllium (Be)-Dissolved (mg/L)				<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)				<0.000050	
	Boron (B)-Dissolved (mg/L)				0.014	
	Cadmium (Cd)-Dissolved (mg/L)				0.0000081	
	Calcium (Ca)-Dissolved (mg/L)				61.5	
	Cesium (Cs)-Dissolved (mg/L)				<0.000010	
	Chromium (Cr)-Dissolved (mg/L)				0.00020	
	Cobalt (Co)-Dissolved (mg/L)				<0.00010	
	Copper (Cu)-Dissolved (mg/L)				0.00024	
	Iron (Fe)-Dissolved (mg/L)				<0.010	
	Lead (Pb)-Dissolved (mg/L)				<0.000050	
	Lithium (Li)-Dissolved (mg/L)				0.0078	
	Magnesium (Mg)-Dissolved (mg/L)				19.7	
	Manganese (Mn)-Dissolved (mg/L)				0.00039	
	Molybdenum (Mo)-Dissolved (mg/L)				0.00114	
	Nickel (Ni)-Dissolved (mg/L)				<0.00050	
	Phosphorus (P)-Dissolved (mg/L)				<0.050	
	Potassium (K)-Dissolved (mg/L)				0.810	
	Rubidium (Rb)-Dissolved (mg/L)				0.00036	
	Selenium (Se)-Dissolved (mg/L)				0.0109	
	Silicon (Si)-Dissolved (mg/L)				1.96	
	Silver (Ag)-Dissolved (mg/L)				<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-6 Water 07-NOV-16 16:00 CD_EV_ER4_31N O3_TERM	L1855268-7 Water 07-NOV-16 16:00 CD_EV_ER4_50N O3_TERM	L1855268-8 Water 07-NOV-16 16:00 CD_GH_FR1_UNN O3_TERM	L1855268-9 Water 07-NOV-16 16:00 CD_GH_FR1_14N O3_TERM	L1855268-10 Water 07-NOV-16 16:00 CD_GH_FR1_20N O3_TERM
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)		<0.00020			
	Thallium (Tl)-Total (mg/L)		<0.00010			
	Thorium (Th)-Total (mg/L)		<0.00010			
	Tin (Sn)-Total (mg/L)		0.00386			
	Titanium (Ti)-Total (mg/L)		<0.00030			
	Tungsten (W)-Total (mg/L)		<0.00010			
	Uranium (U)-Total (mg/L)		0.00124			
	Vanadium (V)-Total (mg/L)		<0.00050			
	Zinc (Zn)-Total (mg/L)		0.0031			
	Zirconium (Zr)-Total (mg/L)		<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location		LAB			
	Aluminum (Al)-Dissolved (mg/L)		0.0085			
	Antimony (Sb)-Dissolved (mg/L)		<0.00010			
	Arsenic (As)-Dissolved (mg/L)		0.00019			
	Barium (Ba)-Dissolved (mg/L)		0.0691			
	Beryllium (Be)-Dissolved (mg/L)		<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050			
	Boron (B)-Dissolved (mg/L)		0.015			
	Cadmium (Cd)-Dissolved (mg/L)		0.0000155			
	Calcium (Ca)-Dissolved (mg/L)		61.6			
	Cesium (Cs)-Dissolved (mg/L)		<0.000010			
	Chromium (Cr)-Dissolved (mg/L)		0.00023			
	Cobalt (Co)-Dissolved (mg/L)		<0.00010			
	Copper (Cu)-Dissolved (mg/L)		0.00070			
	Iron (Fe)-Dissolved (mg/L)		<0.010			
	Lead (Pb)-Dissolved (mg/L)		0.000066			
	Lithium (Li)-Dissolved (mg/L)		0.0081			
	Magnesium (Mg)-Dissolved (mg/L)		20.3			
	Manganese (Mn)-Dissolved (mg/L)		0.00050			
	Molybdenum (Mo)-Dissolved (mg/L)		0.00117			
	Nickel (Ni)-Dissolved (mg/L)		<0.00050			
	Phosphorus (P)-Dissolved (mg/L)		<0.050			
	Potassium (K)-Dissolved (mg/L)		0.912			
	Rubidium (Rb)-Dissolved (mg/L)		0.00046			
	Selenium (Se)-Dissolved (mg/L)		0.0104			
	Silicon (Si)-Dissolved (mg/L)		2.02			
	Silver (Ag)-Dissolved (mg/L)		<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-11 Water 07-NOV-16 16:00 CD_GH_FR1_27N O3_TERM	L1855268-12 Water 07-NOV-16 16:00 CD_GH_FR1_38N O3_TERM	L1855268-13 Water 07-NOV-16 16:00 CD_GH_FR1_54N O3_TERM	L1855268-14 Water 07-NOV-16 16:00 CD_GH_FR1_75N O3_TERM	L1855268-15 Water 07-NOV-16 16:00 CD_GH_FR1HH_U NNO3_TERM
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			<0.00020	
	Thallium (Tl)-Total (mg/L)	<0.000010			<0.000010	
	Thorium (Th)-Total (mg/L)	<0.00010			<0.00010	
	Tin (Sn)-Total (mg/L)	0.00040			0.00042	
	Titanium (Ti)-Total (mg/L)	<0.00030			<0.00030	
	Tungsten (W)-Total (mg/L)	<0.00010			<0.00010	
	Uranium (U)-Total (mg/L)	0.00245			0.00246	
	Vanadium (V)-Total (mg/L)	<0.00050			<0.00050	
	Zinc (Zn)-Total (mg/L)	0.0031			<0.0030	
	Zirconium (Zr)-Total (mg/L)	<0.00030			<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location	LAB			LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.0091			0.0067	
	Antimony (Sb)-Dissolved (mg/L)	0.00016			0.00015	
	Arsenic (As)-Dissolved (mg/L)	<0.00010			<0.00010	
	Barium (Ba)-Dissolved (mg/L)	0.0983			0.101	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			<0.000050	
	Boron (B)-Dissolved (mg/L)	0.019			0.018	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000130			0.0000070	
	Calcium (Ca)-Dissolved (mg/L)	93.5			95.0	
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			<0.000010	
	Chromium (Cr)-Dissolved (mg/L)	0.00014			0.00012	
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00100			0.00031	
	Iron (Fe)-Dissolved (mg/L)	<0.010			<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050			<0.000050	
	Lithium (Li)-Dissolved (mg/L)	0.0165			0.0165	
	Magnesium (Mg)-Dissolved (mg/L)	42.6			44.3	
	Manganese (Mn)-Dissolved (mg/L)	0.00031			0.00031	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00107			0.00105	
	Nickel (Ni)-Dissolved (mg/L)	0.00226			0.00230	
	Phosphorus (P)-Dissolved (mg/L)	<0.050			<0.050	
	Potassium (K)-Dissolved (mg/L)	1.46			1.49	
	Rubidium (Rb)-Dissolved (mg/L)	0.00066			0.00070	
	Selenium (Se)-Dissolved (mg/L)	0.0444			0.0461	
	Silicon (Si)-Dissolved (mg/L)	2.10			2.27	
	Silver (Ag)-Dissolved (mg/L)	<0.000010			<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-16 Water 07-NOV-16 16:00 CD_GH_FR1HH_1 4NO3_TERM	L1855268-17 Water 07-NOV-16 16:00 CD_GH_FR1HH_2 0NO3_TERM	L1855268-18 Water 07-NOV-16 16:00 CD_GH_FR1HH_2 7NO3_TERM	L1855268-19 Water 07-NOV-16 16:00 CD_GH_FR1HH_3 8NO3_TERM	L1855268-20 Water 07-NOV-16 16:00 CD_GH_FR1HH_5 4NO3_TERM
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)			<0.00020		
	Thallium (Tl)-Total (mg/L)			<0.000010		
	Thorium (Th)-Total (mg/L)			<0.00010		
	Tin (Sn)-Total (mg/L)			0.00050		
	Titanium (Ti)-Total (mg/L)			<0.00030		
	Tungsten (W)-Total (mg/L)			<0.00010		
	Uranium (U)-Total (mg/L)			0.00243		
	Vanadium (V)-Total (mg/L)			<0.00050		
	Zinc (Zn)-Total (mg/L)			<0.0030		
	Zirconium (Zr)-Total (mg/L)			<0.00030		
Dissolved Metals	Dissolved Metals Filtration Location			LAB		
	Aluminum (Al)-Dissolved (mg/L)			0.0033		
	Antimony (Sb)-Dissolved (mg/L)			0.00016		
	Arsenic (As)-Dissolved (mg/L)			0.00011		
	Barium (Ba)-Dissolved (mg/L)			0.0996		
	Beryllium (Be)-Dissolved (mg/L)			<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)			<0.000050		
	Boron (B)-Dissolved (mg/L)			0.013		
	Cadmium (Cd)-Dissolved (mg/L)			0.0000087		
	Calcium (Ca)-Dissolved (mg/L)			160		
	Cesium (Cs)-Dissolved (mg/L)			<0.000010		
	Chromium (Cr)-Dissolved (mg/L)			0.00010		
	Cobalt (Co)-Dissolved (mg/L)			<0.00010		
	Copper (Cu)-Dissolved (mg/L)			0.00062		
	Iron (Fe)-Dissolved (mg/L)			<0.010		
	Lead (Pb)-Dissolved (mg/L)			0.000059		
	Lithium (Li)-Dissolved (mg/L)			0.0171		
	Magnesium (Mg)-Dissolved (mg/L)			70.5		
	Manganese (Mn)-Dissolved (mg/L)			0.00040		
	Molybdenum (Mo)-Dissolved (mg/L)			0.00114		
	Nickel (Ni)-Dissolved (mg/L)			0.00258		
	Phosphorus (P)-Dissolved (mg/L)			<0.050		
	Potassium (K)-Dissolved (mg/L)			1.65		
	Rubidium (Rb)-Dissolved (mg/L)			0.00080		
	Selenium (Se)-Dissolved (mg/L)			0.0454		
	Silicon (Si)-Dissolved (mg/L)			2.10		
	Silver (Ag)-Dissolved (mg/L)			<0.000010		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855268-21	L1855268-22	L1855268-23	L1855268-24	L1855268-25
		Description	Water	Water	Water	Water	Water
		Sampled Date	07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16
		Sampled Time	16:00	16:00	16:00	16:00	16:00
		Client ID	CD_GH_FR1HH_7 5NO3_TERM	CD_GH_ER2_UNN O3_TERM	CD_GH_ER2_3NO 3_TERM	CD_GH_ER2_5NO 3_TERM	CD_GH_ER2_9NO 3_TERM
Grouping	Analyte						
WATER							
Total Metals	Tellurium (Te)-Total (mg/L)		<0.00020				
	Thallium (Tl)-Total (mg/L)		<0.000010				
	Thorium (Th)-Total (mg/L)		0.00011				
	Tin (Sn)-Total (mg/L)		0.00060				
	Titanium (Ti)-Total (mg/L)		<0.00030				
	Tungsten (W)-Total (mg/L)		<0.00010				
	Uranium (U)-Total (mg/L)		0.00248				
	Vanadium (V)-Total (mg/L)		<0.00050				
	Zinc (Zn)-Total (mg/L)		<0.0030				
	Zirconium (Zr)-Total (mg/L)		<0.00030				
Dissolved Metals	Dissolved Metals Filtration Location		LAB				LAB
	Aluminum (Al)-Dissolved (mg/L)		0.0038				0.0123
	Antimony (Sb)-Dissolved (mg/L)		0.00017				<0.00010
	Arsenic (As)-Dissolved (mg/L)		0.00010				0.00011
	Barium (Ba)-Dissolved (mg/L)		0.0984				0.0456
	Beryllium (Be)-Dissolved (mg/L)		<0.00010				<0.00010
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050				<0.000050
	Boron (B)-Dissolved (mg/L)		0.012				0.013
	Cadmium (Cd)-Dissolved (mg/L)		0.0000144				0.0000098
	Calcium (Ca)-Dissolved (mg/L)		156				44.9
	Cesium (Cs)-Dissolved (mg/L)		<0.000010				<0.000010
	Chromium (Cr)-Dissolved (mg/L)		0.00012				0.00024
	Cobalt (Co)-Dissolved (mg/L)		<0.00010				<0.00010
	Copper (Cu)-Dissolved (mg/L)		0.00103				0.00060
	Iron (Fe)-Dissolved (mg/L)		<0.010				<0.010
	Lead (Pb)-Dissolved (mg/L)		0.000123				0.000056
	Lithium (Li)-Dissolved (mg/L)		0.0167				0.0017
	Magnesium (Mg)-Dissolved (mg/L)		64.6				10.4
	Manganese (Mn)-Dissolved (mg/L)		0.00034				0.00099
	Molybdenum (Mo)-Dissolved (mg/L)		0.00109				0.000996
	Nickel (Ni)-Dissolved (mg/L)		0.00252				<0.00050
	Phosphorus (P)-Dissolved (mg/L)		<0.050				<0.050
	Potassium (K)-Dissolved (mg/L)		1.61				0.559
	Rubidium (Rb)-Dissolved (mg/L)		0.00074				0.00024
	Selenium (Se)-Dissolved (mg/L)		0.0475				0.000977
	Silicon (Si)-Dissolved (mg/L)		2.21				1.78
	Silver (Ag)-Dissolved (mg/L)		<0.000010				<0.000010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-26 Water 07-NOV-16 16:00 CD_GH_ER2_15N O3_TERM	L1855268-27 Water 07-NOV-16 16:00 CD_GH_ER2_25N O3_TERM	L1855268-28 Water 07-NOV-16 16:00 CD_GH_ER2_43N O3_TERM	
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)				
	Thallium (Tl)-Total (mg/L)				
	Thorium (Th)-Total (mg/L)				
	Tin (Sn)-Total (mg/L)				
	Titanium (Ti)-Total (mg/L)				
	Tungsten (W)-Total (mg/L)				
	Uranium (U)-Total (mg/L)				
	Vanadium (V)-Total (mg/L)				
	Zinc (Zn)-Total (mg/L)				
	Zirconium (Zr)-Total (mg/L)				
Dissolved Metals	Dissolved Metals Filtration Location			LAB	
	Aluminum (Al)-Dissolved (mg/L)			0.0080	
	Antimony (Sb)-Dissolved (mg/L)			<0.00010	
	Arsenic (As)-Dissolved (mg/L)			0.00011	
	Barium (Ba)-Dissolved (mg/L)			0.0459	
	Beryllium (Be)-Dissolved (mg/L)			<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)			<0.000050	
	Boron (B)-Dissolved (mg/L)			0.013	
	Cadmium (Cd)-Dissolved (mg/L)			0.0000085	
	Calcium (Ca)-Dissolved (mg/L)			47.3	
	Cesium (Cs)-Dissolved (mg/L)			<0.000010	
	Chromium (Cr)-Dissolved (mg/L)			0.00025	
	Cobalt (Co)-Dissolved (mg/L)			<0.00010	
	Copper (Cu)-Dissolved (mg/L)			0.00026	
	Iron (Fe)-Dissolved (mg/L)			<0.010	
	Lead (Pb)-Dissolved (mg/L)			<0.000050	
	Lithium (Li)-Dissolved (mg/L)			0.0018	
	Magnesium (Mg)-Dissolved (mg/L)			10.8	
	Manganese (Mn)-Dissolved (mg/L)			0.00102	
	Molybdenum (Mo)-Dissolved (mg/L)			0.00102	
	Nickel (Ni)-Dissolved (mg/L)			<0.00050	
	Phosphorus (P)-Dissolved (mg/L)			<0.050	
	Potassium (K)-Dissolved (mg/L)			0.568	
	Rubidium (Rb)-Dissolved (mg/L)			0.00027	
	Selenium (Se)-Dissolved (mg/L)			0.000842	
	Silicon (Si)-Dissolved (mg/L)			1.82	
	Silver (Ag)-Dissolved (mg/L)			<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-1 Water 07-NOV-16 16:00 CD_EV_ER4_UNN O3_TERM	L1855268-2 Water 07-NOV-16 16:00 CD_EV_ER4_5NO 3_TERM	L1855268-3 Water 07-NOV-16 16:00 CD_EV_ER4_8NO 3_TERM	L1855268-4 Water 07-NOV-16 16:00 CD_EV_ER4_12N O3_TERM	L1855268-5 Water 07-NOV-16 16:00 CD_EV_ER4_20N O3_TERM
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)				17.2	
	Strontium (Sr)-Dissolved (mg/L)				0.237	
	Sulfur (S)-Dissolved (mg/L)				25.3	
	Tellurium (Te)-Dissolved (mg/L)				<0.00020	
	Thallium (Tl)-Dissolved (mg/L)				<0.000010	
	Thorium (Th)-Dissolved (mg/L)				<0.00010	
	Tin (Sn)-Dissolved (mg/L)				0.00363	
	Titanium (Ti)-Dissolved (mg/L)				<0.00030	
	Tungsten (W)-Dissolved (mg/L)				<0.00010	
	Uranium (U)-Dissolved (mg/L)				0.00123	
	Vanadium (V)-Dissolved (mg/L)				<0.00050	
	Zinc (Zn)-Dissolved (mg/L)				0.0019	
	Zirconium (Zr)-Dissolved (mg/L)				<0.00030	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	Description	Sampled Date	Sampled Time	Client ID																																																																														
	L1855268-6	Water	07-NOV-16	16:00	CD_EV_ER4_31N O3_TERM																																																																														
	L1855268-7	Water	07-NOV-16	16:00	CD_EV_ER4_50N O3_TERM																																																																														
	L1855268-8	Water	07-NOV-16	16:00	CD_GH_FR1_UNN O3_TERM																																																																														
	L1855268-9	Water	07-NOV-16	16:00	CD_GH_FR1_14N O3_TERM																																																																														
	L1855268-10	Water	07-NOV-16	16:00	CD_GH_FR1_20N O3_TERM																																																																														
Grouping	Analyte																																																																																		
WATER																																																																																			
Dissolved Metals	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%;">Sodium (Na)-Dissolved (mg/L)</td> <td style="width: 15%;"></td> <td style="width: 15%; text-align: center;">75.7</td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> <td style="width: 15%;"></td> </tr> <tr> <td>Strontium (Sr)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;">0.234</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Sulfur (S)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;">25.9</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Tellurium (Te)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;"><0.00020</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Thallium (Tl)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;"><0.000010</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Thorium (Th)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;"><0.00010</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Tin (Sn)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;">0.00363</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Titanium (Ti)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;"><0.00030</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Tungsten (W)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;"><0.00010</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Uranium (U)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;">0.00122</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Vanadium (V)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;"><0.00050</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Zinc (Zn)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;">0.0024</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Zirconium (Zr)-Dissolved (mg/L)</td> <td></td> <td style="text-align: center;"><0.00030</td> <td></td> <td></td> <td></td> </tr> </table>					Sodium (Na)-Dissolved (mg/L)		75.7				Strontium (Sr)-Dissolved (mg/L)		0.234				Sulfur (S)-Dissolved (mg/L)		25.9				Tellurium (Te)-Dissolved (mg/L)		<0.00020				Thallium (Tl)-Dissolved (mg/L)		<0.000010				Thorium (Th)-Dissolved (mg/L)		<0.00010				Tin (Sn)-Dissolved (mg/L)		0.00363				Titanium (Ti)-Dissolved (mg/L)		<0.00030				Tungsten (W)-Dissolved (mg/L)		<0.00010				Uranium (U)-Dissolved (mg/L)		0.00122				Vanadium (V)-Dissolved (mg/L)		<0.00050				Zinc (Zn)-Dissolved (mg/L)		0.0024				Zirconium (Zr)-Dissolved (mg/L)		<0.00030			
Sodium (Na)-Dissolved (mg/L)		75.7																																																																																	
Strontium (Sr)-Dissolved (mg/L)		0.234																																																																																	
Sulfur (S)-Dissolved (mg/L)		25.9																																																																																	
Tellurium (Te)-Dissolved (mg/L)		<0.00020																																																																																	
Thallium (Tl)-Dissolved (mg/L)		<0.000010																																																																																	
Thorium (Th)-Dissolved (mg/L)		<0.00010																																																																																	
Tin (Sn)-Dissolved (mg/L)		0.00363																																																																																	
Titanium (Ti)-Dissolved (mg/L)		<0.00030																																																																																	
Tungsten (W)-Dissolved (mg/L)		<0.00010																																																																																	
Uranium (U)-Dissolved (mg/L)		0.00122																																																																																	
Vanadium (V)-Dissolved (mg/L)		<0.00050																																																																																	
Zinc (Zn)-Dissolved (mg/L)		0.0024																																																																																	
Zirconium (Zr)-Dissolved (mg/L)		<0.00030																																																																																	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855268-11	L1855268-12	L1855268-13	L1855268-14	L1855268-15
		Description	Water	Water	Water	Water	Water
		Sampled Date	07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16
		Sampled Time	16:00	16:00	16:00	16:00	16:00
		Client ID	CD_GH_FR1_27N O3_TERM	CD_GH_FR1_38N O3_TERM	CD_GH_FR1_54N O3_TERM	CD_GH_FR1_75N O3_TERM	CD_GH_FR1HH_U NNO3_TERM
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		22.1			103	
	Strontium (Sr)-Dissolved (mg/L)		0.143			0.142	
	Sulfur (S)-Dissolved (mg/L)		71.1			77.6	
	Tellurium (Te)-Dissolved (mg/L)		<0.00020			<0.00020	
	Thallium (Tl)-Dissolved (mg/L)		<0.000010			<0.000010	
	Thorium (Th)-Dissolved (mg/L)		<0.00010			<0.00010	
	Tin (Sn)-Dissolved (mg/L)		0.00032			0.00031	
	Titanium (Ti)-Dissolved (mg/L)		<0.00030			<0.00030	
	Tungsten (W)-Dissolved (mg/L)		<0.00010			<0.00010	
	Uranium (U)-Dissolved (mg/L)		0.00241			0.00236	
	Vanadium (V)-Dissolved (mg/L)		<0.00050			<0.00050	
	Zinc (Zn)-Dissolved (mg/L)		0.0024			0.0018	
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030			<0.00030	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855268-16 Water 07-NOV-16 16:00 CD_GH_FR1HH_1 4NO3_TERM	L1855268-17 Water 07-NOV-16 16:00 CD_GH_FR1HH_2 0NO3_TERM	L1855268-18 Water 07-NOV-16 16:00 CD_GH_FR1HH_2 7NO3_TERM	L1855268-19 Water 07-NOV-16 16:00 CD_GH_FR1HH_3 8NO3_TERM	L1855268-20 Water 07-NOV-16 16:00 CD_GH_FR1HH_5 4NO3_TERM
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)			30.8		
	Strontium (Sr)-Dissolved (mg/L)			0.180		
	Sulfur (S)-Dissolved (mg/L)			156		
	Tellurium (Te)-Dissolved (mg/L)			<0.00020		
	Thallium (Tl)-Dissolved (mg/L)			<0.000010		
	Thorium (Th)-Dissolved (mg/L)			<0.00010		
	Tin (Sn)-Dissolved (mg/L)			0.00043		
	Titanium (Ti)-Dissolved (mg/L)			<0.00030		
	Tungsten (W)-Dissolved (mg/L)			<0.00010		
	Uranium (U)-Dissolved (mg/L)			0.00242		
	Vanadium (V)-Dissolved (mg/L)			<0.00050		
	Zinc (Zn)-Dissolved (mg/L)			0.0012		
	Zirconium (Zr)-Dissolved (mg/L)			<0.00030		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1855268-21	L1855268-22	L1855268-23	L1855268-24	L1855268-25
					Water	Water	Water	Water	Water
		07-NOV-16	16:00		07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16	07-NOV-16
					16:00	16:00	16:00	16:00	16:00
					CD_GH_FR1HH_7 5NO3_TERM	CD_GH_ER2_UNN O3_TERM	CD_GH_ER2_3NO 3_TERM	CD_GH_ER2_5NO 3_TERM	CD_GH_ER2_9NO 3_TERM
Grouping	Analyte								
WATER									
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		99.7						15.6
	Strontium (Sr)-Dissolved (mg/L)		0.176						0.217
	Sulfur (S)-Dissolved (mg/L)		170						7.77
	Tellurium (Te)-Dissolved (mg/L)		<0.00020						<0.00020
	Thallium (Tl)-Dissolved (mg/L)		<0.000010						<0.000010
	Thorium (Th)-Dissolved (mg/L)		<0.00010						<0.00010
	Tin (Sn)-Dissolved (mg/L)		0.00052						0.00050
	Titanium (Ti)-Dissolved (mg/L)		<0.00030						<0.00030
	Tungsten (W)-Dissolved (mg/L)		<0.00010						<0.00010
	Uranium (U)-Dissolved (mg/L)		0.00240						0.000757
	Vanadium (V)-Dissolved (mg/L)		<0.00050						<0.00050
	Zinc (Zn)-Dissolved (mg/L)		0.0018						0.0098
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030						<0.00030

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	Description	Sampled Date	Sampled Time	Client ID
	L1855268-26	Water	07-NOV-16	16:00	CD_GH_ER2_15N O3_TERM
	L1855268-27	Water	07-NOV-16	16:00	CD_GH_ER2_25N O3_TERM
	L1855268-28	Water	07-NOV-16	16:00	CD_GH_ER2_43N O3_TERM
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)				71.4
	Strontium (Sr)-Dissolved (mg/L)				0.226
	Sulfur (S)-Dissolved (mg/L)				8.03
	Tellurium (Te)-Dissolved (mg/L)				<0.00020
	Thallium (Tl)-Dissolved (mg/L)				<0.000010
	Thorium (Th)-Dissolved (mg/L)				<0.00010
	Tin (Sn)-Dissolved (mg/L)				0.00040
	Titanium (Ti)-Dissolved (mg/L)				<0.00030
	Tungsten (W)-Dissolved (mg/L)				<0.00010
	Uranium (U)-Dissolved (mg/L)				0.000787
	Vanadium (V)-Dissolved (mg/L)				<0.00050
	Zinc (Zn)-Dissolved (mg/L)				0.0096
	Zirconium (Zr)-Dissolved (mg/L)				<0.00030

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
LPML	Lab-Preserved for Total Metals. Sample received with pH > 2 and preserved at the lab. Total Metals results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Aluminum (Al)-Total	MB-LOR	L1855268-18, -21
Matrix Spike	Barium (Ba)-Total	MS-B	L1855268-11, -14, -7
Matrix Spike	Barium (Ba)-Total	MS-B	L1855268-18, -21, -25, -28
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855268-11, -14, -7
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855268-18, -21, -25, -28
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1855268-11, -14, -7
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1855268-18, -21, -25, -28
Matrix Spike	Selenium (Se)-Total	MS-B	L1855268-18, -21, -25, -28
Matrix Spike	Sodium (Na)-Total	MS-B	L1855268-11, -14, -7
Matrix Spike	Sodium (Na)-Total	MS-B	L1855268-18, -21, -25, -28
Matrix Spike	Strontium (Sr)-Total	MS-B	L1855268-11, -14, -7
Matrix Spike	Strontium (Sr)-Total	MS-B	L1855268-18, -21, -25, -28
Matrix Spike	Sulfur (S)-Total	MS-B	L1855268-11, -14, -7
Matrix Spike	Sulfur (S)-Total	MS-B	L1855268-18, -21, -25, -28
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855268-1, -2, -3, -5
Matrix Spike	Nitrate (as N)	MS-B	L1855268-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855268-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855268-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855268-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855268-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855268-28, -6
Matrix Spike	Nitrate (as N)	MS-B	L1855268-28, -6
Matrix Spike	Phosphorus (P)-Total	MS-B	L1855268-9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
MB-LOR	Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			

Reference Information

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this 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).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

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.



Chain of Custody (COC) / Analytical Request Form



L1855268-COFC

COC Number: 14 -

Page 1 of 3

Canada Toll Free: 1 800 668 9878

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Report To	Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company: Nautilus Environmental	Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)
Contact: Bonnie Lo	Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address: 8664 Commerce Court Burnaby, BC	<input type="checkbox"/> Criteria on Report - provide details below if box checked	E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone: 604-420-8773	Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge
	Email 1 or Fax: bonnie@nautilusenvironmental.ca	Specify Date Required for E2, E or P:
	Email 2:	

Invoice To	Invoice Distribution	Analysis Request
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Email 1 or Fax: bonnie@nautilusenvironmental.ca	
Company: Nautilus Environmental	Email 2: lise@nautilusenvironmental.ca	
Contact: Bonnie Lo		

Project Information	Oil and Gas Required Fields (client use)	
ALS Quote #:	Approver ID:	Cost Center:
Job #:	GL Account:	Routing Code:
PO / AFE:	Activity Code:	
LSD:	Location:	
ALS Lab Work Order # (lab use only)	ALS Contact: Heather McKenzie	Sampler:

ALS Sample # (lab use only)	Sample Identification and Description (This description will appear on report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals, low level	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers
	Cd_EV_ER4_unNO3_term	7-Nov-16	16:00	Water			✓	✓	✓	✓	✓	✓	✓	✓	✓	1
	Cd_EV_ER4_5NO3_term	7-Nov-16		Water											✓	1
	Cd_EV_ER4_8 NO3_term	7-Nov-16		Water											✓	1
	Cd_EV_ER4_12NO3_term	7-Nov-16		Water	✓	✓										1
	Cd_EV_ER4_20NO3_term	7-Nov-16		Water											✓	1
	Cd_EV_ER4_31NO3_term	7-Nov-16		Water											✓	1
	Cd_EV_ER4_50 NO3_term	7-Nov-16		Water	✓	✓										1
	Cd_GH_FR1_unNO3_term	7-Nov-16		Water											✓	1
	Cd_GH_FR1_14 NO3_term	7-Nov-16		Water											✓	1
	Cd_GH_FR1_20NO3_term	7-Nov-16		Water											✓	1
	Cd_GH_FR1_27NO3_term	7-Nov-16		Water	✓	✓									✓	1
	Cd_GH_FR1_38NO3_term	7-Nov-16		Water											✓	1

**Short Holding Time
Rush Processing**

Drinking Water (DW) Samples¹ (client use)	Special Instructions / Specify Criteria to add on report (client Use)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No	For metals (total & dissolved)-low level analysis please	Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>
		Cooling Initiated <input type="checkbox"/>
		INITIAL COOLER TEMPERATURES °C: ... FINAL COOLER TEMPERATURES °C: 20.4/10.0/12.0

SHIPMENT RELEASE (client use)	INITIAL SHIPMENT RECEPTION (lab use only)	FINAL SHIPMENT RECEPTION (lab use only)
Released by: <i>[Signature]</i> Date: 1430 Time: 12/8/2016	Received by: Date: Time:	Received by: <i>[Signature]</i> Date: 11/01/16 Time: 6:30pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS-FRAC1206 v09 Fourth January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																													
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																													
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																													
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																													
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																													
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2,E or P:																													
		Email 2:			Analysis Request																													
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																													
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																																
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca																																
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca																																
Contact: Bonnie Lo																																		
Project Information		Oil and Gas Required Fields (client use)																																
ALS Quote #:		Approver ID:			Cost Center:										Number of Containers																			
Job #:		GL Account:			Routing Code:																													
PO / AFE:		Activity Code:																																
LSD:		Location:																																
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler:																													
ALS Sample # (lab use only)		Sample Identification (This description will appear on report)			Date (dd-mmm-yy)		Time (hh:mm)		Sample Type		Total metals, low level (F)		Dissolved metals-low level (F)		Chloride		Sulphate		Alkalinity		Nitrate		Nitrite		Ammonia		Phosphorus		Total Dissolved Solids		Calcium & Magnesium			
Cd_GH_FR1_54NO3_term					7-Nov-16		16:06		Water																								1	
Cd_GH_FR1_75NO3_term					7-Nov-16				Water		✓		✓																		1			
Cd_GH_FR1HH_UnNO3_term					7-Nov-16				Water																						1			
Cd_GH_FR1HH_14 NO3_term					7-Nov-16				Water																						1			
Cd_GH_FR1HH_20NO3_term					7-Nov-16				Water																						1			
Cd_GH_FR1HH_27NO3_term					7-Nov-16				Water		✓		✓																		1			
Cd_GH_FR1HH_38NO3_term					7-Nov-16				Water																						1			
Cd_GH_FR1HH_54NO3_term					7-Nov-16				Water																						1			
Cd_GH_FR1HH_75NO3_term					7-Nov-16				Water		✓		✓																		1			
					7-Nov-16				Water																						1			
					7-Nov-16				Water																						1			
					7-Nov-16				Water																						1			
					7-Nov-16				Water																						1			
					7-Nov-16				Water																						1			
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)																													
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		For metals (total & dissolved)-low level analysis please			Frozen <input type="checkbox"/> SIF Observations: Yes <input type="checkbox"/> No <input type="checkbox"/>																													
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																													
					Cooling Initiated <input type="checkbox"/>																													
					INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C																								
										20/10/12 C																								
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)																										
Released by: <i>Bonnie</i>		Date: Nov 8/2014		Time: 14:30		Received by: <i>Indy</i>		Date: Nov 8		Time: 6:30pm																								

**Short Holding Time
Rush Processing**



Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)														
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)														
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT														
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT														
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge														
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:														
		Email 2:			Analysis Request														
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below														
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																	
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca																	
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca																	
Contact: Bonnie Lo																			
Project Information		Oil and Gas Required Fields (client use)																	
ALS Quote #:		Approver ID:		Cost Center:															
Job #:		GL Account:		Routing Code:															
PO / AFE:		Activity Code:																	
LSD:		Location:																	
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie		Sampler:															
ALS Sample # (lab use only)		Sample Identification and/or (This description will appear on report)		Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals, low level (F)	Dissolved metals-low level (F)	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers	
		Short Holding Time Rush Processing		7-Nov-16		Water			✓	✓	✓	✓	✓	✓	✓	✓	✓	1	
				7-Nov-16		Water													1
				7-Nov-16		Water													1
				7-Nov-16		Water	✓	✓											1
				7-Nov-16		Water												✓	1
				7-Nov-16		Water												✓	1
				7-Nov-16		Water	✓	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1
				7-Nov-16		Water													1
		7-Nov-16		Water													1		
		7-Nov-16		Water													1		
		7-Nov-16		Water													1		
		7-Nov-16		Water													1		
		7-Nov-16		Water													1		
		7-Nov-16		Water													1		
		7-Nov-16		Water													1		
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)														
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		For metals (total & dissolved)-low level analysis please			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>														
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>														
					Cooling Initiated <input type="checkbox"/>														
					INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C									
										20/10/12-C									
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)														
Released by: <i>[Signature]</i>		Date: 14/30	Time: 12:00	Received by: <i>[Signature]</i>	Date: Nov-8	Time: 6:30pm													



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

Date Received: 03-NOV-16
Report Date: 17-NOV-16 19:41 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1853451
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1853451-1	L1853451-2	L1853451-3	L1853451-4	L1853451-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	02-NOV-16	02-NOV-16	02-NOV-16	02-NOV-16	02-NOV-16
		Sampled Time	14:30	14:30	14:30	14:30	14:30
		Client ID	CD_EV_ER4_350S O4_AR1	CD_EV_ER4_455S O4_AR1	CD_EV_ER4_592S O4_AR1	CD_EV_ER4_769S O4_AR1	CD_EV_ER4_1000 SO4_AR1
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)						
	Sulfate (SO4) (mg/L)		359	469	607	782	1020
Total Metals	Calcium (Ca)-Total (mg/L)		131	163	192	234	292
	Magnesium (Mg)-Total (mg/L)		49.7	60.9	74.9	93.0	117

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1853451-6	L1853451-7	L1853451-8	L1853451-9	L1853451-10
		Description	Water	Water	Water	Water	Water
		Sampled Date	02-NOV-16	02-NOV-16	02-NOV-16	02-NOV-16	02-NOV-16
		Sampled Time	14:30	14:30	14:30	14:30	14:30
		Client ID	CD_EV_ER4_1300 SO4_AR1	CD_GH_FR1_350S O4_AR1	CD_GH_FR1_455S O4_AR1	CD_GH_FR1_592S O4_AR1	CD_GH_FR1_769S O4_AR1
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)						
	Sulfate (SO4) (mg/L)		1350	350	451	594	784
Total Metals	Calcium (Ca)-Total (mg/L)		365	122	159	189	235
	Magnesium (Mg)-Total (mg/L)		145	62.6	74.8	88.1	107

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853451-11 Water 02-NOV-16 14:30 CD_GH_FR1_1000 SO4_AR1	L1853451-12 Water 02-NOV-16 14:30 CD_GH_FR1_1300 SO4_AR1	L1853451-13 Water 02-NOV-16 14:30 CD_CONTROL	
Grouping	Analyte				
WATER					
Anions and Nutrients	Nitrate (as N) (mg/L)			0.423	
	Sulfate (SO4) (mg/L)	1020	1330	6.59	
Total Metals	Calcium (Ca)-Total (mg/L)	279	369	42.7	
	Magnesium (Mg)-Total (mg/L)	126	160	1.10	

* 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	Sulfate (SO4)	MS-B	L1853451-1, -10, -11, -12, -13, -2, -3, -4, -5, -6, -7, -8, -9

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**
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).			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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.



Chain of Custody (COC) / Analytical Request Form



COC Number: 14 -

Page 1 of 2

Canada Toll Free: 1 800 668 9878

L1853451-COFC

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Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																																																																																																								
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																																																																																																								
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																																																																																																								
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																																																																																																								
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																																																																																																								
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:																																																																																																								
		Email 2			Analysis Request																																																																																																								
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																																																								
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			P																																																																																																								
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca			<table border="1"> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>																																																																																																								
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca																																																																																																											
Project Information		Oil and Gas Required Fields (client use)																																																																																																											
ALS Quote #:		Approver ID:			Cost Center:																																																																																																								
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ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler: EMM/JS																																																																																																								
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)		Time (hh:mm)		Sample Type																																																																																																				
							1430		Water																																																																																																				
		Cd_EV_ER4_350SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_EV_ER4_455SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_EV_ER4_592SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_EV_ER4_769SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_EV_ER4_1000SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_EV_ER4_1300SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_GH_FR1_350SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_GH_FR1_455SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_GH_FR1_592SO4_AR1			2-Nov-16				Water																																																																																																				
		Cd_GH_FR1_769SO4_AR1			2-Nov-16				Water																																																																																																				
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																								
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		For metals, metal & dissolved low level analysis please specify by email to COC@nautilus.com or by phone			Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																								
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																								
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SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)																																																																																																								
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Date: Nov 3/16		Date: Nov 3			Date: Nov 3																																																																																																								
Time: 1745		Time: 6:55 PM			Time: 6:55 PM																																																																																																								

Short Holding Time
 Rush Processing

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM 02256-001 Rev 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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

Date Received: 08-NOV-16
Report Date: 28-NOV-16 13:19 (MT)
Version: FINAL REV. 3

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1855267
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Comments: 21-NOV-2016 This version of the analysis includes additional metals parameters and supersedes the previously issued report.

28-NOV-2016 This version includes corrected result for sulphate analysis of samples 6, 7, 14.

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID					
	L1855267-1 Water 08-NOV-16 14:00 CD_EV_ER4_UNSS O4_TERM		L1855267-2 Water 08-NOV-16 14:00 CD_EV_ER4_350S O4_TERM		L1855267-3 Water 08-NOV-16 14:00 CD_EV_ER4_455S O4_TERM	L1855267-4 Water 08-NOV-16 14:00 CD_EV_ER4_592S O4_TERM
					L1855267-5 Water 08-NOV-16 14:00 CD_EV_ER4_769S O4_TERM	
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	295	673	854	1060	1330
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	168	150	168	150	147
	Ammonia, Total (as N) (mg/L)	0.0640	0.0629	0.0555	0.0603	0.0572
	Chloride (Cl) (mg/L)	3.05	2.7	2.7	2.7	2.6
	Nitrate (as N) (mg/L)	2.97	3.00	3.00	3.04	3.01
	Nitrite (as N) (mg/L)	0.0067	0.0081	0.0065	0.0063	0.0072
	Phosphorus (P)-Total (mg/L)	0.0476	0.0504	0.0362	0.0464	0.0468
	Sulfate (SO4) (mg/L)	80.1	360	475	622	798
Total Metals	Aluminum (Al)-Total (mg/L)				0.0156	
	Antimony (Sb)-Total (mg/L)				<0.00010	
	Arsenic (As)-Total (mg/L)				0.00021	
	Barium (Ba)-Total (mg/L)				0.0643	
	Beryllium (Be)-Total (mg/L)				<0.00010	
	Bismuth (Bi)-Total (mg/L)				<0.000050	
	Boron (B)-Total (mg/L)				0.021	
	Cadmium (Cd)-Total (mg/L)				<0.0000050	
	Calcium (Ca)-Total (mg/L)	69.5	132	167	196	245
	Cesium (Cs)-Total (mg/L)				<0.000010	
	Chromium (Cr)-Total (mg/L)				0.00026	
	Cobalt (Co)-Total (mg/L)				<0.00010	
	Copper (Cu)-Total (mg/L)				<0.00050	
	Iron (Fe)-Total (mg/L)				0.012	
	Lead (Pb)-Total (mg/L)				0.000056	
	Lithium (Li)-Total (mg/L)				0.0099	
	Magnesium (Mg)-Total (mg/L)	20.8	48.2	58.7	69.6	90.2
	Manganese (Mn)-Total (mg/L)				0.00092	
	Molybdenum (Mo)-Total (mg/L)				0.00131	
	Nickel (Ni)-Total (mg/L)				0.00142	
	Phosphorus (P)-Total (mg/L)				0.063	
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	0.891	<2.0
	Rubidium (Rb)-Total (mg/L)				0.00045	
	Selenium (Se)-Total (mg/L)				0.0112	
	Silicon (Si)-Total (mg/L)				2.20	
	Silver (Ag)-Total (mg/L)				<0.000010	
	Sodium (Na)-Total (mg/L)	3.4	3.0	3.0	3.01	3.0
	Strontium (Sr)-Total (mg/L)				0.323	
	Sulfur (S)-Total (mg/L)				216	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855267-6 Water 08-NOV-16 14:00 CD_EV_ER4_1000 SO4_TERM	L1855267-7 Water 08-NOV-16 14:00 CD_EV_ER4_1300 SO4_TERM	L1855267-8 Water 08-NOV-16 14:00 CD_GH_FR1_UN5 O4_TERM	L1855267-9 Water 08-NOV-16 14:00 CD_GH_FR1_350S O4_TERM	L1855267-10 Water 08-NOV-16 14:00 CD_GH_FR1_455S O4_TERM
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1670	2110	571	715	904
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	167	167	198	168	184
	Ammonia, Total (as N) (mg/L)	0.0674	0.0640	0.0678	0.0765	0.0670
	Chloride (Cl) (mg/L)	<5.0 ^{DLDS}	<10 ^{DLDS}	<2.5 ^{DLDS}	<2.5 ^{DLDS}	<2.5 ^{DLDS}
	Nitrate (as N) (mg/L)	3.22 ^{HTD}	3.31 ^{HTD}	10.0	9.84	9.77
	Nitrite (as N) (mg/L)	0.014 ^{HTD}	<0.020	0.0114	0.0131	0.0108
	Phosphorus (P)-Total (mg/L)	0.0426	0.0486	0.0387	0.0641	0.0296
	Sulfate (SO4) (mg/L)	1010	1340	231	352	460
Total Metals	Aluminum (Al)-Total (mg/L)		0.0135 ^{DLA}			
	Antimony (Sb)-Total (mg/L)		<0.00020			
	Arsenic (As)-Total (mg/L)		0.00022			
	Barium (Ba)-Total (mg/L)		0.0659 ^{DLA}			
	Beryllium (Be)-Total (mg/L)		<0.00020 ^{DLA}			
	Bismuth (Bi)-Total (mg/L)		<0.00010 ^{DLA}			
	Boron (B)-Total (mg/L)		<0.020 ^{DLA}			
	Cadmium (Cd)-Total (mg/L)		0.000021			
	Calcium (Ca)-Total (mg/L)	313	380 ^{DLA}	107	128	162
	Cesium (Cs)-Total (mg/L)		<0.000020			
	Chromium (Cr)-Total (mg/L)		0.00030 ^{DLA}			
	Cobalt (Co)-Total (mg/L)		<0.00020 ^{DLA}			
	Copper (Cu)-Total (mg/L)		<0.0010 ^{DLA}			
	Iron (Fe)-Total (mg/L)		<0.020 ^{DLA}			
	Lead (Pb)-Total (mg/L)		0.00026			
	Lithium (Li)-Total (mg/L)		0.0103			
	Magnesium (Mg)-Total (mg/L)	111	133	49.9	61.0	71.1
	Manganese (Mn)-Total (mg/L)		0.00116			
	Molybdenum (Mo)-Total (mg/L)		0.00129			
	Nickel (Ni)-Total (mg/L)		0.0036 ^{DLA}			
	Phosphorus (P)-Total (mg/L)		<0.10			
	Potassium (K)-Total (mg/L)	<2.0	0.92	<2.0	<2.0	<2.0
	Rubidium (Rb)-Total (mg/L)		0.00047			
	Selenium (Se)-Total (mg/L)		0.0129			
	Silicon (Si)-Total (mg/L)		2.11 ^{DLA}			
	Silver (Ag)-Total (mg/L)		<0.000020			
	Sodium (Na)-Total (mg/L)	3.1	2.98	3.0	2.9	2.9
	Strontium (Sr)-Total (mg/L)		0.414			
	Sulfur (S)-Total (mg/L)		464			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855267-11 Water 08-NOV-16 14:00 CD_GH_FR1_592S O4_TERM	L1855267-12 Water 08-NOV-16 14:00 CD_GH_FR1_769S O4_TERM	L1855267-13 Water 08-NOV-16 14:00 CD_GH_FR1_1000 SO4_TERM	L1855267-14 Water 08-NOV-16 14:00 CD_GH_FR1_1300 SO4_TERM	L1855267-15 Water 08-NOV-16 14:00 CD_GH_ER2_UNO O4_TERM
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1090	1380	1830	2090	218
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	165	190	193	183	151
	Ammonia, Total (as N) (mg/L)	0.0787	0.0723	0.0518	0.0464	0.0558
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}	<5.0 ^{DLDS}	<5.0 ^{DLDS}	<10 ^{DLDS}	1.08
	Nitrate (as N) (mg/L)	9.73	9.74	9.61	8.58 ^{HTD}	0.174
	Nitrite (as N) (mg/L)	0.0087	<0.010 ^{DLDS}	<0.010 ^{DLDS}	<0.020 ^{HTD}	0.0058
	Phosphorus (P)-Total (mg/L)	0.047	0.0758	0.0598	0.0393	0.0375
	Sulfate (SO4) (mg/L)	596	778	1040	1240	28.4
Total Metals	Aluminum (Al)-Total (mg/L)	0.0135				
	Antimony (Sb)-Total (mg/L)	0.00016				
	Arsenic (As)-Total (mg/L)	0.00022				
	Barium (Ba)-Total (mg/L)	0.0924				
	Beryllium (Be)-Total (mg/L)	<0.00010				
	Bismuth (Bi)-Total (mg/L)	<0.000050				
	Boron (B)-Total (mg/L)	0.016				
	Cadmium (Cd)-Total (mg/L)	<0.0000050				
	Calcium (Ca)-Total (mg/L)	189	243	307		51.5
	Cesium (Cs)-Total (mg/L)	<0.000010				
	Chromium (Cr)-Total (mg/L)	0.00018				
	Cobalt (Co)-Total (mg/L)	0.00010				
	Copper (Cu)-Total (mg/L)	0.00050				
	Iron (Fe)-Total (mg/L)	0.016				
	Lead (Pb)-Total (mg/L)	<0.000050				
	Lithium (Li)-Total (mg/L)	0.0189				
	Magnesium (Mg)-Total (mg/L)	82.8	102	124		11.6
	Manganese (Mn)-Total (mg/L)	0.00060				
	Molybdenum (Mo)-Total (mg/L)	0.00122				
	Nickel (Ni)-Total (mg/L)	0.00346				
	Phosphorus (P)-Total (mg/L)	0.072				
	Potassium (K)-Total (mg/L)	1.56	<2.0	<2.0	1.35	<2.0
	Rubidium (Rb)-Total (mg/L)	0.00072				
	Selenium (Se)-Total (mg/L)	0.0487				
	Silicon (Si)-Total (mg/L)	2.39				
	Silver (Ag)-Total (mg/L)	<0.000010				
	Sodium (Na)-Total (mg/L)	2.77	2.8	2.8	2.82	<2.0
	Strontium (Sr)-Total (mg/L)	0.207				
	Sulfur (S)-Total (mg/L)	219				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855267-1 Water 08-NOV-16 14:00 CD_EV_ER4_UN O4_TERM	L1855267-2 Water 08-NOV-16 14:00 CD_EV_ER4_350S O4_TERM	L1855267-3 Water 08-NOV-16 14:00 CD_EV_ER4_455S O4_TERM	L1855267-4 Water 08-NOV-16 14:00 CD_EV_ER4_592S O4_TERM	L1855267-5 Water 08-NOV-16 14:00 CD_EV_ER4_769S O4_TERM
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)				<0.00020	
	Thallium (Tl)-Total (mg/L)				<0.000010	
	Thorium (Th)-Total (mg/L)				<0.00010	
	Tin (Sn)-Total (mg/L)				0.00091	
	Titanium (Ti)-Total (mg/L)				<0.00030	
	Tungsten (W)-Total (mg/L)				<0.00010	
	Uranium (U)-Total (mg/L)				0.00126	
	Vanadium (V)-Total (mg/L)				<0.00050	
	Zinc (Zn)-Total (mg/L)				<0.0030	
	Zirconium (Zr)-Total (mg/L)				0.00039	
Dissolved Metals	Dissolved Metals Filtration Location				LAB	
	Aluminum (Al)-Dissolved (mg/L)				0.0135	
	Antimony (Sb)-Dissolved (mg/L)				<0.00010	
	Arsenic (As)-Dissolved (mg/L)				0.00017	
	Barium (Ba)-Dissolved (mg/L)				0.0669	
	Beryllium (Be)-Dissolved (mg/L)				<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)				<0.000050	
	Boron (B)-Dissolved (mg/L)				0.018	
	Cadmium (Cd)-Dissolved (mg/L)				<0.0000050	
	Calcium (Ca)-Dissolved (mg/L)				187	
	Cesium (Cs)-Dissolved (mg/L)				<0.000010	
	Chromium (Cr)-Dissolved (mg/L)				0.00022	
	Cobalt (Co)-Dissolved (mg/L)				<0.00010	
	Copper (Cu)-Dissolved (mg/L)				0.00035	
	Iron (Fe)-Dissolved (mg/L)				<0.010	
	Lead (Pb)-Dissolved (mg/L)				<0.000050	
	Lithium (Li)-Dissolved (mg/L)				0.0083	
	Magnesium (Mg)-Dissolved (mg/L)				69.8	
	Manganese (Mn)-Dissolved (mg/L)				0.00087	
	Molybdenum (Mo)-Dissolved (mg/L)				0.00121	
	Nickel (Ni)-Dissolved (mg/L)				0.00123	
	Phosphorus (P)-Dissolved (mg/L)				<0.050	
	Potassium (K)-Dissolved (mg/L)				0.909	
	Rubidium (Rb)-Dissolved (mg/L)				0.00048	
	Selenium (Se)-Dissolved (mg/L)				0.0113	
	Silicon (Si)-Dissolved (mg/L)				2.07	
	Silver (Ag)-Dissolved (mg/L)				<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855267-6 Water 08-NOV-16 14:00 CD_EV_ER4_1000 SO4_TERM	L1855267-7 Water 08-NOV-16 14:00 CD_EV_ER4_1300 SO4_TERM	L1855267-8 Water 08-NOV-16 14:00 CD_GH_FR1_UN5 O4_TERM	L1855267-9 Water 08-NOV-16 14:00 CD_GH_FR1_350S O4_TERM	L1855267-10 Water 08-NOV-16 14:00 CD_GH_FR1_455S O4_TERM
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)		DLA <0.00040			
	Thallium (Tl)-Total (mg/L)		DLA <0.000020			
	Thorium (Th)-Total (mg/L)		DLA <0.00020			
	Tin (Sn)-Total (mg/L)		0.00058			
	Titanium (Ti)-Total (mg/L)		DLA <0.00060			
	Tungsten (W)-Total (mg/L)		DLA <0.00020			
	Uranium (U)-Total (mg/L)		0.00132			
	Vanadium (V)-Total (mg/L)		DLA <0.0010			
	Zinc (Zn)-Total (mg/L)		0.0077			
	Zirconium (Zr)-Total (mg/L)		DLA <0.00060			
Dissolved Metals	Dissolved Metals Filtration Location		LAB			
	Aluminum (Al)-Dissolved (mg/L)		0.0106			
	Antimony (Sb)-Dissolved (mg/L)		DLA <0.00020			
	Arsenic (As)-Dissolved (mg/L)		DLA <0.00020			
	Barium (Ba)-Dissolved (mg/L)		0.0699			
	Beryllium (Be)-Dissolved (mg/L)		DLA <0.00020			
	Bismuth (Bi)-Dissolved (mg/L)		DLA <0.00010			
	Boron (B)-Dissolved (mg/L)		DLA <0.020			
	Cadmium (Cd)-Dissolved (mg/L)		0.000019			
	Calcium (Ca)-Dissolved (mg/L)		374			
	Cesium (Cs)-Dissolved (mg/L)		DLA <0.000020			
	Chromium (Cr)-Dissolved (mg/L)		0.00023			
	Cobalt (Co)-Dissolved (mg/L)		DLA <0.00020			
	Copper (Cu)-Dissolved (mg/L)		0.00050			
	Iron (Fe)-Dissolved (mg/L)		DLA <0.020			
	Lead (Pb)-Dissolved (mg/L)		0.00014			
	Lithium (Li)-Dissolved (mg/L)		0.0087			
	Magnesium (Mg)-Dissolved (mg/L)		136			
	Manganese (Mn)-Dissolved (mg/L)		0.00103			
	Molybdenum (Mo)-Dissolved (mg/L)		0.00120			
	Nickel (Ni)-Dissolved (mg/L)		0.0025			
	Phosphorus (P)-Dissolved (mg/L)		DLA <0.10			
	Potassium (K)-Dissolved (mg/L)		0.98			
	Rubidium (Rb)-Dissolved (mg/L)		0.00051			
	Selenium (Se)-Dissolved (mg/L)		0.0141			
	Silicon (Si)-Dissolved (mg/L)		2.05			
	Silver (Ag)-Dissolved (mg/L)		DLA <0.000020			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855267-11 Water 08-NOV-16 14:00 CD_GH_FR1_592S O4_TERM	L1855267-12 Water 08-NOV-16 14:00 CD_GH_FR1_769S O4_TERM	L1855267-13 Water 08-NOV-16 14:00 CD_GH_FR1_1000 SO4_TERM	L1855267-14 Water 08-NOV-16 14:00 CD_GH_FR1_1300 SO4_TERM	L1855267-15 Water 08-NOV-16 14:00 CD_GH_ER2_UN O4_TERM
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020				
	Thallium (Tl)-Total (mg/L)	<0.000010				
	Thorium (Th)-Total (mg/L)	<0.00010				
	Tin (Sn)-Total (mg/L)	0.00036				
	Titanium (Ti)-Total (mg/L)	<0.00030				
	Tungsten (W)-Total (mg/L)	<0.00010				
	Uranium (U)-Total (mg/L)	0.00251				
	Vanadium (V)-Total (mg/L)	<0.00050				
	Zinc (Zn)-Total (mg/L)	0.0039				
	Zirconium (Zr)-Total (mg/L)	<0.00030				
Dissolved Metals	Dissolved Metals Filtration Location	LAB			LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.0085			0.0121	
	Antimony (Sb)-Dissolved (mg/L)	0.00016			<0.00020 ^{DLA}	
	Arsenic (As)-Dissolved (mg/L)	0.00014			<0.00020 ^{DLA}	
	Barium (Ba)-Dissolved (mg/L)	0.0959			0.0888	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			<0.00020 ^{DLA}	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			<0.00010 ^{DLA}	
	Boron (B)-Dissolved (mg/L)	0.014			<0.020 ^{DLA}	
	Cadmium (Cd)-Dissolved (mg/L)	<0.0000050			0.000017	
	Calcium (Ca)-Dissolved (mg/L)	181			346	
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			<0.000020 ^{DLA}	
	Chromium (Cr)-Dissolved (mg/L)	0.00013			<0.00020 ^{DLA}	
	Cobalt (Co)-Dissolved (mg/L)	0.00011			<0.00020 ^{DLA}	
	Copper (Cu)-Dissolved (mg/L)	0.00035			0.00044	
	Iron (Fe)-Dissolved (mg/L)	<0.010			<0.020 ^{DLA}	
	Lead (Pb)-Dissolved (mg/L)	<0.000050			0.00013	
	Lithium (Li)-Dissolved (mg/L)	0.0157			0.0136	
	Magnesium (Mg)-Dissolved (mg/L)	80.6			127	
	Manganese (Mn)-Dissolved (mg/L)	0.00032			0.00078	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00113			0.00103	
	Nickel (Ni)-Dissolved (mg/L)	0.00280			0.0035	
	Phosphorus (P)-Dissolved (mg/L)	<0.050			<0.10 ^{DLA}	
	Potassium (K)-Dissolved (mg/L)	1.56			1.40	
	Rubidium (Rb)-Dissolved (mg/L)	0.00077			0.00068	
	Selenium (Se)-Dissolved (mg/L)	0.0476			0.0439	
	Silicon (Si)-Dissolved (mg/L)	2.13			2.10	
	Silver (Ag)-Dissolved (mg/L)	<0.000010			<0.000020 ^{DLA}	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1855267-1	L1855267-2	L1855267-3	L1855267-4	L1855267-5
					Water	Water	Water	Water	Water
		08-NOV-16	14:00		08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16
					14:00	14:00	14:00	14:00	14:00
					CD_EV_ER4_UNSO4_TERM	CD_EV_ER4_350SO4_TERM	CD_EV_ER4_455SO4_TERM	CD_EV_ER4_592SO4_TERM	CD_EV_ER4_769SO4_TERM
Grouping	Analyte								
WATER									
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)							2.99	
	Strontium (Sr)-Dissolved (mg/L)							0.309	
	Sulfur (S)-Dissolved (mg/L)							207	
	Tellurium (Te)-Dissolved (mg/L)							<0.00020	
	Thallium (Tl)-Dissolved (mg/L)							<0.000010	
	Thorium (Th)-Dissolved (mg/L)							<0.00010	
	Tin (Sn)-Dissolved (mg/L)							0.00088	
	Titanium (Ti)-Dissolved (mg/L)							<0.00030	
	Tungsten (W)-Dissolved (mg/L)							<0.00010	
	Uranium (U)-Dissolved (mg/L)							0.00124	
	Vanadium (V)-Dissolved (mg/L)							<0.00050	
	Zinc (Zn)-Dissolved (mg/L)							0.0014	
	Zirconium (Zr)-Dissolved (mg/L)							<0.00030	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855267-6 Water 08-NOV-16 14:00 CD_EV_ER4_1000 SO4_TERM	L1855267-7 Water 08-NOV-16 14:00 CD_EV_ER4_1300 SO4_TERM	L1855267-8 Water 08-NOV-16 14:00 CD_GH_FR1_UN O4_TERM	L1855267-9 Water 08-NOV-16 14:00 CD_GH_FR1_350S O4_TERM	L1855267-10 Water 08-NOV-16 14:00 CD_GH_FR1_455S O4_TERM
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		3.04			
	Strontium (Sr)-Dissolved (mg/L)		0.401			
	Sulfur (S)-Dissolved (mg/L)		475			
	Tellurium (Te)-Dissolved (mg/L)		<0.00040 ^{DLA}			
	Thallium (Tl)-Dissolved (mg/L)		<0.000020 ^{DLA}			
	Thorium (Th)-Dissolved (mg/L)		<0.00020 ^{DLA}			
	Tin (Sn)-Dissolved (mg/L)		0.00062			
	Titanium (Ti)-Dissolved (mg/L)		<0.00060 ^{DLA}			
	Tungsten (W)-Dissolved (mg/L)		<0.00020 ^{DLA}			
	Uranium (U)-Dissolved (mg/L)		0.00131			
	Vanadium (V)-Dissolved (mg/L)		<0.0010 ^{DLA}			
	Zinc (Zn)-Dissolved (mg/L)		0.0041			
	Zirconium (Zr)-Dissolved (mg/L)		<0.00060 ^{DLA}			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855267-11	L1855267-12	L1855267-13	L1855267-14	L1855267-15
		Description	Water	Water	Water	Water	Water
		Sampled Date	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16
		Sampled Time	14:00	14:00	14:00	14:00	14:00
		Client ID	CD_GH_FR1_592S O4_TERM	CD_GH_FR1_769S O4_TERM	CD_GH_FR1_1000 SO4_TERM	CD_GH_FR1_1300 SO4_TERM	CD_GH_ER2_UN O4_TERM
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		2.71			2.86	
	Strontium (Sr)-Dissolved (mg/L)		0.199			0.296	
	Sulfur (S)-Dissolved (mg/L)		201			428	
	Tellurium (Te)-Dissolved (mg/L)		<0.00020			<0.00040 ^{DLA}	
	Thallium (Tl)-Dissolved (mg/L)		<0.000010			<0.000020 ^{DLA}	
	Thorium (Th)-Dissolved (mg/L)		<0.00010			<0.00020 ^{DLA}	
	Tin (Sn)-Dissolved (mg/L)		0.00031			0.00051	
	Titanium (Ti)-Dissolved (mg/L)		<0.00030			<0.00060 ^{DLA}	
	Tungsten (W)-Dissolved (mg/L)		<0.00010			<0.00020 ^{DLA}	
	Uranium (U)-Dissolved (mg/L)		0.00243			0.00216	
	Vanadium (V)-Dissolved (mg/L)		<0.00050			<0.0010 ^{DLA}	
	Zinc (Zn)-Dissolved (mg/L)		<0.0010			0.0042	
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030			<0.00060 ^{DLA}	

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
LPML	Lab-Preserved for Total Metals. Sample received with pH > 2 and preserved at the lab. Total Metals results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Total	MS-B	L1855267-11, -14, -4, -7
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855267-11, -14, -4, -7
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1855267-11, -14, -4, -7
Matrix Spike	Potassium (K)-Total	MS-B	L1855267-11, -14, -4, -7
Matrix Spike	Strontium (Sr)-Total	MS-B	L1855267-11, -14, -4, -7
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855267-1, -10, -12, -13, -15, -2, -3, -5, -6, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855267-1, -10, -11, -12, -13, -15, -2, -3, -4, -5, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855267-1, -10, -11, -12, -13, -15, -2, -3, -4, -5, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855267-1, -10, -11, -12, -13, -15, -2, -3, -4, -5, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855267-1, -10, -11, -12, -13, -15, -2, -3, -4, -5, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855267-1, -10, -11, -12, -13, -15, -2, -3, -4, -5, -8, -9
Matrix Spike	Phosphorus (P)-Total	MS-B	L1855267-1, -2, -3, -4, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLA	Detection Limit adjusted for required dilution
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this 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).			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

Reference Information

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

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.



Chain of Custody (COC) / Analytical Request Form



L1855267-COFC

COC Number: 14 -

Page 1 of 2

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Canada Toll Free: 1 800 668 9878

Report To	Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company: Nautilus Environmental	Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)
Contact: Bonnie Lo	Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address: 8664 Commerce Court Burnaby, BC	<input type="checkbox"/> Criteria on Report - provide details below if box checked	E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone: 604-420-8773	Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge
	Email 1 or Fax: bonnie@nautilusenvironmental.ca	Specify Date Required for E2, E or P:
	Email 2:	

Invoice To	Invoice Distribution	Analysis Request
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Email 1 or Fax: bonnie@nautilusenvironmental.ca	
Company: Nautilus Environmental	Email 2: lise@nautilusenvironmental.ca	
Contact: Bonnie Lo		

Project Information	Oil and Gas Required Fields (client use)	
ALS Quote #:	Approver ID:	
Job #:	Cost Center:	
PO / AFE:	GL Account:	
LSD:	Routing Code:	
	Activity Code:	
	Location:	

ALS Lab Work Order # (lab use only)	Contact:	Heather McKenzie	Sampler:	Date	Time	Sample Type	Total metals, low level (up to 1000)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers
				8-Nov-16	1400	Water			✓	✓	✓	✓	✓	✓	✓	✓	✓	1
				8-Nov-16		Water											✓	1
				8-Nov-16		Water											✓	1
				8-Nov-16		Water	✓	✓									✓	1
				8-Nov-16		Water											✓	1
				8-Nov-16		Water	✓	✓									✓	1
				8-Nov-16		Water											✓	1
				8-Nov-16		Water											✓	1
				8-Nov-16		Water	✓	✓									✓	1
				8-Nov-16		Water											✓	1
				8-Nov-16		Water	✓	✓									✓	1
				8-Nov-16		Water											✓	1

Short Holding Time
Rush Processing

Drinking Water (DW) Samples¹ (client use)	Special Instructions / Specify Criteria to add on report (client Use)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No	For metals (total & dissolved)-low level analysis please	Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>
		Cooling Initiated <input type="checkbox"/>
		INITIAL COOLER TEMPERATURES °C
		FINAL COOLER TEMPERATURES °C
		20.9/10/12.1

SHIPMENT RELEASE (client use)	INITIAL SHIPMENT RECEPTION (lab use only)	FINAL SHIPMENT RECEPTION (lab use only)
Released by: <i>[Signature]</i>	Received by: <i>[Signature]</i>	Received by: <i>[Signature]</i>
Date: Nov 8/16	Date:	Date: Nov 8
Time: 1430	Time:	Time: 6:30pm



Chain of Custody (COC) / Analytical Request Form



L1855267-COFC

COC Number: 14 -

Page 2 of 2 *EXC*

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:																																																									
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca			Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																									
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:			<table border="1"> <thead> <tr> <th>Total metals, low level (preserved)</th> <th>Dissolved metals-low level</th> <th>Chloride</th> <th>Sulphate</th> <th>Alkalinity</th> <th>Nitrate</th> <th>Nitrite</th> <th>Ammonia</th> <th>Phosphorus</th> <th>Total Dissolved Solids</th> <th>Calcium & Magnesium</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td><input checked="" type="checkbox"/></td> <td>1</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input type="checkbox"/></td> <td>1</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td>1</td> </tr> </tbody> </table>										Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers			<input checked="" type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1																								
Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers																																																			
		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1																																																			
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ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie	Sampler:																																																											
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																																								
	Cd_GH_FR1_1000SO4_term			8-Nov-16	1400	Water									1																																															
	Cd_GH_FR1_1300SO4_term			8-Nov-16		Water	<input checked="" type="checkbox"/>	1																																																						
	Cd_GH_ER2_unSO4_term			8-Nov-16		Water	<input checked="" type="checkbox"/>	1																																																						

Short Holding Time
Rush Processing

Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) For metals (total & dissolved)-low level analysis please			SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 20/10/12 °C									
SHIPMENT RELEASE (client use) Released by: <i>[Signature]</i> Date: Nov 8 1430		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____			FINAL SHIPMENT RECEPTION (lab use only) Received by: <i>[Signature]</i> Date: Nov 8 Time: 6:30pm									



Nautilus Environmental
ATTN: Jacklyn Poole
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 04-NOV-16
Report Date: 14-NOV-16 17:37 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1853942
Project P.O. #: 2016-0466
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

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ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1853942-1 EV_ER4_UNAMENDED W/COPPER_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	78.2		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	67.1 21.4 0.68 2.4		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		14-NOV-16 14-NOV-16 14-NOV-16 14-NOV-16	R3594557 R3594557 R3594557 R3594557
L1853942-2 EV_ER4_400_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	516		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	157 88.6 0.68 2.4		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		14-NOV-16 14-NOV-16 14-NOV-16 14-NOV-16	R3594557 R3594557 R3594557 R3594557
L1853942-3 EV_ER4_480_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	615		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	177 104 0.67 2.4		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		14-NOV-16 14-NOV-16 14-NOV-16 14-NOV-16	R3594557 R3594557 R3594557 R3594557
L1853942-4 EV_ER4_576_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	731		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	201 125 0.67 2.4		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		14-NOV-16 14-NOV-16 14-NOV-16 14-NOV-16	R3594557 R3594557 R3594557 R3594557
L1853942-5 EV_ER4_691_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	932	DLHC	1.5	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	242 144 <2.5 <5.0	DLDS DLDS DLDS DLDS	0.50 0.50 2.5 5.0	mg/L mg/L mg/L mg/L		14-NOV-16 14-NOV-16 14-NOV-16 14-NOV-16	R3594557 R3594557 R3594557 R3594557
L1853942-6 EV_ER4_829_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1853942-6 EV_ER4_829_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1100	DLHC	1.5	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	281	DLDS	0.50	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	176	DLDS	0.50	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		14-NOV-16	R3594557
L1853942-7 EV_ER4_995_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:00 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1290	DLHC	1.5	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	323	DLDS	0.50	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	209	DLDS	0.50	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		14-NOV-16	R3594557
L1853942-8 GH_FR1_UNAMENDED W/COPPER_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	220		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	102		0.10	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	50.6		0.10	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	1.31		0.50	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	2.1		1.0	mg/L		14-NOV-16	R3594557
L1853942-9 GH_FR1_400_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	472		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	149		0.10	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	85.5		0.10	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	1.28		0.50	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	2.1		1.0	mg/L		14-NOV-16	R3594557
L1853942-10 GH_FR1_480_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	554		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	171		0.10	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	102		0.10	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	1.30		0.50	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	2.1		1.0	mg/L		14-NOV-16	R3594557
L1853942-11 GH_FR1_576_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1853942-11 GH_FR1_576_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	680		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	201		0.10	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	125		0.10	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	1.35		0.50	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	2.2		1.0	mg/L		14-NOV-16	R3594557
L1853942-12 GH_FR1_691_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	844	DLHC	1.5	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	234	DLDS	0.50	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	141	DLDS	0.50	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		14-NOV-16	R3594557
L1853942-13 GH_FR1_829_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1020	DLHC	1.5	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	273	DLDS	0.50	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	172	DLDS	0.50	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		14-NOV-16	R3594557
L1853942-14 GH_FR1_995_R1 Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1200	DLHC	1.5	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	314	DLDS	0.50	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	199	DLDS	0.50	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		14-NOV-16	R3594557
L1853942-15 CONTROL WATER TAP W/COPPER Sampled By: CLIENT on 03-NOV-16 @ 15:05 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	73.1		0.30	mg/L		06-NOV-16	R3593675
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	50.9		0.10	mg/L		14-NOV-16	R3594557
Magnesium (Mg)-Total	18.6		0.10	mg/L		14-NOV-16	R3594557
Potassium (K)-Total	0.97		0.50	mg/L		14-NOV-16	R3594557
Sodium (Na)-Total	7.4		1.0	mg/L		14-NOV-16	R3594557

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:
GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

*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
mg/L - unit of concentration based on volume, parts per million.*

< - Less than.

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1853942

Report Date: 14-NOV-16

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: Jacklyn Poole

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3594557							
WG2429954-3	DUP	L1853942-1						
Calcium (Ca)-Total		67.1	67.0		mg/L	0.2	20	14-NOV-16
Magnesium (Mg)-Total		21.4	21.3		mg/L	0.2	20	14-NOV-16
Potassium (K)-Total		0.68	0.65		mg/L	4.3	20	14-NOV-16
Sodium (Na)-Total		2.4	2.4		mg/L	0.0	20	14-NOV-16
WG2429954-2	LCS	TMRM						
Calcium (Ca)-Total			103.8		%		80-120	14-NOV-16
Magnesium (Mg)-Total			100.5		%		80-120	14-NOV-16
Potassium (K)-Total			100.4		%		80-120	14-NOV-16
Sodium (Na)-Total			100.6		%		80-120	14-NOV-16
WG2429954-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	14-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	14-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	14-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	14-NOV-16
SO4-IC-N-CL								
	Water							
Batch	R3593675							
WG2431596-28	DUP	L1853942-15						
Sulfate (SO4)		73.1	72.8		mg/L	0.5	20	06-NOV-16
WG2431596-22	LCS							
Sulfate (SO4)			101.5		%		90-110	06-NOV-16
WG2431596-26	LCS							
Sulfate (SO4)			102.6		%		90-110	06-NOV-16
WG2431596-21	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	06-NOV-16
WG2431596-25	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	06-NOV-16
WG2431596-27	MS	L1853942-15						
Sulfate (SO4)			101.5		%		75-125	06-NOV-16

Quality Control Report

Workorder: L1853942

Report Date: 14-NOV-16

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Report To		Client / Distribution		Service Requested (Rush for routine analysis subject to availability)	
Company: Nautilus Environmental (acct# 10253)	<input checked="" type="checkbox"/> STANDARDQC_ALS			<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)	
Contact: Jacklyn Poole (403-826-0992)	Email 1: jacklyn@nautilusenvironmental.ca			<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT	
Address: #4, 6125 - 12 Street SE	Email 2: claudio@nautilusenvironmental.ca			<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT	
Calgary, AB T2H 2K1	Email 3:			<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT	
Phone: 403-253-7121 Fax:	Email 4:			Analysis Request	

Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)						Number of Containers	
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Job #: SP1617-015									
Company:		PO / AFE: 2016-0466									
Contact: abaccounts@nautilusenvironmental.com		LSD:									
Address:		Quote #: Q59174									
Phone: Fax:		ALS Contact: Nelson Kwan		Sampler:							

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL									Number of Containers	
1	EV_ER4_Unamended w/Copper_R1	03-Nov-16	15:00	Water			X				X										2
2	EV_ER4_400_R1	03-Nov-16	15:00	Water			X				X										2
3	EV_ER4_480_R1	03-Nov-16	15:00	Water			X				X										2
4	EV_ER4_576_R1	03-Nov-16	15:00	Water			X				X										2
5	EV_ER4_691_R1	03-Nov-16	15:00	Water			X				X										2
6	EV_ER4_829_R1	03-Nov-16	15:00	Water			X				X										2
7	EV_ER4_995_R1	03-Nov-16	15:00	Water			X				X										2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details :

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)			SHIPMENT VERIFICATION (lab use only)			Observations: Yes/No? If Yes add SIF
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	
			<i>[Signature]</i>	04/4	10:20	10 °C			



L1853942-COFC

Chain of Custody / Analytical Request Form
 Canada Toll Free: 1 800 668 9878
 www.alsglobal.com

COC # 02082
 Page 2 of 2

Report To					Format / Distribution					Service Requested (Rush for routine analysis subject to availability)											
Company: Nautilus Environmental (acct# 10253)					<input checked="" type="checkbox"/> STANDARDQC_ALS					<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)											
Contact: Jacklyn Poole (403-826-0992)					Email 1: jacklyn@nautilusenvironmental.ca					<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT											
Address: #4, 6125 - 12 Street SE Calgary, AB T2H 2K1					Email 2: claudio@nautilusenvironmental.ca					<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT											
Phone: 403-253-7121 Fax:					Email 3:					<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT											
Email 4:																					
Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No					Client / Project Information					Please indicate below Filtered, Preserved or both (F, P, F/P)											
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					Job #: SP1617-015																
Company:					PO / AFE: 2016-0466																
Contact: abaccounts@nautilusenvironmental.com					LSD:																
Address:					Quote #: Q59174																
Phone: Fax:																					
Lab Work Order # (lab use only)					ALS Contact: Nelson Kwan					Sampler:											
Sample #	Sample Identification (This description will appear on the report)				Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL							Number of Containers
8	GH_FR1_Unamended w/Copper_R1				03-Nov-16	15:05	Water			X				X							2
9	GH_FR1_400_R1				03-Nov-16	15:05	Water			X				X							2
10	GH_FR1_480_R1				03-Nov-16	15:05	Water			X				X							2
11	GH_FR1_576_R1				03-Nov-16	15:05	Water			X				X							2
12	GH_FR1_691_R1				03-Nov-16	15:05	Water			X				X							2
13	GH_FR1_829_R1				03-Nov-16	15:05	Water			X				X							2
14	GH_FR1_995_R1				03-Nov-16	15:05	Water			X				X							2
15	Control Water Tap w/Copper				03-Nov-16	15:05	Water			X				X							2
Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details																					
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.																					
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.																					
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.																					
SHIPMENT, RELEASE (client use) SHIPMENT, RECEPTION (lab use only) SHIPMENT, VERIFICATION (lab use only)																					
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations:											
			<i>AK</i>	04/11	10:20	10 °C				Yes (No?) If Yes add SIF											



Nautilus Environmental
ATTN: Jacklyn Poole
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 12-NOV-16
Report Date: 21-NOV-16 15:46 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1856957
Project P.O. #: 2016-0466
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-1 GH_FR1_400_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:40 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	95.5		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.120		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	1.61		0.50	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	467		0.30	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	793	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0106		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	119		0.10	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	85.6		0.10	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	1.36		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.4		1.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	9.49		0.020	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	9.50		0.050	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.015		0.010	mg/L		12-NOV-16	R3597027
L1856957-2 GH_FR1_480_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:40 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	95.4		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.108		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	1.55		0.50	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	577		0.30	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	998	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0127		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	141		0.10	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	102		0.10	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	1.37		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.4		1.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	9.58		0.020	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	9.60		0.050	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.019		0.010	mg/L		12-NOV-16	R3597027
L1856957-3 GH_FR1_576_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:30 Matrix: WATER							
Dissolved Metals							
Dissolved Metals by ICPOES							
Dissolved Metals Filtration Location	LAB					20-NOV-16	R3599011
Calcium (Ca)-Dissolved	164		0.10	mg/L		20-NOV-16	R3598978
Iron (Fe)-Dissolved	<0.030		0.030	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Dissolved	122		0.10	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Dissolved	<0.0050		0.0050	mg/L		20-NOV-16	R3598978

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-3 GH_FR1_576_TERM							
Sampled By: CLIENT on 10-NOV-16 @ 11:30							
Matrix: WATER							
Dissolved Metals by ICPOES							
Potassium (K)-Dissolved	1.37		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Dissolved	2.5		1.0	mg/L		20-NOV-16	R3598978
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	LAB					19-NOV-16	R3598633
Aluminum (Al)-Dissolved	<0.0050	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Antimony (Sb)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Arsenic (As)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Barium (Ba)-Dissolved	0.0693	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Beryllium (Be)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Bismuth (Bi)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Boron (B)-Dissolved	<0.050	DLDS	0.050	mg/L		19-NOV-16	R3598644
Cadmium (Cd)-Dissolved	<0.000025	DLDS	0.000025	mg/L		19-NOV-16	R3598644
Chromium (Cr)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Cobalt (Co)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Copper (Cu)-Dissolved	<0.0010	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Lead (Pb)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Molybdenum (Mo)-Dissolved	0.00119	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Nickel (Ni)-Dissolved	<0.0025	DLDS	0.0025	mg/L		19-NOV-16	R3598644
Selenium (Se)-Dissolved	0.0431	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Silver (Ag)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Strontium (Sr)-Dissolved	0.159	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Thallium (Tl)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Tin (Sn)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Titanium (Ti)-Dissolved	<0.0015	DLDS	0.0015	mg/L		19-NOV-16	R3598644
Uranium (U)-Dissolved	0.00220	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Vanadium (V)-Dissolved	<0.0025	DLDS	0.0025	mg/L		19-NOV-16	R3598644
Zinc (Zn)-Dissolved	<0.0050	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Total Metals							
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	<0.015	DLDS	0.015	mg/L		20-NOV-16	R3598983
Antimony (Sb)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Arsenic (As)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Barium (Ba)-Total	0.0712	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Beryllium (Be)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Bismuth (Bi)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Boron (B)-Total	<0.050	DLDS	0.050	mg/L		20-NOV-16	R3598983
Cadmium (Cd)-Total	<0.000025	DLDS	0.000025	mg/L		20-NOV-16	R3598983
Chromium (Cr)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Cobalt (Co)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Copper (Cu)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Lead (Pb)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Molybdenum (Mo)-Total	0.00124	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Nickel (Ni)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Selenium (Se)-Total	0.0461	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Silver (Ag)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Strontium (Sr)-Total	0.175	DLDS	0.0010	mg/L		20-NOV-16	R3598983
Thallium (Tl)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Tin (Sn)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Titanium (Ti)-Total	<0.0015	DLDS	0.0015	mg/L		20-NOV-16	R3598983
Uranium (U)-Total	0.00234	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Vanadium (V)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-3 GH_FR1_576_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:30 Matrix: WATER							
Total Metals in Water by CRC ICPMS							
Zinc (Zn)-Total	<0.015	DLDS	0.015	mg/L		20-NOV-16	R3598983
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	169		0.10	mg/L		20-NOV-16	R3598978
Iron (Fe)-Total	<0.030		0.030	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	125		0.10	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Total	<0.0050		0.0050	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	1.40		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.5		1.0	mg/L		20-NOV-16	R3598978
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	90.3		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.099		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	1.56		0.50	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	710		0.30	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1180	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0118		0.0050	mg/L		14-NOV-16	R3594391
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	9.55		0.020	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	9.57		0.050	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.019		0.010	mg/L		12-NOV-16	R3597027
L1856957-4 GH_FR1_691_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:45 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	89.4		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.136		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	<2.5	DLHC	2.5	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	959	DLHC	1.5	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1460	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0142		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	210	DLDS	0.50	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	150	DLDS	0.50	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	10.2	DLHC	0.10	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	10.2		0.11	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		12-NOV-16	R3597027
L1856957-5 GH_FR1_829_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:45 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	93.4		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.153		0.050	mg/L		21-NOV-16	R3599750

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-5 GH_FR1_829_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:45 Matrix: WATER							
Chloride (Cl)	<2.5	DLHC	2.5	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	1100	DLHC	1.5	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1720	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0242		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	244	DLDS	0.50	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	173	DLDS	0.50	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	9.49	DLHC	0.10	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	9.56		0.11	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.071	DLHC	0.050	mg/L		12-NOV-16	R3597027
L1856957-6 GH_FR1_995_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:50 Matrix: WATER							
Dissolved Metals							
Dissolved Metals by ICPOES							
Dissolved Metals Filtration Location	LAB					20-NOV-16	R3599011
Calcium (Ca)-Dissolved	271		0.10	mg/L		20-NOV-16	R3598978
Iron (Fe)-Dissolved	<0.030		0.030	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Dissolved	205		0.10	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Dissolved	<0.0050		0.0050	mg/L		20-NOV-16	R3598978
Potassium (K)-Dissolved	1.75		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Dissolved	2.8		1.0	mg/L		20-NOV-16	R3598978
Dissolved Metals in Water by CRC IC PMS							
Dissolved Metals Filtration Location	LAB					19-NOV-16	R3598633
Aluminum (Al)-Dissolved	0.0127	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Antimony (Sb)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Arsenic (As)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Barium (Ba)-Dissolved	0.0475	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Beryllium (Be)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Bismuth (Bi)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Boron (B)-Dissolved	<0.050	DLDS	0.050	mg/L		19-NOV-16	R3598644
Cadmium (Cd)-Dissolved	<0.000025	DLDS	0.000025	mg/L		19-NOV-16	R3598644
Chromium (Cr)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Cobalt (Co)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Copper (Cu)-Dissolved	0.0012	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Lead (Pb)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Molybdenum (Mo)-Dissolved	0.00149	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Nickel (Ni)-Dissolved	0.0027	DLDS	0.0025	mg/L		19-NOV-16	R3598644
Selenium (Se)-Dissolved	0.0420	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Silver (Ag)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Strontium (Sr)-Dissolved	0.189	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Thallium (Tl)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Tin (Sn)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Titanium (Ti)-Dissolved	<0.0015	DLDS	0.0015	mg/L		19-NOV-16	R3598644
Uranium (U)-Dissolved	0.00221	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Vanadium (V)-Dissolved	<0.0025	DLDS	0.0025	mg/L		19-NOV-16	R3598644

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-6 GH_FR1_995_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:50 Matrix: WATER							
Dissolved Metals in Water by CRC ICPMS							
Zinc (Zn)-Dissolved	<0.0050	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Total Metals							
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	0.016	DLDS	0.015	mg/L		20-NOV-16	R3598983
Antimony (Sb)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Arsenic (As)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Barium (Ba)-Total	0.0530	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Beryllium (Be)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Bismuth (Bi)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Boron (B)-Total	<0.050	DLDS	0.050	mg/L		20-NOV-16	R3598983
Cadmium (Cd)-Total	0.000041	DLDS	0.000025	mg/L		20-NOV-16	R3598983
Chromium (Cr)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Cobalt (Co)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Copper (Cu)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Lead (Pb)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Molybdenum (Mo)-Total	0.00161	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Nickel (Ni)-Total	0.0032	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Selenium (Se)-Total	0.0459	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Silver (Ag)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Strontium (Sr)-Total	0.200	DLDS	0.0010	mg/L		20-NOV-16	R3598983
Thallium (Tl)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Tin (Sn)-Total	0.00053	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Titanium (Ti)-Total	<0.0015	DLDS	0.0015	mg/L		20-NOV-16	R3598983
Uranium (U)-Total	0.00235	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Vanadium (V)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Zinc (Zn)-Total	<0.015	DLDS	0.015	mg/L		20-NOV-16	R3598983
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	298	DLDS	0.50	mg/L		20-NOV-16	R3598978
Iron (Fe)-Total	<0.15	DLDS	0.15	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	210	DLDS	0.50	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Total	<0.025	DLDS	0.025	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		20-NOV-16	R3598978
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	96.1		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.114		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	<2.5	DLHC	2.5	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	1320	DLHC	1.5	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1990	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0255		0.0050	mg/L		14-NOV-16	R3594391
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	9.72	DLHC	0.10	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	9.83		0.11	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.106	DLHC	0.050	mg/L		12-NOV-16	R3597027
L1856957-7 GH_FR1_UNAMENDED W/COPPER_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:50 Matrix: WATER							
Miscellaneous Parameters							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-7 GH_FR1_UNAMENDED W/COPPER_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:50 Matrix: WATER							
Alkalinity, Total (as CaCO3)	94.7		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.085		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	1.53		0.50	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	224		0.30	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	453	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0062		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	68.4		0.10	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	49.1		0.10	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	1.33		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.3		1.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	9.63		0.020	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	9.64		0.050	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.015		0.010	mg/L		12-NOV-16	R3597027
L1856957-8 EV_ER4_400_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	85.0		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.085		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	2.13		0.50	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	541		0.30	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	893	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0131		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	134		0.10	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	89.4		0.10	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	0.74		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.7		1.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	2.99		0.020	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	3.01		0.050	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.016		0.010	mg/L		12-NOV-16	R3597027
L1856957-9 EV_ER4_480_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	87.5		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.130		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	2.12		0.50	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	661		0.30	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1030	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0157		0.0050	mg/L		14-NOV-16	R3594391

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-9 EV_ER4_480_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: WATER							
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	160		0.10	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	108		0.10	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	0.74		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.7		1.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	3.06		0.020	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	3.08		0.050	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.018		0.010	mg/L		12-NOV-16	R3597027
L1856957-10 EV_ER4_576_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:35 Matrix: WATER							
Dissolved Metals							
Dissolved Metals by ICPOES							
Dissolved Metals Filtration Location	LAB					20-NOV-16	R3599011
Calcium (Ca)-Dissolved	181		0.10	mg/L		20-NOV-16	R3598978
Iron (Fe)-Dissolved	<0.030		0.030	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Dissolved	127		0.10	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Dissolved	<0.0050		0.0050	mg/L		20-NOV-16	R3598978
Potassium (K)-Dissolved	0.72		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Dissolved	2.7		1.0	mg/L		20-NOV-16	R3598978
Dissolved Metals in Water by CRC ICPMS							
Dissolved Metals Filtration Location	LAB					19-NOV-16	R3598633
Aluminum (Al)-Dissolved	<0.0050	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Antimony (Sb)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Arsenic (As)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Barium (Ba)-Dissolved	0.0523	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Beryllium (Be)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Bismuth (Bi)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Boron (B)-Dissolved	<0.050	DLDS	0.050	mg/L		19-NOV-16	R3598644
Cadmium (Cd)-Dissolved	<0.000025	DLDS	0.000025	mg/L		19-NOV-16	R3598644
Chromium (Cr)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Cobalt (Co)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Copper (Cu)-Dissolved	<0.0010	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Lead (Pb)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Molybdenum (Mo)-Dissolved	0.00125	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Nickel (Ni)-Dissolved	<0.0025	DLDS	0.0025	mg/L		19-NOV-16	R3598644
Selenium (Se)-Dissolved	0.0108	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Silver (Ag)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Strontium (Sr)-Dissolved	0.267	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Thallium (Tl)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Tin (Sn)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Titanium (Ti)-Dissolved	<0.0015	DLDS	0.0015	mg/L		19-NOV-16	R3598644
Uranium (U)-Dissolved	0.00115	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Vanadium (V)-Dissolved	<0.0025	DLDS	0.0025	mg/L		19-NOV-16	R3598644
Zinc (Zn)-Dissolved	<0.0050	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Total Metals							
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	<0.015	DLDS	0.015	mg/L		20-NOV-16	R3598983

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-10 EV_ER4_576_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:35 Matrix: WATER							
Total Metals in Water by CRC ICPMS							
Antimony (Sb)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Arsenic (As)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Barium (Ba)-Total	0.0528	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Beryllium (Be)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Bismuth (Bi)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Boron (B)-Total	<0.050	DLDS	0.050	mg/L		20-NOV-16	R3598983
Cadmium (Cd)-Total	<0.000025	DLDS	0.000025	mg/L		20-NOV-16	R3598983
Chromium (Cr)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Cobalt (Co)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Copper (Cu)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Lead (Pb)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Molybdenum (Mo)-Total	0.00132	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Nickel (Ni)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Selenium (Se)-Total	0.0111	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Silver (Ag)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Strontium (Sr)-Total	0.283	DLDS	0.0010	mg/L		20-NOV-16	R3598983
Thallium (Tl)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Tin (Sn)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Titanium (Ti)-Total	<0.0015	DLDS	0.0015	mg/L		20-NOV-16	R3598983
Uranium (U)-Total	0.00120	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Vanadium (V)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Zinc (Zn)-Total	<0.015	DLDS	0.015	mg/L		20-NOV-16	R3598983
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	178		0.10	mg/L		20-NOV-16	R3598978
Iron (Fe)-Total	<0.030		0.030	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	123		0.10	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Total	<0.0050		0.0050	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	0.71		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.6		1.0	mg/L		20-NOV-16	R3598978
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	85.2		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.123		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	<2.5	DLHC	2.5	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	827	DLHC	1.5	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1230	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0165		0.0050	mg/L		14-NOV-16	R3594391
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	3.00	DLHC	0.10	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	3.00		0.11	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		12-NOV-16	R3597027
L1856957-11 EV_ER4_691_TERM Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	82.5		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.118		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	<2.5	DLHC	2.5	mg/L		12-NOV-16	R3597027

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-11 EV_ER4_691_TERM Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: WATER							
Sulfate (SO4)	1020	DLHC	1.5	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1540	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0171		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	226	DLDS	0.50	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	155	DLDS	0.50	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	3.03	DLHC	0.10	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	3.03		0.11	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		12-NOV-16	R3597027
L1856957-12 EV_ER4_829_TERM Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	97.4		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.090		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	<2.5	DLHC	2.5	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	1230	DLHC	1.5	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	1870	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0148		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	261	DLDS	0.50	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	177	DLDS	0.50	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	2.97	DLHC	0.10	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	2.97		0.11	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	<0.050	DLHC	0.050	mg/L		12-NOV-16	R3597027
L1856957-13 EV_ER4_995_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:35 Matrix: WATER							
Dissolved Metals							
Dissolved Metals by ICPOES							
Dissolved Metals Filtration Location	LAB					20-NOV-16	R3599011
Calcium (Ca)-Dissolved	300		0.10	mg/L		20-NOV-16	R3598978
Iron (Fe)-Dissolved	<0.030		0.030	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Dissolved	212		0.10	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Dissolved	<0.0050		0.0050	mg/L		20-NOV-16	R3598978
Potassium (K)-Dissolved	0.78		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Dissolved	2.7		1.0	mg/L		20-NOV-16	R3598978
Dissolved Metals in Water by CRC IC PMS							
Dissolved Metals Filtration Location	LAB					19-NOV-16	R3598633

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-13 EV_ER4_995_TERM							
Sampled By: CLIENT on 10-NOV-16 @ 11:35							
Matrix: WATER							
Dissolved Metals in Water by CRC ICPMS							
Aluminum (Al)-Dissolved	<0.0050	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Antimony (Sb)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Arsenic (As)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Barium (Ba)-Dissolved	0.0380	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Beryllium (Be)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Bismuth (Bi)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Boron (B)-Dissolved	<0.050	DLDS	0.050	mg/L		19-NOV-16	R3598644
Cadmium (Cd)-Dissolved	<0.000025	DLDS	0.000025	mg/L		19-NOV-16	R3598644
Chromium (Cr)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Cobalt (Co)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Copper (Cu)-Dissolved	<0.0010	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Lead (Pb)-Dissolved	<0.00025	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Molybdenum (Mo)-Dissolved	0.00125	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Nickel (Ni)-Dissolved	<0.0025	DLDS	0.0025	mg/L		19-NOV-16	R3598644
Selenium (Se)-Dissolved	0.0106	DLDS	0.00025	mg/L		19-NOV-16	R3598644
Silver (Ag)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Strontium (Sr)-Dissolved	0.298	DLDS	0.0010	mg/L		19-NOV-16	R3598644
Thallium (Tl)-Dissolved	<0.000050	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Tin (Sn)-Dissolved	<0.00050	DLDS	0.00050	mg/L		19-NOV-16	R3598644
Titanium (Ti)-Dissolved	<0.0015	DLDS	0.0015	mg/L		19-NOV-16	R3598644
Uranium (U)-Dissolved	0.00118	DLDS	0.000050	mg/L		19-NOV-16	R3598644
Vanadium (V)-Dissolved	<0.0025	DLDS	0.0025	mg/L		19-NOV-16	R3598644
Zinc (Zn)-Dissolved	<0.0050	DLDS	0.0050	mg/L		19-NOV-16	R3598644
Total Metals							
Total Metals in Water by CRC ICPMS							
Aluminum (Al)-Total	<0.015	DLDS	0.015	mg/L		20-NOV-16	R3598983
Antimony (Sb)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Arsenic (As)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Barium (Ba)-Total	0.0391	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Beryllium (Be)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Bismuth (Bi)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Boron (B)-Total	<0.050	DLDS	0.050	mg/L		20-NOV-16	R3598983
Cadmium (Cd)-Total	<0.000025	DLDS	0.000025	mg/L		20-NOV-16	R3598983
Chromium (Cr)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Cobalt (Co)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Copper (Cu)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Lead (Pb)-Total	<0.00025	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Molybdenum (Mo)-Total	0.00129	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Nickel (Ni)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Selenium (Se)-Total	0.0106	DLDS	0.00025	mg/L		20-NOV-16	R3598983
Silver (Ag)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Strontium (Sr)-Total	0.317	DLDS	0.0010	mg/L		20-NOV-16	R3598983
Thallium (Tl)-Total	<0.000050	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Tin (Sn)-Total	<0.00050	DLDS	0.00050	mg/L		20-NOV-16	R3598983
Titanium (Ti)-Total	<0.0015	DLDS	0.0015	mg/L		20-NOV-16	R3598983
Uranium (U)-Total	0.00122	DLDS	0.000050	mg/L		20-NOV-16	R3598983
Vanadium (V)-Total	<0.0025	DLDS	0.0025	mg/L		20-NOV-16	R3598983
Zinc (Zn)-Total	<0.015	DLDS	0.015	mg/L		20-NOV-16	R3598983
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	319	DLDS	0.50	mg/L		20-NOV-16	R3598978
Iron (Fe)-Total	<0.15	DLDS	0.15	mg/L		20-NOV-16	R3598978

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856957-13 EV_ER4_995_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:35 Matrix: WATER							
Total Metals in Water by ICPOES							
Magnesium (Mg)-Total	217	DLDS	0.50	mg/L		20-NOV-16	R3598978
Manganese (Mn)-Total	<0.025	DLDS	0.025	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		20-NOV-16	R3598978
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	96.4		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.104		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	3.6	DLHC	2.5	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	1480	DLHC	1.5	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	2190	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0166		0.0050	mg/L		14-NOV-16	R3594391
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	2.96	DLHC	0.10	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	3.02		0.11	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.067	DLHC	0.050	mg/L		12-NOV-16	R3597027
L1856957-14 EV_ER4_UNAMENDED W/COPPER_TERM Sampled By: CLIENT on 10-NOV-16 @ 11:50 Matrix: WATER							
Miscellaneous Parameters							
Alkalinity, Total (as CaCO3)	94.6		5.0	mg/L		16-NOV-16	R3596834
Ammonia, Total (as N)	0.109		0.050	mg/L		21-NOV-16	R3599750
Chloride (Cl)	2.05		0.50	mg/L		12-NOV-16	R3597027
Sulfate (SO4)	80.2		0.30	mg/L		12-NOV-16	R3597027
Total Dissolved Solids	213	DLHC	20	mg/L		16-NOV-16	R3597035
Phosphorus (P)-Total	0.0096		0.0050	mg/L		14-NOV-16	R3594391
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	42.9		0.10	mg/L		20-NOV-16	R3598978
Magnesium (Mg)-Total	21.4		0.10	mg/L		20-NOV-16	R3598978
Potassium (K)-Total	0.69		0.50	mg/L		20-NOV-16	R3598978
Sodium (Na)-Total	2.6		1.0	mg/L		20-NOV-16	R3598978
NO2, NO3 and Sum of NO2/NO3							
Nitrate in Water by IC							
Nitrate (as N)	2.95		0.020	mg/L		12-NOV-16	R3597027
Nitrate+Nitrite							
Nitrate and Nitrite (as N)	2.96		0.050	mg/L		17-NOV-16	
Nitrite in Water by IC							
Nitrite (as N)	0.013		0.010	mg/L		12-NOV-16	R3597027

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
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-TOT-CL	Water	Alkalinity, Total	APHA 2320 B-Auto-Pot. Titration
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint.			
CL-IC-N-CL	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-CL	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-DIS-ICP-CL	Water	Dissolved Metals by ICPOES	APHA 3030B/EPA 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 procedure involves filtration (APHA Method 3030B) and analysis by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B).			
MET-T-CCMS-CL	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
N2N3-CALC-CL	Water	Nitrate+Nitrite	CALCULATION
NH3-COL-CL	Water	Ammonia, Total (as N)	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out using procedures adapted from APHA Method 4500 NH3 "NITROGEN (AMMONIA)". Ammonia is determined using the phenate colourimetric method.			
NO2-IC-N-CL	Water	Nitrite in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-IC-N-CL	Water	Nitrate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-COL-CL	Water	Total P in Water by Colour	APHA 4500-P PHOSPHORUS
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TDS-CL	Water	Total Dissolved Solids	APHA 2540 C
A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).			

** 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
----------------------------	---------------------

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL		ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA	

Chain of Custody Numbers:
GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1856957

Report Date: 21-NOV-16

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Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: Jacklyn Poole

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-TOT-CL		Water						
Batch	R3596834							
WG2434528-11	LCS							
Alkalinity, Total (as CaCO3)			94.7		%		85-115	16-NOV-16
WG2434528-8	LCS							
Alkalinity, Total (as CaCO3)			95.2		%		85-115	16-NOV-16
WG2434528-10	MB							
Alkalinity, Total (as CaCO3)			<5.0		mg/L		5	16-NOV-16
WG2434528-7	MB							
Alkalinity, Total (as CaCO3)			<5.0		mg/L		5	16-NOV-16
CL-IC-N-CL		Water						
Batch	R3597027							
WG2434684-15	DUP	L1856957-14						
Chloride (Cl)		2.05	2.01		mg/L	2.2	20	12-NOV-16
WG2434684-14	LCS							
Chloride (Cl)			101.7		%		90-110	12-NOV-16
WG2434684-13	MB							
Chloride (Cl)			<0.50		mg/L		0.5	12-NOV-16
WG2434684-16	MS	L1856957-14						
Chloride (Cl)			103.5		%		75-125	12-NOV-16
MET-D-CCMS-CL		Water						
Batch	R3598644							
WG2436343-6	DUP	L1856957-3						
Aluminum (Al)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	19-NOV-16
Antimony (Sb)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-16
Arsenic (As)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-16
Barium (Ba)-Dissolved		0.0693	0.0688		mg/L	0.7	20	19-NOV-16
Beryllium (Be)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-16
Bismuth (Bi)-Dissolved		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	19-NOV-16
Boron (B)-Dissolved		<0.050	<0.050	RPD-NA	mg/L	N/A	20	19-NOV-16
Cadmium (Cd)-Dissolved		<0.000025	<0.000025	RPD-NA	mg/L	N/A	20	19-NOV-16
Chromium (Cr)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-16
Cobalt (Co)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-16
Copper (Cu)-Dissolved		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	19-NOV-16
Lead (Pb)-Dissolved		<0.00025	<0.00025	RPD-NA	mg/L	N/A	20	19-NOV-16
Molybdenum (Mo)-Dissolved		0.00119	0.00122		mg/L	2.9	20	19-NOV-16
Nickel (Ni)-Dissolved		<0.0025	<0.0025	RPD-NA	mg/L	N/A	20	19-NOV-16
Selenium (Se)-Dissolved		0.0431	0.0432		mg/L	0.4	20	19-NOV-16
Silver (Ag)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-16



Quality Control Report

Workorder: L1856957

Report Date: 21-NOV-16

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL								
	Water							
Batch	R3598644							
WG2436343-6	DUP	L1856957-3						
Strontium (Sr)-Dissolved		0.159	0.161		mg/L	1.2	20	19-NOV-16
Thallium (Tl)-Dissolved		<0.000050	<0.000050	RPD-NA	mg/L	N/A	20	19-NOV-16
Tin (Sn)-Dissolved		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	19-NOV-16
Titanium (Ti)-Dissolved		<0.0015	<0.0015	RPD-NA	mg/L	N/A	20	19-NOV-16
Uranium (U)-Dissolved		0.00220	0.00221		mg/L	0.4	20	19-NOV-16
Vanadium (V)-Dissolved		<0.0025	<0.0025	RPD-NA	mg/L	N/A	20	19-NOV-16
Zinc (Zn)-Dissolved		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	19-NOV-16
WG2436343-2	LCS	TMRM						
Aluminum (Al)-Dissolved			97.7		%		80-120	19-NOV-16
Antimony (Sb)-Dissolved			91.2		%		80-120	19-NOV-16
Arsenic (As)-Dissolved			97.8		%		80-120	19-NOV-16
Barium (Ba)-Dissolved			97.4		%		80-120	19-NOV-16
Beryllium (Be)-Dissolved			94.0		%		80-120	19-NOV-16
Bismuth (Bi)-Dissolved			95.0		%		80-120	19-NOV-16
Boron (B)-Dissolved			90.1		%		80-120	19-NOV-16
Cadmium (Cd)-Dissolved			95.3		%		80-120	19-NOV-16
Chromium (Cr)-Dissolved			97.6		%		80-120	19-NOV-16
Cobalt (Co)-Dissolved			96.0		%		80-120	19-NOV-16
Copper (Cu)-Dissolved			94.8		%		80-120	19-NOV-16
Lead (Pb)-Dissolved			96.3		%		80-120	19-NOV-16
Molybdenum (Mo)-Dissolved			99.8		%		80-120	19-NOV-16
Nickel (Ni)-Dissolved			96.2		%		80-120	19-NOV-16
Selenium (Se)-Dissolved			91.7		%		80-120	19-NOV-16
Silver (Ag)-Dissolved			97.9		%		80-120	19-NOV-16
Strontium (Sr)-Dissolved			96.1		%		80-120	19-NOV-16
Thallium (Tl)-Dissolved			96.5		%		80-120	19-NOV-16
Tin (Sn)-Dissolved			95.4		%		80-120	19-NOV-16
Titanium (Ti)-Dissolved			102.9		%		80-120	19-NOV-16
Uranium (U)-Dissolved			94.1		%		80-120	19-NOV-16
Vanadium (V)-Dissolved			99.3		%		80-120	19-NOV-16
Zinc (Zn)-Dissolved			91.9		%		80-120	19-NOV-16
WG2436343-5	LCS	TMRM						
Aluminum (Al)-Dissolved			96.7		%		80-120	19-NOV-16
Antimony (Sb)-Dissolved			90.2		%		80-120	19-NOV-16
Arsenic (As)-Dissolved			96.4		%		80-120	19-NOV-16



Quality Control Report

Workorder: L1856957

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL								
	Water							
Batch	R3598644							
WG2436343-5	LCS	TMRM						
Barium (Ba)-Dissolved			95.9		%		80-120	19-NOV-16
Beryllium (Be)-Dissolved			93.1		%		80-120	19-NOV-16
Bismuth (Bi)-Dissolved			94.9		%		80-120	19-NOV-16
Boron (B)-Dissolved			87.1		%		80-120	19-NOV-16
Cadmium (Cd)-Dissolved			94.0		%		80-120	19-NOV-16
Chromium (Cr)-Dissolved			94.1		%		80-120	19-NOV-16
Cobalt (Co)-Dissolved			95.1		%		80-120	19-NOV-16
Copper (Cu)-Dissolved			91.9		%		80-120	19-NOV-16
Lead (Pb)-Dissolved			95.4		%		80-120	19-NOV-16
Molybdenum (Mo)-Dissolved			98.5		%		80-120	19-NOV-16
Nickel (Ni)-Dissolved			90.7		%		80-120	19-NOV-16
Selenium (Se)-Dissolved			90.8		%		80-120	19-NOV-16
Silver (Ag)-Dissolved			97.7		%		80-120	19-NOV-16
Strontium (Sr)-Dissolved			95.2		%		80-120	19-NOV-16
Thallium (Tl)-Dissolved			95.5		%		80-120	19-NOV-16
Tin (Sn)-Dissolved			94.2		%		80-120	19-NOV-16
Titanium (Ti)-Dissolved			94.7		%		80-120	19-NOV-16
Uranium (U)-Dissolved			93.4		%		80-120	19-NOV-16
Vanadium (V)-Dissolved			97.7		%		80-120	19-NOV-16
Zinc (Zn)-Dissolved			85.9		%		80-120	19-NOV-16
WG2436343-1 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	19-NOV-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Boron (B)-Dissolved			<0.010		mg/L		0.01	19-NOV-16
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	19-NOV-16
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	19-NOV-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16



Quality Control Report

Workorder: L1856957

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-D-CCMS-CL		Water						
Batch	R3598644							
WG2436343-1 MB								
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	19-NOV-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-16
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	19-NOV-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	19-NOV-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	19-NOV-16
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	19-NOV-16
WG2436343-4 MB								
Aluminum (Al)-Dissolved			<0.0010		mg/L		0.001	19-NOV-16
Antimony (Sb)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Arsenic (As)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Barium (Ba)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Beryllium (Be)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Bismuth (Bi)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Boron (B)-Dissolved			<0.010		mg/L		0.01	19-NOV-16
Cadmium (Cd)-Dissolved			<0.0000050		mg/L		0.000005	19-NOV-16
Chromium (Cr)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Cobalt (Co)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Copper (Cu)-Dissolved			<0.00020		mg/L		0.0002	19-NOV-16
Lead (Pb)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Molybdenum (Mo)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Nickel (Ni)-Dissolved			<0.00050		mg/L		0.0005	19-NOV-16
Selenium (Se)-Dissolved			<0.000050		mg/L		0.00005	19-NOV-16
Silver (Ag)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-16
Strontium (Sr)-Dissolved			<0.00020		mg/L		0.0002	19-NOV-16
Thallium (Tl)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-16
Tin (Sn)-Dissolved			<0.00010		mg/L		0.0001	19-NOV-16
Titanium (Ti)-Dissolved			<0.00030		mg/L		0.0003	19-NOV-16
Uranium (U)-Dissolved			<0.000010		mg/L		0.00001	19-NOV-16
Vanadium (V)-Dissolved			<0.00050		mg/L		0.0005	19-NOV-16
Zinc (Zn)-Dissolved			<0.0010		mg/L		0.001	19-NOV-16



Quality Control Report

Workorder: L1856957

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-DIS-ICP-CL								
	Water							
Batch	R3598978							
WG2436580-2	LCS	TMRM						
Calcium (Ca)-Dissolved			99.6		%		80-120	20-NOV-16
Iron (Fe)-Dissolved			93.9		%		80-120	20-NOV-16
Magnesium (Mg)-Dissolved			97.0		%		80-120	20-NOV-16
Manganese (Mn)-Dissolved			95.0		%		80-120	20-NOV-16
Potassium (K)-Dissolved			95.5		%		80-120	20-NOV-16
Sodium (Na)-Dissolved			99.7		%		80-120	20-NOV-16
WG2436580-1	MB							
Calcium (Ca)-Dissolved			<0.10		mg/L		0.1	20-NOV-16
Iron (Fe)-Dissolved			<0.030		mg/L		0.03	20-NOV-16
Magnesium (Mg)-Dissolved			<0.10		mg/L		0.1	20-NOV-16
Manganese (Mn)-Dissolved			<0.0050		mg/L		0.005	20-NOV-16
Potassium (K)-Dissolved			<0.50		mg/L		0.5	20-NOV-16
Sodium (Na)-Dissolved			<1.0		mg/L		1	20-NOV-16
MET-T-CCMS-CL								
	Water							
Batch	R3598042							
WG2436001-2	LCS	TMRM						
Aluminum (Al)-Total			102.6		%		80-120	18-NOV-16
Antimony (Sb)-Total			100.6		%		80-120	18-NOV-16
Arsenic (As)-Total			97.6		%		80-120	18-NOV-16
Barium (Ba)-Total			96.0		%		80-120	18-NOV-16
Beryllium (Be)-Total			96.7		%		80-120	18-NOV-16
Bismuth (Bi)-Total			95.6		%		80-120	18-NOV-16
Boron (B)-Total			93.4		%		80-120	18-NOV-16
Cadmium (Cd)-Total			92.8		%		80-120	18-NOV-16
Chromium (Cr)-Total			99.5		%		80-120	18-NOV-16
Cobalt (Co)-Total			96.4		%		80-120	18-NOV-16
Copper (Cu)-Total			95.6		%		80-120	18-NOV-16
Lead (Pb)-Total			96.0		%		80-120	18-NOV-16
Molybdenum (Mo)-Total			100.8		%		80-120	18-NOV-16
Nickel (Ni)-Total			98.4		%		80-120	18-NOV-16
Selenium (Se)-Total			91.8		%		80-120	18-NOV-16
Silver (Ag)-Total			99.4		%		80-120	18-NOV-16
Strontium (Sr)-Total			95.9		%		80-120	18-NOV-16
Thallium (Tl)-Total			96.5		%		80-120	18-NOV-16



Quality Control Report

Workorder: L1856957

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-CL								
	Water							
Batch	R3598042							
WG2436001-2	LCS	TMRM						
Tin (Sn)-Total			96.1		%		80-120	18-NOV-16
Titanium (Ti)-Total			99.7		%		80-120	18-NOV-16
Uranium (U)-Total			97.0		%		80-120	18-NOV-16
Vanadium (V)-Total			99.4		%		80-120	18-NOV-16
Zinc (Zn)-Total			93.0		%		80-120	18-NOV-16
WG2436001-1	MB							
Aluminum (Al)-Total			<0.0030		mg/L		0.003	18-NOV-16
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	18-NOV-16
Arsenic (As)-Total			<0.00010		mg/L		0.0001	18-NOV-16
Barium (Ba)-Total			<0.000050		mg/L		0.00005	18-NOV-16
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	18-NOV-16
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	18-NOV-16
Boron (B)-Total			<0.010		mg/L		0.01	18-NOV-16
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	18-NOV-16
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	18-NOV-16
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	18-NOV-16
Copper (Cu)-Total			<0.00050		mg/L		0.0005	18-NOV-16
Lead (Pb)-Total			<0.000050		mg/L		0.00005	18-NOV-16
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	18-NOV-16
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	18-NOV-16
Selenium (Se)-Total			<0.000050		mg/L		0.00005	18-NOV-16
Silver (Ag)-Total			<0.000010		mg/L		0.00001	18-NOV-16
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	18-NOV-16
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	18-NOV-16
Tin (Sn)-Total			<0.00010		mg/L		0.0001	18-NOV-16
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	18-NOV-16
Uranium (U)-Total			<0.000010		mg/L		0.00001	18-NOV-16
Vanadium (V)-Total			<0.00050		mg/L		0.0005	18-NOV-16
Zinc (Zn)-Total			<0.0030		mg/L		0.003	18-NOV-16
Batch	R3598983							
WG2436001-5	LCS	TMRM						
Aluminum (Al)-Total			97.9		%		80-120	20-NOV-16
Antimony (Sb)-Total			94.8		%		80-120	20-NOV-16
Arsenic (As)-Total			100.3		%		80-120	20-NOV-16
Barium (Ba)-Total			101.4		%		80-120	20-NOV-16



Quality Control Report

Workorder: L1856957

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-CL								
	Water							
Batch	R3598983							
WG2436001-5	LCS	TMRM						
Beryllium (Be)-Total			100.6		%		80-120	20-NOV-16
Bismuth (Bi)-Total			97.6		%		80-120	20-NOV-16
Boron (B)-Total			94.2		%		80-120	20-NOV-16
Cadmium (Cd)-Total			100.5		%		80-120	20-NOV-16
Chromium (Cr)-Total			99.2		%		80-120	20-NOV-16
Cobalt (Co)-Total			100.6		%		80-120	20-NOV-16
Copper (Cu)-Total			98.3		%		80-120	20-NOV-16
Lead (Pb)-Total			96.6		%		80-120	20-NOV-16
Molybdenum (Mo)-Total			104.2		%		80-120	20-NOV-16
Nickel (Ni)-Total			101.1		%		80-120	20-NOV-16
Selenium (Se)-Total			93.7		%		80-120	20-NOV-16
Silver (Ag)-Total			100.8		%		80-120	20-NOV-16
Strontium (Sr)-Total			99.8		%		80-120	20-NOV-16
Thallium (Tl)-Total			97.7		%		80-120	20-NOV-16
Tin (Sn)-Total			100.0		%		80-120	20-NOV-16
Titanium (Ti)-Total			95.5		%		80-120	20-NOV-16
Uranium (U)-Total			97.0		%		80-120	20-NOV-16
Vanadium (V)-Total			100.1		%		80-120	20-NOV-16
Zinc (Zn)-Total			91.3		%		80-120	20-NOV-16
WG2436001-4	MB							
Aluminum (Al)-Total			<0.0030		mg/L		0.003	20-NOV-16
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	20-NOV-16
Arsenic (As)-Total			<0.00010		mg/L		0.0001	20-NOV-16
Barium (Ba)-Total			<0.000050		mg/L		0.00005	20-NOV-16
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	20-NOV-16
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	20-NOV-16
Boron (B)-Total			<0.010		mg/L		0.01	20-NOV-16
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	20-NOV-16
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	20-NOV-16
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	20-NOV-16
Copper (Cu)-Total			<0.00050		mg/L		0.0005	20-NOV-16
Lead (Pb)-Total			<0.000050		mg/L		0.00005	20-NOV-16
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	20-NOV-16
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	20-NOV-16



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Workorder: L1856957

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-CCMS-CL								
	Water							
Batch	R3599789							
WG2436001-7	MB							
Aluminum (Al)-Total			<0.0030		mg/L		0.003	21-NOV-16
Antimony (Sb)-Total			<0.00010		mg/L		0.0001	21-NOV-16
Arsenic (As)-Total			<0.00010		mg/L		0.0001	21-NOV-16
Barium (Ba)-Total			<0.000050		mg/L		0.00005	21-NOV-16
Beryllium (Be)-Total			<0.00010		mg/L		0.0001	21-NOV-16
Bismuth (Bi)-Total			<0.000050		mg/L		0.00005	21-NOV-16
Boron (B)-Total			<0.010		mg/L		0.01	21-NOV-16
Cadmium (Cd)-Total			<0.0000050		mg/L		0.000005	21-NOV-16
Chromium (Cr)-Total			<0.00010		mg/L		0.0001	21-NOV-16
Cobalt (Co)-Total			<0.00010		mg/L		0.0001	21-NOV-16
Copper (Cu)-Total			<0.00050		mg/L		0.0005	21-NOV-16
Lead (Pb)-Total			<0.000050		mg/L		0.00005	21-NOV-16
Molybdenum (Mo)-Total			<0.000050		mg/L		0.00005	21-NOV-16
Nickel (Ni)-Total			<0.00050		mg/L		0.0005	21-NOV-16
Selenium (Se)-Total			<0.000050		mg/L		0.00005	21-NOV-16
Silver (Ag)-Total			<0.000010		mg/L		0.00001	21-NOV-16
Strontium (Sr)-Total			<0.00020		mg/L		0.0002	21-NOV-16
Thallium (Tl)-Total			<0.000010		mg/L		0.00001	21-NOV-16
Tin (Sn)-Total			<0.00010		mg/L		0.0001	21-NOV-16
Titanium (Ti)-Total			<0.00030		mg/L		0.0003	21-NOV-16
Uranium (U)-Total			<0.000010		mg/L		0.00001	21-NOV-16
Vanadium (V)-Total			<0.00050		mg/L		0.0005	21-NOV-16
Zinc (Zn)-Total			<0.0030		mg/L		0.003	21-NOV-16
MET-TOT-ICP-CL								
	Water							
Batch	R3598978							
WG2436001-9	DUP	L1856957-1						
Calcium (Ca)-Total		119	117		mg/L	1.2	20	20-NOV-16
Magnesium (Mg)-Total		85.6	86.1		mg/L	0.6	20	20-NOV-16
Potassium (K)-Total		1.36	1.38		mg/L	1.3	20	20-NOV-16
Sodium (Na)-Total		2.4	2.4		mg/L	0.3	20	20-NOV-16
WG2436001-2	LCS	TMRM						
Calcium (Ca)-Total			99.9		%		80-120	20-NOV-16
Iron (Fe)-Total			92.7		%		80-120	20-NOV-16
Magnesium (Mg)-Total			97.7		%		80-120	20-NOV-16



Quality Control Report

Workorder: L1856957

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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3598978							
WG2436001-2	LCS	TMRM						
Manganese (Mn)-Total			94.7		%		80-120	20-NOV-16
Potassium (K)-Total			96.3		%		80-120	20-NOV-16
Sodium (Na)-Total			99.7		%		80-120	20-NOV-16
WG2436001-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	20-NOV-16
Iron (Fe)-Total			<0.030		mg/L		0.03	20-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	20-NOV-16
Manganese (Mn)-Total			<0.0050		mg/L		0.005	20-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	20-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	20-NOV-16
NH3-COL-CL								
	Water							
Batch	R3599750							
WG2436992-2	DUP	L1856957-3						
Ammonia, Total (as N)		0.099	0.104		mg/L	5.1	20	21-NOV-16
WG2436992-4	LCS							
Ammonia, Total (as N)			99.8		%		85-115	21-NOV-16
WG2436992-1	MB							
Ammonia, Total (as N)			<0.050		mg/L		0.05	21-NOV-16
WG2436992-3	MS	L1856957-3						
Ammonia, Total (as N)			94.5		%		75-125	21-NOV-16
NO2-IC-N-CL								
	Water							
Batch	R3597027							
WG2434684-15	DUP	L1856957-14						
Nitrite (as N)		0.013	0.013		mg/L	0.7	20	12-NOV-16
WG2434684-14	LCS							
Nitrite (as N)			105.4		%		90-110	12-NOV-16
WG2434684-13	MB							
Nitrite (as N)			<0.010		mg/L		0.01	12-NOV-16
WG2434684-16	MS	L1856957-14						
Nitrite (as N)			106.1		%		75-125	12-NOV-16
NO3-IC-N-CL								
	Water							
Batch	R3597027							
WG2434684-15	DUP	L1856957-14						
Nitrate (as N)		2.95	2.94		mg/L	0.1	20	12-NOV-16
WG2434684-14	LCS							
Nitrate (as N)			102.7		%		90-110	12-NOV-16



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Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-IC-N-CL								
Batch R3597027								
WG2434684-13 MB								
Nitrate (as N)			<0.020		mg/L		0.02	12-NOV-16
WG2434684-16 MS		L1856957-14						
Nitrate (as N)			N/A	MS-B	%		-	12-NOV-16
P-T-COL-CL								
Batch R3594391								
WG2432005-2 DUP		L1856957-1						
Phosphorus (P)-Total		0.0106	0.0100		mg/L	5.6	20	14-NOV-16
WG2432005-4 LCS								
Phosphorus (P)-Total			102.0		%		80-120	14-NOV-16
WG2432005-1 MB								
Phosphorus (P)-Total			<0.0050		mg/L		0.005	14-NOV-16
WG2432005-3 MS		L1856957-1						
Phosphorus (P)-Total			99.0		%		70-130	14-NOV-16
SO4-IC-N-CL								
Batch R3597027								
WG2434684-15 DUP		L1856957-14						
Sulfate (SO4)		80.2	80.1		mg/L	0.1	20	12-NOV-16
WG2434684-14 LCS								
Sulfate (SO4)			102.7		%		90-110	12-NOV-16
WG2434684-13 MB								
Sulfate (SO4)			<0.30		mg/L		0.3	12-NOV-16
WG2434684-16 MS		L1856957-14						
Sulfate (SO4)			101.1		%		75-125	12-NOV-16
SOLIDS-TDS-CL								
Batch R3597035								
WG2433585-2 LCS								
Total Dissolved Solids			97.4		%		85-115	16-NOV-16
WG2433585-1 MB								
Total Dissolved Solids			<10		mg/L		10	16-NOV-16

Quality Control Report

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Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Report To		<input checked="" type="checkbox"/> STANDARDQC_ALS		Service Requested (Rush for routine analysis subject to availability)	
Company: Nautilus Environmental (acct# 10253)		Email 1: jacklyn@nautilusenvironmental.ca		<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)	
Contact: Jacklyn Poole (403-921-4806)		Email 2: claudio@nautilusenvironmental.ca		<input checked="" type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT	
Address: #4, 6125 - 12 Street SE		Email 3:		<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT	
Calgary, AB T2H 2K1		Email 4:		<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT	
Phone: 403-253-7121 Fax:				Analysis Request	

Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)						Number of Containers									
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Job #: SP1617-015				P	P	P											
Company:		PO / AFE: 2016-0466																	
Contact: abaccounts@nautilusenvironmental.com		LSD:																	
Address:		Quote #: Q59174																	
Phone: Fax:																			

Lab Work Order # (lab use only)	ALS Contact: Nelson Kwan	Sampler:
---------------------------------	--------------------------	----------

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (major cation)	N2O3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL	SOLIDS-TDS-CL	MET-DIS-LOW-CL	MET-TOT-LOW-CL	Number of Containers
8	EV_ER4_400_term	10-Nov-16	11:55	Water	x	x	x	x	x	x	x	x			3
9	EV_ER4_480_term	10-Nov-16	11:55	Water	x	x	x	x	x	x	x	x			3
10	EV_ER4_576_term	10-Nov-16	11:35	Water	x	x		x	x	x	x	x	x	x	4
17	EV_ER4_691_term	10-Nov-16	12:00	Water	x	x	x	x	x	x	x	x			3
18	EV_ER4_829_term	10-Nov-16	12:00	Water	x	x	x	x	x	x	x	x			3
13	EV_ER4_995_term	10-Nov-16	11:35	Water	x	x		x	x	x	x	x	x	x	4
15	EV_ER4_Unamended w/Copper_term	10-Nov-16	11:50	Water	x	x	x	x	x	x	x	x			3

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Note: for dissolved metals, if requested, please sub-sample and filter/preserve at lab (SFPL) *Need results by Wednesday November 16*

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)		SHIPMENT RECEPTION (lab use only)			SHIPMENT VERIFICATION (lab use only)			Observations: Yes / No ? If Yes add SIF	
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:		Date:



Nautilus Environmental
ATTN: Jacklyn Poole
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 10-NOV-16
Report Date: 18-NOV-16 15:47 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1856675
Project P.O. #: 2016-0466
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856675-1 EV_ER4_UNAMENDED W/COPPER_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water							
Miscellaneous Parameters							
Sulfate (SO4)	77.3		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	43.5		0.10	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	17.8		0.10	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	0.63		0.50	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	2.2		1.0	mg/L		17-NOV-16	R3597292
L1856675-2 EV_ER4_400_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water							
Miscellaneous Parameters							
Sulfate (SO4)	527		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	127		0.10	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	86.6		0.10	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	0.63		0.50	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	2.2		1.0	mg/L		17-NOV-16	R3597292
L1856675-3 EV_ER4_480_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water							
Miscellaneous Parameters							
Sulfate (SO4)	600		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	147		0.10	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	106		0.10	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	0.66		0.50	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	2.3		1.0	mg/L		17-NOV-16	R3597292
L1856675-4 EV_ER4_576_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water							
Miscellaneous Parameters							
Sulfate (SO4)	764		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	176		0.10	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	127		0.10	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	0.66		0.50	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	2.4		1.0	mg/L		17-NOV-16	R3597292
L1856675-5 EV_ER4_691_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water							
Miscellaneous Parameters							
Sulfate (SO4)	973		1.5	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	229	DLDS	0.50	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	152	DLDS	0.50	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		17-NOV-16	R3597292
L1856675-6 EV_ER4_829_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856675-6 EV_ER4_829_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water Miscellaneous Parameters Sulfate (SO4)	1140		1.5	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	263 177 <2.5 <5.0	DLDS DLDS DLDS DLDS	0.50 0.50 2.5 5.0	mg/L mg/L mg/L mg/L		17-NOV-16 17-NOV-16 17-NOV-16 17-NOV-16	R3597292 R3597292 R3597292 R3597292
L1856675-7 EV_ER4_995_R2 Sampled By: CLIENT on 10-NOV-16 @ 12:00 Matrix: water Miscellaneous Parameters Sulfate (SO4)	1310		1.5	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	335 213 <2.5 <5.0	DLDS DLDS DLDS DLDS	0.50 0.50 2.5 5.0	mg/L mg/L mg/L mg/L		17-NOV-16 17-NOV-16 17-NOV-16 17-NOV-16	R3597292 R3597292 R3597292 R3597292
L1856675-8 EV_FR1_UNAMENDED W/COPPER_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water Miscellaneous Parameters Sulfate (SO4)	217		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	83.2 49.1 1.29 2.2		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		17-NOV-16 17-NOV-16 17-NOV-16 17-NOV-16	R3597292 R3597292 R3597292 R3597292
L1856675-9 EV_FR1_400_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water Miscellaneous Parameters Sulfate (SO4)	459		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	134 85.1 1.32 2.2		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		17-NOV-16 17-NOV-16 17-NOV-16 17-NOV-16	R3597292 R3597292 R3597292 R3597292
L1856675-10 EV_FR1_480_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water Miscellaneous Parameters Sulfate (SO4)	564		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	154 99.8 1.32 2.1		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		17-NOV-16 17-NOV-16 17-NOV-16 17-NOV-16	R3597292 R3597292 R3597292 R3597292
L1856675-11 EV_FR1_576_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1856675-11 EV_FR1_576_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water Miscellaneous Parameters							
Sulfate (SO4)	680		0.30	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	172		0.10	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	118		0.10	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	1.29		0.50	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	2.1		1.0	mg/L		17-NOV-16	R3597292
L1856675-12 EV_FR1_691_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water Miscellaneous Parameters							
Sulfate (SO4)	906		1.5	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	215	DLDS	0.50	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	145	DLDS	0.50	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		17-NOV-16	R3597292
L1856675-13 EV_FR1_829_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water Miscellaneous Parameters							
Sulfate (SO4)	1050		1.5	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	255	DLDS	0.50	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	173	DLDS	0.50	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		17-NOV-16	R3597292
L1856675-14 EV_FR1_995_R2 Sampled By: CLIENT on 10-NOV-16 @ 11:55 Matrix: water Miscellaneous Parameters							
Sulfate (SO4)	1260		1.5	mg/L		12-NOV-16	R3597027
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	312	DLDS	0.50	mg/L		17-NOV-16	R3597292
Magnesium (Mg)-Total	204	DLDS	0.50	mg/L		17-NOV-16	R3597292
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		17-NOV-16	R3597292
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		17-NOV-16	R3597292

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
EXTEMP10	14C - same day sampling - Samples Received with temperature >10 Degrees C

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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
 mg/L - unit of concentration based on volume, parts per million.

< - Less than.
 D.L. - The reporting limit.
 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.



Quality Control Report

Workorder: L1856675

Report Date: 18-NOV-16

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: Jacklyn Poole

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3596167							
WG2433602-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	16-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	16-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	16-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	16-NOV-16
Batch	R3597292							
WG2433602-5	LCS	TMRM						
Calcium (Ca)-Total			95.2		%		80-120	17-NOV-16
Magnesium (Mg)-Total			103.1		%		80-120	17-NOV-16
Potassium (K)-Total			96.2		%		80-120	17-NOV-16
Sodium (Na)-Total			98.7		%		80-120	17-NOV-16
WG2433602-4	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	17-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	17-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	17-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	17-NOV-16
SO4-IC-N-CL								
	Water							
Batch	R3597027							
WG2434684-2	LCS							
Sulfate (SO4)			100.4		%		90-110	12-NOV-16
WG2434684-6	LCS							
Sulfate (SO4)			101.8		%		90-110	12-NOV-16
WG2434684-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	12-NOV-16
WG2434684-5	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	12-NOV-16

Quality Control Report

Workorder: L1856675

Report Date: 18-NOV-16

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Report To			Report Format / Distribution			Please indicate below Filtered, Preserved or both (F, P, F/P)										
Company: Nautilus Environmental (acct# 10253)			<input checked="" type="checkbox"/> STANDARDQC_ALS			<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)										
Contact: Jacklyn Poole (403-826-0992)			Email 1: jacklyn@nautilusenvironmental.ca			<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT										
Address: #4, 6125 - 12 Street SE			Email 2: claudio@nautilusenvironmental.ca			<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT										
Calgary, AB T2H 2K1			Email 3:			<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT										
Phone: 403-253-7121 Fax:			Email 4:			Analysis Request										
Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			Client / Project Information			Please indicate below Filtered, Preserved or both (F, P, F/P)										
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No			Job #: SP1617-015													
Company:			PO / AFE: 2016-0466													
Contact: abaccounts@nautilusenvironmental.com			LSD:													
Address:			Quote #: Q59174													
Phone: Fax:			ALS Contact: Nelson Kwan													
Lab Work Order # (lab use only)			Sampler:													
Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL	Number of Containers				
	EV_ER4_Unamended w/Copper RT R2	10-Nov-16	12:00	Water			X				X				2	
	EV_ER4_400_R2	10-Nov-16	↓	Water			X				X				2	
	EV_ER4_480_R2	10-Nov-16		Water			X					X				2
	EV_ER4_576_R2	10-Nov-16		Water			X					X				2
	EV_ER4_691_R2	10-Nov-16		Water			X					X				2
	EV_ER4_829_R2	10-Nov-16		Water			X					X				2
	EV_ER4_995_R2	10-Nov-16		Water			X					X				2
Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details																
Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab. Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.																
SHIPMENT: RELEASE (client use)				SHIPMENT: RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)								
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF						
			<i>[Signature]</i>	Nov 10	2:55pm	14 °C										



Chain of Custody / Analyt
 Canada Toll Free: 1
 www.alsglob



COC #

Page 2 of 2

Report To		Report Format / Distribution		ir routine analysis subject to availability)	
Company: Nautilus Environmental (acct# 10253)		<input checked="" type="checkbox"/> STANDARDQC_ALS		<input checked="" type="radio"/> Regular Times - Business Days)	
Contact: Jacklyn Poole (403-826-0992)		Email 1: jacklyn@nautilusenvironmental.ca		<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT	
Address: #4, 6125 - 12 Street SE		Email 2: claudio@nautilusenvironmental.ca		<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT	
Calgary, AB T2H 2K1		Email 3:		<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT	
Phone: 403-253-7121 Fax:		Email 4:		Analysis Request	

Invoice To Same as Report ? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Client / Project Information		Please indicate below Filtered, Preserved or both (F, P, F/P)						Number of Containers										
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Job #: SP1617-015				P		P	P											
Company:		PO / AFE: 2016-0466																		
Contact: abaccounts@nautilusenvironmental.com		LSD:																		
Address:		Quote #: Q59174																		

Lab Work Order # (lab use only)		ALS Contact: Nelson Kwan		Sampler:	
---------------------------------	--	---------------------------------	--	-----------------	--

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2NG-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL												
	GH_FR1_Unamended w/Copper #22	10-Nov-16	11:55	Water			X				X											2	
	GH_FR1_400_R2	10-Nov-16	↓	Water			X				X											2	
	GH_FR1_480_R2	10-Nov-16		Water			X					X											2
	GH_FR1_576_R2	10-Nov-16		Water			X					X											2
	GH_FR1_691_R2	10-Nov-16		Water			X					X											2
	GH_FR1_829_R2	10-Nov-16		Water			X					X											2
	GH_FR1_995_R2	10-Nov-16		Water			X					X											2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT: RELEASE (client use)			SHIPMENT: RECEPTION (lab use only)			SHIPMENT: VERIFICATION (lab use only)			Observations: Yes / No ? If Yes add SIF		
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:		
			<i>[Signature]</i>	10/10	2:55pm	°C					



Nautilus Environmental
ATTN: Jacklyn Poole
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 17-NOV-16
Report Date: 25-NOV-16 11:26 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1859394
Project P.O. #: 2016-0484
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

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ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1859394-1 EV_ER4_UNAMENDEDW/COPPER_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	75.9		0.30	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	49.9 22.7 0.76 2.8		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		23-NOV-16 23-NOV-16 23-NOV-16 23-NOV-16	R3601549 R3601549 R3601549 R3601549
L1859394-2 EV_ER4_400_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	620		0.30	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	143 96.4 0.78 2.8		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		23-NOV-16 23-NOV-16 23-NOV-16 23-NOV-16	R3601549 R3601549 R3601549 R3601549
L1859394-3 EV_ER4_480_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	511		0.30	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	168 116 0.79 2.9		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		23-NOV-16 23-NOV-16 23-NOV-16 23-NOV-16	R3601549 R3601549 R3601549 R3601549
L1859394-4 EV_ER4_576_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	750	DLHC	1.5	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	209 135 <2.5 <5.0	DLDS DLDS DLDS DLDS	0.50 0.50 2.5 5.0	mg/L mg/L mg/L mg/L		23-NOV-16 23-NOV-16 23-NOV-16 23-NOV-16	R3601549 R3601549 R3601549 R3601549
L1859394-5 EV_ER4_691_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	912	DLHC	1.5	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	249 162 <2.5 <5.0	DLDS DLDS DLDS DLDS	0.50 0.50 2.5 5.0	mg/L mg/L mg/L mg/L		23-NOV-16 23-NOV-16 23-NOV-16 23-NOV-16	R3601549 R3601549 R3601549 R3601549
L1859394-6 EV_ER4_829_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1859394-6 EV_ER4_829_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1120	DLHC	1.5	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	293	DLDS	0.50	mg/L		23-NOV-16	R3601549
Magnesium (Mg)-Total	191	DLDS	0.50	mg/L		23-NOV-16	R3601549
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		23-NOV-16	R3601549
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		23-NOV-16	R3601549
L1859394-7 EV_ER4_995_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:25 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1270	DLHC	1.5	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	335	DLDS	0.50	mg/L		23-NOV-16	R3601549
Magnesium (Mg)-Total	222	DLDS	0.50	mg/L		23-NOV-16	R3601549
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		23-NOV-16	R3601549
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		23-NOV-16	R3601549
L1859394-8 GH_FR1_UNAMENDEDW/COPPER_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	211		0.30	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	89.8		0.10	mg/L		24-NOV-16	R3602295
Magnesium (Mg)-Total	55.4		0.10	mg/L		24-NOV-16	R3602295
Potassium (K)-Total	1.33		0.50	mg/L		24-NOV-16	R3602295
Sodium (Na)-Total	2.2		1.0	mg/L		24-NOV-16	R3602295
L1859394-9 GH_FR1_400_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	451		0.30	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	142		0.10	mg/L		24-NOV-16	R3602295
Magnesium (Mg)-Total	97.4		0.10	mg/L		24-NOV-16	R3602295
Potassium (K)-Total	1.36		0.50	mg/L		24-NOV-16	R3602295
Sodium (Na)-Total	2.3		1.0	mg/L		24-NOV-16	R3602295
L1859394-10 GH_FR1_480_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	547		0.30	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	166		0.10	mg/L		24-NOV-16	R3602295
Magnesium (Mg)-Total	113		0.10	mg/L		24-NOV-16	R3602295
Potassium (K)-Total	1.36		0.50	mg/L		24-NOV-16	R3602295
Sodium (Na)-Total	2.2		1.0	mg/L		24-NOV-16	R3602295
L1859394-11 GH_FR1_576_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1859394-11 GH_FR1_576_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	678		0.30	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	190		0.10	mg/L		24-NOV-16	R3602295
Magnesium (Mg)-Total	137		0.10	mg/L		24-NOV-16	R3602295
Potassium (K)-Total	1.34		0.50	mg/L		24-NOV-16	R3602295
Sodium (Na)-Total	2.2		1.0	mg/L		24-NOV-16	R3602295
L1859394-12 GH_FR1_691_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	839	DLHC	1.5	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	235	DLDS	0.50	mg/L		24-NOV-16	R3602295
Magnesium (Mg)-Total	165	DLDS	0.50	mg/L		24-NOV-16	R3602295
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		24-NOV-16	R3602295
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		24-NOV-16	R3602295
L1859394-13 GH_FR1_829_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	1030	DLHC	1.5	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	275	DLDS	0.50	mg/L		24-NOV-16	R3602295
Magnesium (Mg)-Total	202	DLDS	0.50	mg/L		24-NOV-16	R3602295
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		24-NOV-16	R3602295
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		24-NOV-16	R3602295
L1859394-14 GH_FR1_995_R3 Sampled By: CLIENT on 17-NOV-16 @ 11:30 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	1220	DLHC	1.5	mg/L		19-NOV-16	R3601409
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	332	DLDS	0.50	mg/L		24-NOV-16	R3602295
Magnesium (Mg)-Total	236	DLDS	0.50	mg/L		24-NOV-16	R3602295
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		24-NOV-16	R3602295
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		24-NOV-16	R3602295

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
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**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

- 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*
- mg/L - unit of concentration based on volume, parts per million.*
- < - Less than.*

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1859394

Report Date: 25-NOV-16

Page 1 of 3

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1

Contact: Jacklyn Poole

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3598978							
WG2436001-2	LCS	TMRM						
Calcium (Ca)-Total			99.9		%		80-120	20-NOV-16
Magnesium (Mg)-Total			97.7		%		80-120	20-NOV-16
Potassium (K)-Total			96.3		%		80-120	20-NOV-16
Sodium (Na)-Total			99.7		%		80-120	20-NOV-16
WG2436001-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	20-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	20-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	20-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	20-NOV-16
Batch	R3601549							
WG2436001-5	LCS	TMRM						
Calcium (Ca)-Total			109.5		%		80-120	23-NOV-16
Magnesium (Mg)-Total			109.0		%		80-120	23-NOV-16
Potassium (K)-Total			115.3		%		80-120	23-NOV-16
Sodium (Na)-Total			109.9		%		80-120	23-NOV-16
WG2438926-2	LCS	TMRM						
Calcium (Ca)-Total			108.1		%		80-120	23-NOV-16
Magnesium (Mg)-Total			107.6		%		80-120	23-NOV-16
Potassium (K)-Total			117.7		%		80-120	23-NOV-16
Sodium (Na)-Total			111.4		%		80-120	23-NOV-16
WG2438926-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	23-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	23-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	23-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	23-NOV-16
Batch	R3602295							
WG2436001-8	LCS	TMRM						
Calcium (Ca)-Total			110.2		%		80-120	24-NOV-16
Magnesium (Mg)-Total			111.3		%		80-120	24-NOV-16
Potassium (K)-Total			98.6		%		80-120	24-NOV-16
Sodium (Na)-Total			93.4		%		80-120	24-NOV-16
WG2436001-7	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	24-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	24-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	24-NOV-16



Quality Control Report

Workorder: L1859394

Report Date: 25-NOV-16

Page 2 of 3

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL	Water							
Batch	R3602295							
WG2436001-7	MB							
Sodium (Na)-Total			<1.0		mg/L		1	24-NOV-16
SO4-IC-N-CL	Water							
Batch	R3601409							
WG2438751-2	LCS							
Sulfate (SO4)			98.0		%		90-110	19-NOV-16
WG2438751-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	19-NOV-16

Quality Control Report

Workorder: L1859394

Report Date: 25-NOV-16

Page 3 of 3

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



L1859394-COFC

rm

COC # _____

Report To

Company: Nautilus Environmental (acct# 10253)
 Contact: Jacklyn Poole (403-826-0992)
 Address: #4, 6125 - 12 Street SE
 Calgary, AB T2H 2K1
 Phone: 403-253-7121 Fax: _____

Email 1: jacklyn@nautilusenvironmental.ca
 Email 2: claudio@nautilusenvironmental.ca
 Email 3: madison@nautilusenvironmental.ca
 Email 4: _____

Service Requested (Rush for routine analysis subject to availability)
 Regular (Standard Turnaround Times - Business Days)
 Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
 Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
 Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Invoice To Same as Report? Yes No
 Hardcopy of Invoice with Report? Yes No

Client / Project Information
 Job #: SP1617-015
 PO / AFE: 2016-0484
 LSD: _____
 Quote #: Q59174

Analysis Request
 Please indicate below Filtered, Preserved or both (F, P, F/P)

Company: _____
 Contact: abaccounts@nautilusenvironmental.ca
 Address: _____
 Phone: _____ Fax: _____

Lab Work Order # _____
 (lab use only)

ALS Contact: Nelson Kwan
 Sampler: _____

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL	Number of Containers
1	EV_ER4_Unamended w/Copper_R3	17-Nov-16	11:25	Water			X				X	2
2	EV_ER4_400_R3	17-Nov-16		Water			X				X	2
3	EV_ER4_480_R3	17-Nov-16		Water			X				X	2
4	EV_ER4_576_R3	17-Nov-16		Water			X				X	2
5	EV_ER4_691_R3	17-Nov-16		Water			X				X	2
6	EV_ER4_829_R3	17-Nov-16		Water			X				X	2
7	EV_ER4_995_R3	17-Nov-16		Water			X				X	2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT, RELEASE (client use)			SHIPMENT, RECEPTION (lab use only)			SHIPMENT, VERIFICATION (lab use only)			Observations: Yes / No ? If Yes add 31F	
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	
				11/17	9:15pm	7°C				



L1859394-COFC

Report To

Company: Nautilus Environmental (acct# 10253)

Contact: Jacklyn Poole (403-826-0992)

Address: #4, 6125 - 12 Street SE
Calgary, AB T2H 2K1

Phone: 403-253-7121 Fax: _____

Invoice To Same as Report? Yes No

Hardcopy of Invoice with Report? Yes No

Company: _____

Contact: abaccounts@nautilusenvironmental.ca

Address: _____

Phone: _____ Fax: _____

Email 1: jacklyn@nautilusenvironmental.ca

Email 2: claudio@nautilusenvironmental.ca

Email 3: madison@nautilusenvironmental.ca

Email 4: _____

Service Requested (Rush for routine analysis subject to availability)

Regular (Standard Turnaround Times - Business Days)

Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT

Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT

Same Day or Weekend Emergency - Contact ALS to Confirm TAT

Lab Work Order # _____
(lab use only)

Client / Project Information

Job #: SP1617-015

PO / AFE: 2016-0484

LSD: _____

Quote #: Q59174

Analysis Request

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2O3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL									Number of Containers	
89	GH_FR1_Unamended w/Copper_R3	17-Nov-16	11:30	Water			X				X										2
90	GH_FR1_400_R3	17-Nov-16		Water			X				X										2
100	GH_FR1_480_R3	17-Nov-16		Water			X				X										2
111	GH_FR1_576_R3	17-Nov-16		Water			X				X										2
122	GH_FR1_691_R3	17-Nov-16		Water			X				X										2
133	GH_FR1_829_R3	17-Nov-16		Water			X				X										2
144	GH_FR1_995_R3	17-Nov-16		Water			X				X										2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)			SHIPMENT VERIFICATION (lab use only)				
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature: °C	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF



Nautilus Environmental
ATTN: Madison Lenti
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 28-NOV-16
Report Date: 05-DEC-16 13:27 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1863286
Project P.O. #: 2016-1013
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1863286-1 EV_ER4_400_R3 REDO Sampled By: CLIENT on 25-NOV-16 @ 14:40 Matrix: WATER Individual Total Metal Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total Miscellaneous Parameters Sulfate (SO4)	 123 91.8 0.76 2.6 562	 	 0.10 0.50 0.50 1.0 0.30	 mg/L mg/L mg/L mg/L mg/L	 	 03-DEC-16 03-DEC-16 03-DEC-16 03-DEC-16 28-NOV-16	 R3609766 R3609766 R3609766 R3609766 R3606151
L1863286-2 EV_ER4_480_R3 REDO Sampled By: CLIENT on 25-NOV-16 @ 14:40 Matrix: WATER Individual Total Metal Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total Miscellaneous Parameters Sulfate (SO4)	 154 111 0.75 2.6 693	 	 0.10 0.10 0.50 1.0 0.30	 mg/L mg/L mg/L mg/L mg/L	 	 03-DEC-16 03-DEC-16 03-DEC-16 03-DEC-16 28-NOV-16	 R3609766 R3609766 R3609766 R3609766 R3606151

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1863286

Report Date: 05-DEC-16

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: Madison Lenti

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3607963							
WG2443646-2	LCS	TMRM						
Calcium (Ca)-Total			105.7		%		80-120	30-NOV-16
Magnesium (Mg)-Total			100.4		%		80-120	30-NOV-16
Potassium (K)-Total			98.4		%		80-120	30-NOV-16
Sodium (Na)-Total			94.9		%		80-120	30-NOV-16
WG2443646-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	30-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	30-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	30-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	30-NOV-16
Batch	R3609766							
WG2443646-5	LCS	TMRM						
Calcium (Ca)-Total			93.9		%		80-120	03-DEC-16
Magnesium (Mg)-Total			93.4		%		80-120	03-DEC-16
Potassium (K)-Total			95.5		%		80-120	03-DEC-16
Sodium (Na)-Total			95.5		%		80-120	03-DEC-16
WG2443646-4	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	03-DEC-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	03-DEC-16
Potassium (K)-Total			<0.50		mg/L		0.5	03-DEC-16
Sodium (Na)-Total			<1.0		mg/L		1	03-DEC-16
SO4-IC-N-CL								
	Water							
Batch	R3606151							
WG2442490-2	LCS							
Sulfate (SO4)			101.1		%		90-110	28-NOV-16
WG2442490-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	28-NOV-16
WG2442490-4	MS	L1863286-1						
Sulfate (SO4)			N/A	MS-B	%		-	28-NOV-16

Quality Control Report

Workorder: L1863286

Report Date: 05-DEC-16

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

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

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Nautilus Environmental
ATTN: Jacklyn Poole
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 24-NOV-16
Report Date: 01-DEC-16 14:06 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1862272
Project P.O. #: 2016-0486
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

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ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1862272-1 EV_ER4_UNAMENDED W/COPPER_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	83.0		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	62.3		0.10	mg/L		30-NOV-16	R3607963
Magnesium (Mg)-Total	21.8		0.10	mg/L		30-NOV-16	R3607963
Potassium (K)-Total	0.71		0.50	mg/L		30-NOV-16	R3607963
Sodium (Na)-Total	2.6		1.0	mg/L		30-NOV-16	R3607963
L1862272-2 EV_ER4_400_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	533		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	151		0.10	mg/L		30-NOV-16	R3607963
Magnesium (Mg)-Total	93.6		0.10	mg/L		30-NOV-16	R3607963
Potassium (K)-Total	0.68		0.50	mg/L		30-NOV-16	R3607963
Sodium (Na)-Total	2.5		1.0	mg/L		30-NOV-16	R3607963
L1862272-3 EV_ER4_480_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	638		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	175		0.10	mg/L		30-NOV-16	R3607963
Magnesium (Mg)-Total	111		0.10	mg/L		30-NOV-16	R3607963
Potassium (K)-Total	0.72		0.50	mg/L		30-NOV-16	R3607963
Sodium (Na)-Total	2.6		1.0	mg/L		30-NOV-16	R3607963
L1862272-4 EV_ER4_576_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	753		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	191		0.10	mg/L		30-NOV-16	R3607963
Magnesium (Mg)-Total	126		0.10	mg/L		30-NOV-16	R3607963
Potassium (K)-Total	0.72		0.50	mg/L		30-NOV-16	R3607963
Sodium (Na)-Total	2.6		1.0	mg/L		30-NOV-16	R3607963
L1862272-5 EV_ER4_691_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	905		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	215		0.10	mg/L		30-NOV-16	R3607963
Magnesium (Mg)-Total	151		0.10	mg/L		30-NOV-16	R3607963
Potassium (K)-Total	0.70		0.50	mg/L		30-NOV-16	R3607963
Sodium (Na)-Total	2.5		1.0	mg/L		30-NOV-16	R3607963
L1862272-6 EV_ER4_829_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1862272-6 EV_ER4_829_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	1030		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	247 172 0.72 2.5		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-7 EV_ER4_995_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:35 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	1310	DLHC	1.5	mg/L		28-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	307 224 0.74 2.6		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-8 GH_FR1_UNAMENDED W/COPPER_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	223		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	89.3 50.4 1.35 2.2		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-9 GH_FR1_400_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	466		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	139 88.4 1.37 2.2		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-10 GH_FR1_480_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	568		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	165 106 1.38 2.3		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-11 GH_FR1_576_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1862272-11 GH_FR1_576_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	689		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	189 121 1.39 2.3		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-12 GH_FR1_691_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	845		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	215 146 1.36 2.3		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-13 GH_FR1_829_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	985		0.30	mg/L		24-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	246 174 1.41 2.3		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963
L1862272-14 GH_FR1_995_R4 Sampled By: CLIENT on 24-NOV-16 @ 13:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	1170	DLHC	1.5	mg/L		28-NOV-16	R3605171
Total Metals in Water by ICPOES Calcium (Ca)-Total Magnesium (Mg)-Total Potassium (K)-Total Sodium (Na)-Total	283 205 1.48 2.4		0.10 0.10 0.50 1.0	mg/L mg/L mg/L mg/L		30-NOV-16 30-NOV-16 30-NOV-16 30-NOV-16	R3607963 R3607963 R3607963 R3607963

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

- 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*
- mg/L - unit of concentration based on volume, parts per million.*

< - Less than.

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1862272

Report Date: 01-DEC-16

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: Jacklyn Poole

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3607963							
WG2443027-2	LCS	TMRM						
Calcium (Ca)-Total			103.2		%		80-120	30-NOV-16
Magnesium (Mg)-Total			100.9		%		80-120	30-NOV-16
Potassium (K)-Total			98.8		%		80-120	30-NOV-16
Sodium (Na)-Total			97.4		%		80-120	30-NOV-16
WG2443027-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	30-NOV-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	30-NOV-16
Potassium (K)-Total			<0.50		mg/L		0.5	30-NOV-16
Sodium (Na)-Total			<1.0		mg/L		1	30-NOV-16
WG2444157-1	MS	L1862272-1						
Calcium (Ca)-Total			122.1		%		70-130	30-NOV-16
Magnesium (Mg)-Total			110.6		%		70-130	30-NOV-16
Sodium (Na)-Total			117.8		%		70-130	30-NOV-16
SO4-IC-N-CL								
	Water							
Batch	R3605171							
WG2441655-10	LCS							
Sulfate (SO4)			104.6		%		90-110	24-NOV-16
WG2441655-9	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	24-NOV-16

Quality Control Report

Workorder: L1862272

Report Date: 01-DEC-16

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



L1862272-COFC

Chain of Custody / Analytical Request Form

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

COC #

Page 2 of 2

Report To	Report Format / Distribution	Service Requested (Rush for routine analysis subject to availability)
Company: Nautilus Environmental (acct# 10253)	<input checked="" type="checkbox"/> STANDARDQC_ALS	<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)
Contact: Jacklyn Poole (403-826-0992)	Email 1: jacklyn@nautilusenvironmental.ca	<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address: #4, 6125 - 12 Street SE	Email 2: claudio@nautilusenvironmental.ca	<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
Calgary, AB T2H 2K1	Email 3: madison@nautilusenvironmental.ca	<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone: 403-253-7121 Fax:	Email 4:	Analysis Request

Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Client / Project Information	Please indicate below Filtered, Preserved or both (F, P, F/P)																		
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Job #: SP1617-015			P		P	P													
Company:	PO / AFE: 2016-0486																			
Contact: abaccounts@nautilusenvironmental.ca	LSD:																			
Address:																				
Phone: Fax:	Quote #: Q59174																			

Lab Work Order # (lab use only)	ALS Contact: Nelson Kwan	Sampler:
---------------------------------	--------------------------	----------

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL										Number of Containers		
8	GH_FR1_Unamended w/Copper_R4	24-Nov-16	13:40	Water			X				X											2	
9	GH_FR1_400_R4	24-Nov-16	}	Water			X				X											2	
10	GH_FR1_480_R4	24-Nov-16		Water			X				X												2
11	GH_FR1_576_R4	24-Nov-16		Water			X				X												2
12	GH_FR1_691_R4	24-Nov-16		Water			X				X												2
13	GH_FR1_829_R4	24-Nov-16		Water			X				X												2
14	GH_FR1_995_R4	24-Nov-16		Water			X				X												2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)			SHIPMENT VERIFICATION (lab use only)				
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			<i>[Signature]</i>	11/24	3:05	15 °C				



Nautilus Environmental
ATTN: Madison Lehti
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 01-DEC-16
Report Date: 08-DEC-16 19:14 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1865253
Project P.O. #: 2016-0486
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

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ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1865253-1 GH_FR1_UNAMENDED W/COPPER_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	207		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	85.2		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	50.2		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	1.46		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	2.5		1.0	mg/L		08-DEC-16	R3613060
L1865253-2 GH_FR1_400_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	432		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	134		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	87.1		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	1.53		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	2.6		1.0	mg/L		08-DEC-16	R3613060
L1865253-3 GH_FR1_480_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	530		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	153		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	104		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	1.50		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	2.6		1.0	mg/L		08-DEC-16	R3613060
L1865253-4 GH_FR1_576_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	656		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	174		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	124		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	1.56		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	2.7		1.0	mg/L		08-DEC-16	R3613060
L1865253-5 GH_FR1_691_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	837	DLHC	1.5	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	227	DLDS	0.50	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	145	DLDS	0.50	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		08-DEC-16	R3613060
L1865253-6 GH_FR1_829_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1865253-6 GH_FR1_829_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	990	DLHC	1.5	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	271	DLDS	0.50	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	174	DLDS	0.50	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		08-DEC-16	R3613060
L1865253-7 GH_FR1_995_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:50 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	1180	DLHC	1.5	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	310	DLDS	0.50	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	204	DLDS	0.50	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		08-DEC-16	R3613060

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 6010B
<p>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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)</p>			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

*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
 mg/L - unit of concentration based on volume, parts per million.*

< - Less than.

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1865253

Report Date: 08-DEC-16

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: Madison Lehti

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3613060							
WG2447481-6	DUP	L1865253-1						
Calcium (Ca)-Total		85.2	85.3		mg/L	0.2	20	08-DEC-16
Magnesium (Mg)-Total		50.2	51.2		mg/L	1.9	20	08-DEC-16
Potassium (K)-Total		1.46	1.52		mg/L	3.8	20	08-DEC-16
Sodium (Na)-Total		2.5	2.6		mg/L	3.2	20	08-DEC-16
WG2447481-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	08-DEC-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	08-DEC-16
Potassium (K)-Total			<0.50		mg/L		0.5	08-DEC-16
Sodium (Na)-Total			<1.0		mg/L		1	08-DEC-16
SO4-IC-N-CL								
	Water							
Batch	R3611818							
WG2447078-2	LCS							
Sulfate (SO4)			96.7		%		90-110	02-DEC-16
WG2447078-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	02-DEC-16

Quality Control Report

Workorder: L1865253

Report Date: 08-DEC-16

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Nautilus Environmental
ATTN: Madison Lehti
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 01-DEC-16
Report Date: 08-DEC-16 19:15 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1865254
Project P.O. #: 2016-1014
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

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ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1865254-1 EV_ER4_UNAMENDED W/COPPER_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	74.3		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	49.2		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	22.1		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	0.80		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	3.1		1.0	mg/L		08-DEC-16	R3613060
L1865254-2 EV_ER4_400_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	494		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	140		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	92.2		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	0.80		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	3.1		1.0	mg/L		08-DEC-16	R3613060
L1865254-3 EV_ER4_480_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	610		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	159		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	110		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	0.80		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	3.1		1.0	mg/L		08-DEC-16	R3613060
L1865254-4 EV_ER4_576_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	699		0.30	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	181		0.10	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	126		0.10	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	0.79		0.50	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	3.1		1.0	mg/L		08-DEC-16	R3613060
L1865254-5 EV_ER4_691_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	935	DLHC	1.5	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	225	DLDS	0.50	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	147	DLDS	0.50	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		08-DEC-16	R3613060
L1865254-6 EV_ER4_829_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1865254-6 EV_ER4_829_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	1030	DLHC	1.5	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	263	DLDS	0.50	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	165	DLDS	0.50	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		08-DEC-16	R3613060
L1865254-7 EV_ER4_995_R5 Sampled By: CLIENT on 01-DEC-16 @ 12:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	959	DLHC	1.5	mg/L		02-DEC-16	R3611818
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	494	DLDS	0.50	mg/L		08-DEC-16	R3613060
Magnesium (Mg)-Total	43.7	DLDS	0.50	mg/L		08-DEC-16	R3613060
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		08-DEC-16	R3613060
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		08-DEC-16	R3613060

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:
GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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.

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Quality Control Report

Workorder: L1865254

Report Date: 08-DEC-16

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1

Contact: Madison Lehti

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3613060							
WG2447481-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	08-DEC-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	08-DEC-16
Potassium (K)-Total			<0.50		mg/L		0.5	08-DEC-16
Sodium (Na)-Total			<1.0		mg/L		1	08-DEC-16
SO4-IC-N-CL								
	Water							
Batch	R3611818							
WG2447078-3	DUP	L1865254-1						
Sulfate (SO4)		74.3	74.1		mg/L	0.2	20	02-DEC-16
WG2447078-2	LCS							
Sulfate (SO4)			96.7		%		90-110	02-DEC-16
WG2447078-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	02-DEC-16
WG2447078-4	MS	L1865254-1						
Sulfate (SO4)			95.3		%		75-125	02-DEC-16

Quality Control Report

Workorder: L1865254

Report Date: 08-DEC-16

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



L1865254-COFC

of Custody / Analytical Request Form
 Canada Toll Free: 1 800 668 9878
 www.alsglobal.com

COC # _____
 Page 1 of 1

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)						
Company: Nautilus Environmental (acct# 10253)		<input checked="" type="checkbox"/> STANDARDQC_ALS		<input checked="" type="radio"/> Regular (Standard Turnaround Times - Business Days)						
Contact: Madison Lehti		Email 1: madison@nautilusenvironmental.ca		<input type="radio"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT						
Address: #4, 6125 - 12 Street SE		Email 2: claudio@nautilusenvironmental.ca		<input type="radio"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT						
Calgary, AB T2H 2K1		Email 3:		<input type="radio"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT						
Phone: 403-253-7121 Fax:		Email 4:		Analysis Request Please indicate below Filtered, Preserved or both (F, P, F/P)						
Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Client / Project Information								
Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Job #: SP1617-015		P		P		P		Number of Containers
Company:		PO / AFE: 2016-0486-2016-104		MET-TOT-ICP-CL (total cations)						
Contact: abaccounts@nautilusenvironmental.ca		LSD:		N2N3-P-CL		NH3-COL-CL		P-T-COL-CL		
Address:		Quote #: Q59174		SO4-IC-N-CL						
Phone: Fax:		ALS Contact: Nelson Kwan		Sampler:						

Lab Work Order # (lab use only) 2364		ALS Contact: Nelson Kwan		Sampler:								Number of Containers
Sample #		Sample Identification (This description will appear on the report)		Date (dd-mmm-yy)		Time (hh:mm)		Sample Type				

Sample #	Sample Identification	Date	Time	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (total cations)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL									Number of Containers
1	EV_ER4_Unamended w/Copper_R5	01-Dec-16	12:40	Water			X				X									2
2	EV_ER4_400_R5	01-Dec-16	12:40	Water			X				X									2
3	EV_ER4_480_R5	01-Dec-16	12:40	Water			X				X									2
4	EV_ER4_576_R5	01-Dec-16	12:40	Water			X				X									2
5	EV_ER4_691_R5	01-Dec-16	12:40	Water			X				X									2
6	EV_ER4_829_R5	01-Dec-16	12:40	Water			X				X									2
7	EV_ER4_995_R5	01-Dec-16	12:40	Water			X				X									2

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)			SHIPMENT VERIFICATION (lab use only)				Observations: Yes / No ? If Yes add SIF
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	
			<i>[Signature]</i>	12/11	3:57pm	9 °C				



Nautilus Environmental
ATTN: MADISON LEHTI
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 12-DEC-16
Report Date: 19-DEC-16 10:39 (MT)
Version: FINAL

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1868903
Project P.O. #: 2016-1036
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Nelson Kwan, B.Sc.
Account Manager

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ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1868903-1 EV_ER4_829-R5_REDO Sampled By: CLIENT on 12-DEC-16 @ 09:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	1390		0.30	mg/L		14-DEC-16	R3617985
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	333	DLDS	0.50	mg/L		18-DEC-16	R3619485
Magnesium (Mg)-Total	215	DLDS	0.50	mg/L		18-DEC-16	R3619485
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		18-DEC-16	R3619485
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		18-DEC-16	R3619485
L1868903-2 EV_ER4_995-R5_REDO Sampled By: CLIENT on 12-DEC-16 @ 09:40 Matrix: WATER							
Miscellaneous Parameters							
Sulfate (SO4)	1400		0.30	mg/L		14-DEC-16	R3617985
Total Metals in Water by ICPOES							
Calcium (Ca)-Total	649	DLDS	0.50	mg/L		18-DEC-16	R3619485
Magnesium (Mg)-Total	48.5	DLDS	0.50	mg/L		18-DEC-16	R3619485
Potassium (K)-Total	<2.5	DLDS	2.5	mg/L		18-DEC-16	R3619485
Sodium (Na)-Total	<5.0	DLDS	5.0	mg/L		18-DEC-16	R3619485

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
MET-TOT-ICP-CL	Water	Total Metals in Water by ICPOES	APHA 3030E/EPA 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 a hotblock (APHA Method 3030E). Instrumental analysis is by inductively coupled plasma - optical emission spectrophotometry (EPA Method 6010B)			
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

*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
 mg/L - unit of concentration based on volume, parts per million.*

< - Less than.

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1868903

Report Date: 19-DEC-16

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: MADISON LEHTI

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-ICP-CL								
	Water							
Batch	R3617235							
WG2451492-2	LCS	TMRM						
Calcium (Ca)-Total			104.3		%		80-120	14-DEC-16
Magnesium (Mg)-Total			100.8		%		80-120	14-DEC-16
Potassium (K)-Total			108.4		%		80-120	14-DEC-16
Sodium (Na)-Total			105.4		%		80-120	14-DEC-16
WG2451492-1	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	14-DEC-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	14-DEC-16
Potassium (K)-Total			<0.50		mg/L		0.5	14-DEC-16
Sodium (Na)-Total			<1.0		mg/L		1	14-DEC-16
Batch	R3619485							
WG2451492-3	DUP	L1868903-1						
Calcium (Ca)-Total		333	318		mg/L	4.6	20	18-DEC-16
Magnesium (Mg)-Total		215	212		mg/L	1.5	20	18-DEC-16
Potassium (K)-Total		<2.5	<2.5	RPD-NA	mg/L	N/A	20	18-DEC-16
Sodium (Na)-Total		<5.0	<5.0	RPD-NA	mg/L	N/A	20	18-DEC-16
WG2451492-5	LCS	TMRM						
Calcium (Ca)-Total			108.7		%		80-120	18-DEC-16
Magnesium (Mg)-Total			100.9		%		80-120	18-DEC-16
Potassium (K)-Total			99.6		%		80-120	18-DEC-16
Sodium (Na)-Total			101.0		%		80-120	18-DEC-16
WG2451492-4	MB							
Calcium (Ca)-Total			<0.10		mg/L		0.1	18-DEC-16
Magnesium (Mg)-Total			<0.10		mg/L		0.1	18-DEC-16
Potassium (K)-Total			<0.50		mg/L		0.5	18-DEC-16
Sodium (Na)-Total			<1.0		mg/L		1	18-DEC-16
SO4-IC-N-CL								
	Water							
Batch	R3617985							
WG2452539-2	LCS							
Sulfate (SO4)			102.1		%		90-110	14-DEC-16
WG2452539-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	14-DEC-16

Quality Control Report

Workorder: L1868903

Report Date: 19-DEC-16

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



Nautilus Environmental
ATTN: MADISON LEHTI
#4, 6125 - 12 Street SE
Calgary AB T2H 2K1

Date Received: 05-DEC-16
Report Date: 04-JAN-17 16:57 (MT)
Version: FINAL REV. 2

Client Phone: 403-253-7121

Certificate of Analysis

Lab Work Order #: L1866237
Project P.O. #: 2016-1024
Job Reference: SP1617-015
C of C Numbers:
Legal Site Desc:

Comments: ADDITIONAL 28-DEC-16 14:03

28-DEC-16

Additional analysis: as per Madison Lehti, request for additional SO4-IC-N-CL analysis on -1 to -7

Nelson Kwan, B.Sc.
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 2559 29 Street NE, Calgary, AB T1Y 7B5 Canada | Phone: +1 403 291 9897 | Fax: +1 403 291 0298
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1866237-1 EV_ER4_400_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	528	DLHC	1.5	mg/L		31-DEC-16	R3627401
Total Dissolved Solids	860	DLHC	20	mg/L		06-DEC-16	R3612607
L1866237-2 EV_ER4_480_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	658	DLHC	1.5	mg/L		31-DEC-16	R3627401
Total Dissolved Solids	970	DLHC	40	mg/L		06-DEC-16	R3612607
L1866237-3 EV_ER4_576_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	766	DLHC	1.5	mg/L		31-DEC-16	R3627401
Total Dissolved Solids	1080	DLHC	40	mg/L		06-DEC-16	R3612607
L1866237-4 EV_ER4_691_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	983	DLHC	1.5	mg/L		31-DEC-16	R3627401
Total Dissolved Solids	1480	DLHC	40	mg/L		06-DEC-16	R3612607
L1866237-5 EV_ER4_829_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1100	DLHC	1.5	mg/L		31-DEC-16	R3627401
Total Dissolved Solids	1560	DLHC	40	mg/L		06-DEC-16	R3612607
L1866237-6 EV_ER4_995_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	1120	DLHC	1.5	mg/L		31-DEC-16	R3627401
Total Dissolved Solids	1590	DLHC	40	mg/L		06-DEC-16	R3612607
L1866237-7 EV_ER4_UNAMENDED W/COPPER_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	76.0	DLHC	1.5	mg/L		31-DEC-16	R3627401
Total Dissolved Solids	210	DLHC	20	mg/L		06-DEC-16	R3612607
L1866237-8 GH_FR1_400_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							
Sulfate (SO4)	444		0.30	mg/L		06-DEC-16	R3613232
L1866237-9 GH_FR1_480_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1866237-9 GH_FR1_480_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Sulfate (SO4)	554		0.30	mg/L		06-DEC-16	R3613232
L1866237-10 GH_FR1_576_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	686		0.30	mg/L		06-DEC-16	R3613232
L1866237-11 GH_FR1_691_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	859		0.30	mg/L		06-DEC-16	R3613232
L1866237-12 GH_FR1_829_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	998		0.30	mg/L		06-DEC-16	R3613232
L1866237-13 GH_FR1_995_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	1290	DLHC	1.5	mg/L		06-DEC-16	R3613232
L1866237-14 GH_FR1_UNAMENDED W/COPPER_TERM_5 Sampled By: CLIENT on 05-DEC-16 @ 10:40 Matrix: WATER Miscellaneous Parameters Sulfate (SO4)	218		0.30	mg/L		06-DEC-16	R3613232

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLHC	Detection Limit Raised: Dilution required due to high concentration of test analyte(s).
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**
SO4-IC-N-CL	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
SOLIDS-TDS-CL	Water	Total Dissolved Solids	APHA 2540 C
A well-mixed sample is filtered through a glass fibre filter paper. The filtrate is then evaporated to dryness in a pre-weighed vial and dried at 180 – 2 °C. The increase in vial weight represents the total dissolved solids (TDS).			

** 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
CL	ALS ENVIRONMENTAL - CALGARY, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

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
 mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

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.



Quality Control Report

Workorder: L1866237

Report Date: 04-JAN-17

Page 1 of 2

Client: Nautilus Environmental
 #4, 6125 - 12 Street SE
 Calgary AB T2H 2K1
 Contact: MADISON LEHTI

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SO4-IC-N-CL		Water						
Batch	R3613232							
WG2448409-2	LCS							
Sulfate (SO4)			101.7		%		90-110	06-DEC-16
WG2448409-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	06-DEC-16
Batch	R3627401							
WG2459738-2	LCS							
Sulfate (SO4)			99.1		%		90-110	31-DEC-16
WG2459738-1	MB							
Sulfate (SO4)			<0.30		mg/L		0.3	31-DEC-16
SOLIDS-TDS-CL		Water						
Batch	R3612607							
WG2446742-2	LCS							
Total Dissolved Solids			87.1		%		85-115	06-DEC-16
WG2446742-1	MB							
Total Dissolved Solids			<10		mg/L		10	06-DEC-16

Quality Control Report

Workorder: L1866237

Report Date: 04-JAN-17

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



L1866237-COFC

Report To		Report Format / Distribution		<input checked="" type="checkbox"/> STANDARDQC_ALS <input type="checkbox"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT <input type="checkbox"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT <input type="checkbox"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT	
Company: Nautilus Environmental (acct# 10253)		<input checked="" type="checkbox"/> STANDARDQC_ALS		<input type="checkbox"/> Business Days <input type="checkbox"/> Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT <input type="checkbox"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT <input type="checkbox"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT	
Contact: Madison Lehti		Email 1: madison@nautilusenvironmental.ca			
Address: #4, 6125 - 12 Street SE		Email 2: claudio@nautilusenvironmental.ca			
Calgary, AB T2H 2K1		Email 3:			
Phone: 403-253-7121 Fax:		Email 4:			

Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Client / Project Information		Analysis Request					
Hardcopy of invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		Job #: SP1617-015		Please indicate below Filtered, Preserved or both (F, P, F/P)					
Company:		PO / AFE: 2016-1024							
Contact: abaccounts@nautilusenvironmental.com		LSD:							
Address:		Quote #: Q59174							
Phone: Fax:									

Lab Work Order # (lab use only)	ALS Contact: Nelson Kwan	Sampler:	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (major cation)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL	SOLIDS-TDS-CL	MET-DIS-LOW-CL	MET-TOT-LOW-CL	Number of Containers
---------------------------------	--------------------------	----------	------------	------------	-------------------------------	-----------	------------	------------	-------------	---------------	----------------	----------------	----------------------

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (major cation)	N2N3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL	SOLIDS-TDS-CL	MET-DIS-LOW-CL	MET-TOT-LOW-CL	Number of Containers
EV_ER4_400_term_5		05-Dec-16	10:40	Water							<input checked="" type="checkbox"/>	X			1
EV_ER4_480_term_5		05-Dec-16		Water								X			1
EV_ER4_576_term_5		05-Dec-16		Water								X			1
EV_ER4_691_term_5		05-Dec-16		Water								X			1
EV_ER4_829_term_5		05-Dec-16		Water								X			1
EV_ER4_995_term_5		05-Dec-16		Water								X			1
EV_ER4_Unamended w/Copper_term_5		05-Dec-16		Water								X			1

Additional analysis as per Madison Lehti 28-DEC-16

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Note: for dissolved metals, if requested, please sub-sample and filter/preserve at lab (SFPL)

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes (No?) If Yes add SIF
			<i>JK</i>	05/12	3:05	5 °C				



Report To	Report Format / Distribution	<input checked="" type="checkbox"/> STANDARDQC_ALS <input type="checkbox"/> Routine analysis subject to availability) <input type="checkbox"/> 15 - Business Days) Surcharge - Contact ALS to Confirm TAT
Company: Nautilus Environmental (acctest# 10253)	<input checked="" type="checkbox"/> STANDARDQC_ALS	
Contact: Madison Lehti	Email 1: madison@nautilusenvironmental.ca	<input type="checkbox"/> Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT <input type="checkbox"/> Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Address: #4, 6125 - 12 Street SE Calgary, AB T2H 2K1	Email 2: claudio@nautilusenvironmental.ca Email 3:	
Phone: 403-253-7121 Fax:	Email 4:	

Invoice To Same as Report? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Hardcopy of Invoice with Report? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No	Client / Project Information Job #: SP1617-015 PO / AFE: 2016-1024 LSD: Quote #: Q59174	Analysis Request											
Please indicate below Filtered, Preserved or both (F, P, F/P)													

Lab Work Order # (lab use only)	ALS Contact: Nelson Kwan	Sampler:
---------------------------------	--------------------------	----------

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	ALK-TOT-CL	CL-IC-N-CL	MET-TOT-ICP-CL (major cation)	NP3-P-CL	NH3-COL-CL	P-T-COL-CL	SO4-IC-N-CL	SOLIDS-TDS-CL	MET-DIS-LOW-CL	MET-TOT-LOW-CL	Number of Containers
8	GH_FR1_400_term_5	05-Dec-16	10:40	Water							X				1
9	GH_FR1_480_term_5	05-Dec-16		Water							X				1
10	GH_FR1_576_term_5	05-Dec-16		Water							X				1
11	GH_FR1_691_term_5	05-Dec-16		Water							X				1
12	GH_FR1_829_term_5	05-Dec-16		Water							X				1
13	GH_FR1_995_term_5	05-Dec-16		Water							X				1
14	GH_FR1_Unamended w/Copper_term_5	05-Dec-16		Water							X				1

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Natural, etc) / Hazardous Details

Note: for dissolved metals, if requested, please sub-sample and filter/preserve at lab (SFPL)

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
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 Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes/No? If Yes add SIF
			<i>JK</i>	05/12	3:05 PM	5 °C				

Nelson Kwan



L1866237-COFC

From: Nelson Kwan
Sent: December-28-16 1:34 PM
To: 'Madison Lehti'
Cc: 'Claudio Quinteros'
Subject: RE: (NE/HQ) SP1617-015 Invoice and Sample Redo - L1866237 SO4 analysis

Hi Madison,

I have confirmed that those 7 samples we have sufficient volume. I will forward a request right away to proceed with additional analysis, on reg-TAT (unless otherwise noted by you).

Regards,

Nelson Kwan
Account Manager, Environmental (Calgary)

From: Nelson Kwan
Sent: December-28-16 11:28 AM
To: 'Madison Lehti'
Cc: Claudio Quinteros
Subject: RE: (NE/HQ) SP1617-015 Invoice and Sample Redo - L1866237 SO4 analysis

Hi Madison,

I attached the invoice copy for L1863286 in the previous email ☺ (invoice emails were previously requested to go directly to abaccounts@nautilusenvironmental.com , this was in effect a while back)

As for L1866237, for those first 7 samples, once we have confirmed that we have volume to run the test, we will proceed right away.

Nelson Kwan
Account Manager, Environmental (Calgary)

From: Madison Lehti [<mailto:madison@nautilusenvironmental.ca>]
Sent: December-28-16 10:48 AM
To: Nelson Kwan
Cc: Claudio Quinteros
Subject: RE: (NE/HQ) SP1617-015 Invoice and Sample Redo

Thanks Nelson!

Hope you had a great holiday! I'll look again for that invoice.

And if you do have enough sample to run sulfate for L1866237, only the 7 samples that had TDS need to be redone for sulfate instead. So the samples to be redone for sulfate are:

EV ER4 400 TERM 5

EV ER4 480 TERM 5

EV_ER4_576_TERM_5

EV_ER4_691_TERM_5

EV_ER4_829_TERM_5

EV_ER4_995_TERM_5

EV_ER4_UNAMENDED_W/COPPER_TERM_5



Thanks,

Maddy

Madison Lehti
Biologist
Nautilus Environmental
#4, 6125 - 12 Street SE, Calgary, AB, Canada, T2H 2K1
Phone: 403-253-7121
www.nautilusenvironmental.ca

On Dec 28, 2016 10:30, "Nelson Kwan" <Nelson.Kwan@alsglobal.com> wrote:

Good morning Madison,

Sorry for the delayed reply, I was not on-call this weekend.

According to my records, both the COA + invoice for L1863286 was emailed out Dec. 5th ~1:30PM

As for L1866237, received on Dec. 5th, we typically keep water samples in storage for a min. of 30 days, so we most likely still have the sample containers. If we have sufficient volume, we'll run SO4. I'll check with the lab and get back to you.

Nelson Kwan
Account Manager, Environmental (Calgary)

From: Madison Lehti [<mailto:madison@nautilusenvironmental.ca>]
Sent: December-24-16 3:00 PM
To: Nelson Kwan
Cc: Claudio Quinteros
Subject: SP1617-015 Invoice and Sample Redo

Hello Nelson,



L1866237-COFC

We are missing the invoice for L1863286 for the SP1617-015 project.

Also do you still have any of our water on file for the work requested under invoice L1866237, as the analysis on all 14 samples should have been total sulphate, not TDS. My fault.

If not I think I have some saved, so will resubmit that one for sulphate next week.

Thanks,

Maddy

--

Madison Lehti, B.Sc.
Biologist
Nautilus Environmental

#4, 6125 - 12 Street SE, Calgary, AB, Canada T2H 2K1
Phone: 403-253-7121

www.nautilusenvironmental.ca

Nautilus' 2016 Holiday Hours (for Sample Reception)

December 24, 2016 - 8 am - 12:00 pm*

December 25 & 26 2016 and January 2, 2017 – CLOSED*

***Samples may be accommodated beyond these times if pre-arranged with the laboratory**



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

Date Received: 03-NOV-16
Report Date: 17-NOV-16 20:01 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1853453
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1853453-1	L1853453-2	L1853453-3	L1853453-4	L1853453-5
		Description	Water	Water	Water	Water	Water
		Sampled Date	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16
		Sampled Time	14:30	14:30	14:30	14:30	14:30
		Client ID	RBT_EV_ER4_400 SO4_AR1	RBT_EV_ER4_480 SO4_AR1	RBT_EV_ER4_576 SO4_AR1	RBT_EV_ER4_691 SO4_AR1	RBT_EV_ER4_829 SO4_AR1
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)						
	Sulfate (SO4) (mg/L)	404	488	593	712	841	
Total Metals	Calcium (Ca)-Total (mg/L)	150	172	198	225	258	
	Magnesium (Mg)-Total (mg/L)	53.9	63.8	73.5	84.0	97.3	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1853453-6	L1853453-7	L1853453-8	L1853453-9	L1853453-10
		Description	Water	Water	Water	Water	Water
		Sampled Date	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16
		Sampled Time	14:30	14:30	14:30	14:30	14:30
		Client ID	RBT_EV_ER4_995 SO4_AR1	RBT_GH_FR1_400 SO4_AR1	RBT_GH_FR1_480 SO4_AR1	RBT_GH_FR1_576 SO4_AR1	RBT_GH_FR1_691 SO4_AR1
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)						
	Sulfate (SO4) (mg/L)		986	398	470	576	686
Total Metals	Calcium (Ca)-Total (mg/L)		296	148	171	191	225
	Magnesium (Mg)-Total (mg/L)		114	68.5	76.4	84.2	99.8

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1853453-11	L1853453-12	L1853453-13		
		Description	Water	Water	Water		
		Sampled Date	01-NOV-16	01-NOV-16	01-NOV-16		
		Sampled Time	14:30	14:30	14:30		
		Client ID	RBT_GH_FR1_829 SO4_AR1	RBT_GH_FR1_995 SO4_AR1	RBT_CONTROL		
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)				0.114		
	Sulfate (SO4) (mg/L)	841	984	0.89			
Total Metals	Calcium (Ca)-Total (mg/L)	257	278	3.25			
	Magnesium (Mg)-Total (mg/L)	110	128	0.18			

* 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	L1853453-1, -10, -11, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1853453-1, -10, -11, -13, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1853453-13
Matrix Spike	Nitrate (as N)	MS-B	L1853453-13
Matrix Spike	Nitrate (as N)	MS-B	L1853453-13

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**
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
<p>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).</p>			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			

** 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.



www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)												
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)												
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT												
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT												
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge												
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:												
		Email 2			Analysis Request												
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX															
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca															
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca															
Contact: Bonnie Lo																	
Project information		Oil and Gas Required Fields (client use)															
ALS Quote #:		Approver ID:			Cost Center:												
Job #:		GL Account:			Routing Code:												
PO / AFE:		Activity Code:															
LSD:		Location:															
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler: YYL/KL												
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)		Time (hh:mm)		Sample Type		Sulphate		Calcium & Magnesium		Number of Containers		
							1430										
		RBT_EV_ER4_400SO4_AR1			1-Nov-16				Water						2		
		RBT_EV_ER4_480SO4_AR1			1-Nov-16				Water						2		
		RBT_EV_ER4_576SO4_AR1			1-Nov-16				Water						2		
		RBT_EV_ER4_691SO4_AR1			1-Nov-16				Water						2		
		RBT_EV_ER4_829SO4_AR1			1-Nov-16				Water						2		
		RBT_EV_ER4_995SO4_AR1			1-Nov-16				Water						2		
		RBT_GH_FR1_400SO4_AR1			1-Nov-16				Water						2		
		RBT_GH_FR1_480SO4_AR1			1-Nov-16				Water						2		
		RBT_GH_FR1_576SO4_AR1			1-Nov-16				Water						2		
		RBT_GH_FR1_691SO4_AR1			1-Nov-16				Water						2		
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)									
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No				For Metals (with a dissolved lead and copper test) test for lead, copper, zinc, and manganese. BPL				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>									
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No								Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>									
								Cooling Initiated <input type="checkbox"/>									
								INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C					
												9/8C					
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)									
Released by: <i>[Signature]</i>		Date: Nov 3/16		Time: 17:45		Received by: <i>[Signature]</i>		Date: Nov. 3		Time: 6:55pm							

Short Holding Time
 Rush Processing



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

Date Received: 08-NOV-16
Report Date: 16-NOV-16 16:59 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1855260
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855260-1 Water 08-NOV-16 16:45 RBT_EV_ER4_UN SO4_W1	L1855260-2 Water 08-NOV-16 16:45 RBT_EV_ER4_400 SO4_W1	L1855260-3 Water 08-NOV-16 16:45 RBT_EV_ER4_480 SO4_W1	L1855260-4 Water 08-NOV-16 16:45 RBT_EV_ER4_576 SO4_W1	L1855260-5 Water 08-NOV-16 16:45 RBT_EV_ER4_691 SO4_W1
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	307	796	951	1080	1260
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	165	164	163	162	163
	Ammonia, Total (as N) (mg/L)	0.0104	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}	0.0060 ^{DLDS}	0.0183 ^{DLDS}
	Chloride (Cl) (mg/L)	2.48	<2.5	<2.5	<2.5	<2.5
	Nitrate (as N) (mg/L)	2.91	2.92	2.91	2.92	2.89
	Nitrite (as N) (mg/L)	0.0034	0.0071	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}
	Phosphorus (P)-Total (mg/L)	0.022	0.0092	0.0214	0.0152	0.0295
	Sulfate (SO4) (mg/L)	77.6	408	487	581	694
Total Metals	Aluminum (Al)-Total (mg/L)				0.0036	
	Antimony (Sb)-Total (mg/L)				<0.00010	
	Arsenic (As)-Total (mg/L)				0.00021	
	Barium (Ba)-Total (mg/L)				0.0673	
	Beryllium (Be)-Total (mg/L)				<0.00010	
	Bismuth (Bi)-Total (mg/L)				<0.000050	
	Boron (B)-Total (mg/L)				<0.010	
	Cadmium (Cd)-Total (mg/L)				0.0000212	
	Calcium (Ca)-Total (mg/L)	69.9	152	179	192	230
	Cesium (Cs)-Total (mg/L)				<0.000010	
	Chromium (Cr)-Total (mg/L)				0.00026	
	Cobalt (Co)-Total (mg/L)				<0.00010	
	Copper (Cu)-Total (mg/L)				<0.00050	
	Iron (Fe)-Total (mg/L)				<0.010	
	Lead (Pb)-Total (mg/L)				0.000207	
	Lithium (Li)-Total (mg/L)				0.0087	
	Magnesium (Mg)-Total (mg/L)	20.4	53.3	62.0	67.1	81.7
	Manganese (Mn)-Total (mg/L)				0.00035	
	Molybdenum (Mo)-Total (mg/L)				0.00121	
	Nickel (Ni)-Total (mg/L)				0.00131	
	Phosphorus (P)-Total (mg/L)				<0.050	
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	0.714	<2.0
	Rubidium (Rb)-Total (mg/L)				0.00034	
	Selenium (Se)-Total (mg/L)				0.0119	
	Silicon (Si)-Total (mg/L)				2.16	
	Silver (Ag)-Total (mg/L)				<0.000010	
	Sodium (Na)-Total (mg/L)	2.6	2.5	2.6	2.63	2.5
	Strontium (Sr)-Total (mg/L)				0.320	
	Sulfur (S)-Total (mg/L)				216	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1855260-6 Water 08-NOV-16 16:45 RBT_EV_ER4_829 SO4_W1	L1855260-7 Water 08-NOV-16 16:45 RBT_EV_ER4_995 SO4_W1	L1855260-8 Water 08-NOV-16 16:45 RBT_GH_FR1_UN SO4_W1	L1855260-9 Water 08-NOV-16 16:45 RBT_GH_FR1_400 SO4_W1	L1855260-10 Water 08-NOV-16 16:45 RBT_GH_FR1_480 SO4_W1
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)				
	1490	1730	611	921	1030
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)				
	166	165	193	198	193
	Ammonia, Total (as N) (mg/L)				
	<0.0050	0.0229	0.0633	0.0263	0.0270
	<5.0 ^{DLDS}	<5.0 ^{DLDS}	<2.5 ^{DLDS}	<2.5 ^{DLDS}	<2.5 ^{DLDS}
	Chloride (Cl) (mg/L)				
	<5.0	<5.0	<2.5	<2.5	<2.5
	Nitrate (as N) (mg/L)				
	2.90	2.91	9.70	9.74	9.67
	<0.010 ^{DLDS}	<0.010 ^{DLDS}	0.0053	<0.0050 ^{DLDS}	0.0069
	Nitrite (as N) (mg/L)				
	<0.010	<0.010	0.0053	<0.0050	0.0069
	Phosphorus (P)-Total (mg/L)				
	0.0548	0.0392	0.0750	0.0185	0.0375
	Sulfate (SO4) (mg/L)				
	835	997	224	405	483
Total Metals	Aluminum (Al)-Total (mg/L)				
		0.0034			
	Antimony (Sb)-Total (mg/L)				
		0.00014			
	Arsenic (As)-Total (mg/L)				
		0.00023			
	Barium (Ba)-Total (mg/L)				
		0.0698			
	Beryllium (Be)-Total (mg/L)				
		<0.00010			
	Bismuth (Bi)-Total (mg/L)				
		<0.000050			
	Boron (B)-Total (mg/L)				
		<0.010			
	Cadmium (Cd)-Total (mg/L)				
		0.0000286			
	Calcium (Ca)-Total (mg/L)				
	267	294	106	155	173
	Cesium (Cs)-Total (mg/L)				
		<0.000010			
	Chromium (Cr)-Total (mg/L)				
		0.00025			
	Cobalt (Co)-Total (mg/L)				
		<0.00010			
	Copper (Cu)-Total (mg/L)				
		0.00057			
	Iron (Fe)-Total (mg/L)				
		<0.010			
	Lead (Pb)-Total (mg/L)				
		0.000231			
	Lithium (Li)-Total (mg/L)				
		0.0088			
	Magnesium (Mg)-Total (mg/L)				
	95.6	104	48.0	66.7	72.8
	Manganese (Mn)-Total (mg/L)				
		0.00046			
	Molybdenum (Mo)-Total (mg/L)				
		0.00121			
	Nickel (Ni)-Total (mg/L)				
		0.00204			
	Phosphorus (P)-Total (mg/L)				
		0.054			
	Potassium (K)-Total (mg/L)				
	<2.0	0.794	<2.0	<2.0	<2.0
	Rubidium (Rb)-Total (mg/L)				
		0.00039			
	Selenium (Se)-Total (mg/L)				
		0.0128			
	Silicon (Si)-Total (mg/L)				
		2.10			
	Silver (Ag)-Total (mg/L)				
		<0.000010			
	Sodium (Na)-Total (mg/L)				
	2.5	2.64	2.4	2.4	2.4
	Strontium (Sr)-Total (mg/L)				
		0.378			
	Sulfur (S)-Total (mg/L)				
		381			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1855260-11 Water 08-NOV-16 16:45 RBT_GH_FR1_576 SO4_W1	L1855260-12 Water 08-NOV-16 16:45 RBT_GH_FR1_691 SO4_W1	L1855260-13 Water 08-NOV-16 16:45 RBT_GH_FR1_829 SO4_W1	L1855260-14 Water 08-NOV-16 16:45 RBT_EV_ER4_995 SO4_W1	L1855260-15 Water 08-NOV-16 16:45 RBT_GH_ER2_UN SO4_W1
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)				
	1170	1400	1590	1820	219
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)				
	192	191	195	196	148
	Ammonia, Total (as N) (mg/L)				
	0.0169	<0.0050 ^{DLDS}	0.0181 ^{DLDS}	0.0341 ^{DLDS}	0.0289
	Chloride (Cl) (mg/L)				
	<2.5 ^{DLDS}	<2.5 ^{DLDS}	<5.0 ^{DLDS}	<5.0 ^{DLDS}	1.03
	Nitrate (as N) (mg/L)				
	9.77	9.60	9.67 ^{DLDS}	9.73 ^{DLDS}	0.0838
	Nitrite (as N) (mg/L)				
	0.0078	0.0075	<0.010 ^{DLDS}	<0.010 ^{DLDS}	0.0042
	Phosphorus (P)-Total (mg/L)				
	0.0173	0.0258	0.0374	0.166	0.0115
	Sulfate (SO4) (mg/L)				
	588	696	847	1010	24.6
Total Metals	Aluminum (Al)-Total (mg/L)				
	<0.0030			<0.0030	
	Antimony (Sb)-Total (mg/L)				
	0.00027			0.00022	
	Arsenic (As)-Total (mg/L)				
	0.00015			0.00019	
	Barium (Ba)-Total (mg/L)				
	0.104			0.0988	
	Beryllium (Be)-Total (mg/L)				
	<0.00010			<0.00010	
	Bismuth (Bi)-Total (mg/L)				
	<0.000050			<0.000050	
	Boron (B)-Total (mg/L)				
	<0.010			<0.010	
	Cadmium (Cd)-Total (mg/L)				
	0.0000192			0.0000257	
	Calcium (Ca)-Total (mg/L)				
	188	227	264	297	51.3
	Cesium (Cs)-Total (mg/L)				
	<0.000010			<0.000010	
	Chromium (Cr)-Total (mg/L)				
	0.00017			0.00014	
	Cobalt (Co)-Total (mg/L)				
	<0.00010			<0.00010	
	Copper (Cu)-Total (mg/L)				
	<0.00050			0.00058	
	Iron (Fe)-Total (mg/L)				
	<0.010			<0.010	
	Lead (Pb)-Total (mg/L)				
	0.000066			0.000145	
	Lithium (Li)-Total (mg/L)				
	0.0175			0.0174	
	Magnesium (Mg)-Total (mg/L)				
	74.6	96.5	107	108	11.2
	Manganese (Mn)-Total (mg/L)				
	0.00042			0.00053	
	Molybdenum (Mo)-Total (mg/L)				
	0.00116			0.00113	
	Nickel (Ni)-Total (mg/L)				
	0.00304			0.00371	
	Phosphorus (P)-Total (mg/L)				
	<0.050			0.088	
	Potassium (K)-Total (mg/L)				
	1.40	<2.0	<2.0	1.53	<2.0
	Rubidium (Rb)-Total (mg/L)				
	0.00073			0.00087	
	Selenium (Se)-Total (mg/L)				
	0.0500			0.0531	
	Silicon (Si)-Total (mg/L)				
	2.35			2.35	
	Silver (Ag)-Total (mg/L)				
	<0.000010			<0.000010	
	Sodium (Na)-Total (mg/L)				
	2.47	2.4	2.3	2.38	<2.0
	Strontium (Sr)-Total (mg/L)				
	0.201			0.259	
	Sulfur (S)-Total (mg/L)				
	216			377	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1855260-1 Water 08-NOV-16 16:45 RBT_EV_ER4_UN SO4_W1	L1855260-2 Water 08-NOV-16 16:45 RBT_EV_ER4_400 SO4_W1	L1855260-3 Water 08-NOV-16 16:45 RBT_EV_ER4_480 SO4_W1	L1855260-4 Water 08-NOV-16 16:45 RBT_EV_ER4_576 SO4_W1	L1855260-5 Water 08-NOV-16 16:45 RBT_EV_ER4_691 SO4_W1
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)			<0.00020	
	Thallium (Tl)-Total (mg/L)			<0.000010	
	Thorium (Th)-Total (mg/L)			<0.00010	
	Tin (Sn)-Total (mg/L)			0.00016	
	Titanium (Ti)-Total (mg/L)			<0.00030	
	Tungsten (W)-Total (mg/L)			<0.00010	
	Uranium (U)-Total (mg/L)			0.00130	
	Vanadium (V)-Total (mg/L)			<0.00050	
	Zinc (Zn)-Total (mg/L)			0.0032	
	Zirconium (Zr)-Total (mg/L)			<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location			LAB	
	Aluminum (Al)-Dissolved (mg/L)			0.0015	
	Antimony (Sb)-Dissolved (mg/L)			<0.00010	
	Arsenic (As)-Dissolved (mg/L)			0.00015	
	Barium (Ba)-Dissolved (mg/L)			0.0676	
	Beryllium (Be)-Dissolved (mg/L)			<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)			<0.000050	
	Boron (B)-Dissolved (mg/L)			<0.010	
	Cadmium (Cd)-Dissolved (mg/L)			0.0000182	
	Calcium (Ca)-Dissolved (mg/L)			186	
	Cesium (Cs)-Dissolved (mg/L)			<0.000010	
	Chromium (Cr)-Dissolved (mg/L)			0.00015	
	Cobalt (Co)-Dissolved (mg/L)			<0.00010	
	Copper (Cu)-Dissolved (mg/L)			0.00038	
	Iron (Fe)-Dissolved (mg/L)			<0.010	
	Lead (Pb)-Dissolved (mg/L)			0.000091	
	Lithium (Li)-Dissolved (mg/L)			0.0085	
	Magnesium (Mg)-Dissolved (mg/L)			62.8	
	Manganese (Mn)-Dissolved (mg/L)			0.00017	
	Molybdenum (Mo)-Dissolved (mg/L)			0.00116	
	Nickel (Ni)-Dissolved (mg/L)			0.00119	
	Phosphorus (P)-Dissolved (mg/L)			<0.050	
	Potassium (K)-Dissolved (mg/L)			0.678	
	Rubidium (Rb)-Dissolved (mg/L)			0.00034	
	Selenium (Se)-Dissolved (mg/L)			0.0121	
	Silicon (Si)-Dissolved (mg/L)			1.96	
	Silver (Ag)-Dissolved (mg/L)			<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855260-6 Water 08-NOV-16 16:45 RBT_EV_ER4_829 SO4_W1	L1855260-7 Water 08-NOV-16 16:45 RBT_EV_ER4_995 SO4_W1	L1855260-8 Water 08-NOV-16 16:45 RBT_GH_FR1_UN SO4_W1	L1855260-9 Water 08-NOV-16 16:45 RBT_GH_FR1_400 SO4_W1	L1855260-10 Water 08-NOV-16 16:45 RBT_GH_FR1_480 SO4_W1
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)		<0.00020			
	Thallium (Tl)-Total (mg/L)		<0.000010			
	Thorium (Th)-Total (mg/L)		<0.00010			
	Tin (Sn)-Total (mg/L)		0.00019			
	Titanium (Ti)-Total (mg/L)		<0.00030			
	Tungsten (W)-Total (mg/L)		<0.00010			
	Uranium (U)-Total (mg/L)		0.00128			
	Vanadium (V)-Total (mg/L)		<0.00050			
	Zinc (Zn)-Total (mg/L)		0.0035			
	Zirconium (Zr)-Total (mg/L)		<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location		LAB			
	Aluminum (Al)-Dissolved (mg/L)		0.0022			
	Antimony (Sb)-Dissolved (mg/L)		<0.00010			
	Arsenic (As)-Dissolved (mg/L)		0.00017			
	Barium (Ba)-Dissolved (mg/L)		0.0675			
	Beryllium (Be)-Dissolved (mg/L)		<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050			
	Boron (B)-Dissolved (mg/L)		<0.010			
	Cadmium (Cd)-Dissolved (mg/L)		0.0000231			
	Calcium (Ca)-Dissolved (mg/L)		283			
	Cesium (Cs)-Dissolved (mg/L)		<0.000010			
	Chromium (Cr)-Dissolved (mg/L)		0.00021			
	Cobalt (Co)-Dissolved (mg/L)		<0.00010			
	Copper (Cu)-Dissolved (mg/L)		0.00048			
	Iron (Fe)-Dissolved (mg/L)		<0.010			
	Lead (Pb)-Dissolved (mg/L)		0.000197			
	Lithium (Li)-Dissolved (mg/L)		0.0085			
	Magnesium (Mg)-Dissolved (mg/L)		95.8			
	Manganese (Mn)-Dissolved (mg/L)		0.00034			
	Molybdenum (Mo)-Dissolved (mg/L)		0.00114			
	Nickel (Ni)-Dissolved (mg/L)		0.00188			
	Phosphorus (P)-Dissolved (mg/L)		<0.050			
	Potassium (K)-Dissolved (mg/L)		0.738			
	Rubidium (Rb)-Dissolved (mg/L)		0.00040			
	Selenium (Se)-Dissolved (mg/L)		0.0126			
	Silicon (Si)-Dissolved (mg/L)		1.94			
	Silver (Ag)-Dissolved (mg/L)		<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855260-11 Water 08-NOV-16 16:45 RBT_GH_FR1_576 SO4_W1	L1855260-12 Water 08-NOV-16 16:45 RBT_GH_FR1_691 SO4_W1	L1855260-13 Water 08-NOV-16 16:45 RBT_GH_FR1_829 SO4_W1	L1855260-14 Water 08-NOV-16 16:45 RBT_EV_ER4_995 SO4_W1	L1855260-15 Water 08-NOV-16 16:45 RBT_GH_ER2_UN SO4_W1
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			<0.00020	
	Thallium (Tl)-Total (mg/L)	<0.000010			<0.000010	
	Thorium (Th)-Total (mg/L)	<0.00010			<0.00010	
	Tin (Sn)-Total (mg/L)	0.00043			0.00011	
	Titanium (Ti)-Total (mg/L)	<0.00030			<0.00030	
	Tungsten (W)-Total (mg/L)	<0.00010			<0.00010	
	Uranium (U)-Total (mg/L)	0.00250			0.00250	
	Vanadium (V)-Total (mg/L)	<0.00050			<0.00050	
	Zinc (Zn)-Total (mg/L)	0.0035			<0.0030	
	Zirconium (Zr)-Total (mg/L)	<0.00030			<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location	LAB			LAB	
	Aluminum (Al)-Dissolved (mg/L)	0.0012			0.0011	
	Antimony (Sb)-Dissolved (mg/L)	0.00017			0.00016	
	Arsenic (As)-Dissolved (mg/L)	0.00010			0.00011	
	Barium (Ba)-Dissolved (mg/L)	0.0979			0.0968	
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			<0.000050	
	Boron (B)-Dissolved (mg/L)	<0.010			<0.010	
	Cadmium (Cd)-Dissolved (mg/L)	0.0000155			0.0000243	
	Calcium (Ca)-Dissolved (mg/L)	180			277	
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			<0.000010	
	Chromium (Cr)-Dissolved (mg/L)	<0.00010			<0.00010	
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			<0.00010	
	Copper (Cu)-Dissolved (mg/L)	0.00037			0.00047	
	Iron (Fe)-Dissolved (mg/L)	<0.010			<0.010	
	Lead (Pb)-Dissolved (mg/L)	<0.000050			0.000104	
	Lithium (Li)-Dissolved (mg/L)	0.0166			0.0162	
	Magnesium (Mg)-Dissolved (mg/L)	70.5			102	
	Manganese (Mn)-Dissolved (mg/L)	0.00024			0.00031	
	Molybdenum (Mo)-Dissolved (mg/L)	0.00105			0.00103	
	Nickel (Ni)-Dissolved (mg/L)	0.00286			0.00333	
	Phosphorus (P)-Dissolved (mg/L)	<0.050			0.070	
	Potassium (K)-Dissolved (mg/L)	1.33			1.45	
	Rubidium (Rb)-Dissolved (mg/L)	0.00067			0.00080	
	Selenium (Se)-Dissolved (mg/L)	0.0513			0.0517	
	Silicon (Si)-Dissolved (mg/L)	2.14			2.06	
	Silver (Ag)-Dissolved (mg/L)	<0.000010			<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1855260-1	L1855260-2	L1855260-3	L1855260-4	L1855260-5
					Water	Water	Water	Water	Water
		08-NOV-16	16:45		08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16
					16:45	16:45	16:45	16:45	16:45
					RBT_EV_ER4_UN SO4_W1	RBT_EV_ER4_400 SO4_W1	RBT_EV_ER4_480 SO4_W1	RBT_EV_ER4_576 SO4_W1	RBT_EV_ER4_691 SO4_W1
Grouping	Analyte								
WATER									
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)							2.47	
	Strontium (Sr)-Dissolved (mg/L)							0.312	
	Sulfur (S)-Dissolved (mg/L)							198	
	Tellurium (Te)-Dissolved (mg/L)							<0.00020	
	Thallium (Tl)-Dissolved (mg/L)							<0.000010	
	Thorium (Th)-Dissolved (mg/L)							<0.00010	
	Tin (Sn)-Dissolved (mg/L)							0.00016	
	Titanium (Ti)-Dissolved (mg/L)							<0.00030	
	Tungsten (W)-Dissolved (mg/L)							<0.00010	
	Uranium (U)-Dissolved (mg/L)							0.00125	
	Vanadium (V)-Dissolved (mg/L)							<0.00050	
	Zinc (Zn)-Dissolved (mg/L)							0.0024	
	Zirconium (Zr)-Dissolved (mg/L)							<0.00030	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855260-6 Water 08-NOV-16 16:45 RBT_EV_ER4_829 SO4_W1	L1855260-7 Water 08-NOV-16 16:45 RBT_EV_ER4_995 SO4_W1	L1855260-8 Water 08-NOV-16 16:45 RBT_GH_FR1_UN SO4_W1	L1855260-9 Water 08-NOV-16 16:45 RBT_GH_FR1_400 SO4_W1	L1855260-10 Water 08-NOV-16 16:45 RBT_GH_FR1_480 SO4_W1
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		2.45			
	Strontium (Sr)-Dissolved (mg/L)		0.368			
	Sulfur (S)-Dissolved (mg/L)		347			
	Tellurium (Te)-Dissolved (mg/L)		<0.00020			
	Thallium (Tl)-Dissolved (mg/L)		<0.000010			
	Thorium (Th)-Dissolved (mg/L)		<0.00010			
	Tin (Sn)-Dissolved (mg/L)		0.00021			
	Titanium (Ti)-Dissolved (mg/L)		<0.00030			
	Tungsten (W)-Dissolved (mg/L)		<0.00010			
	Uranium (U)-Dissolved (mg/L)		0.00123			
	Vanadium (V)-Dissolved (mg/L)		<0.00050			
	Zinc (Zn)-Dissolved (mg/L)		0.0029			
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855260-11	L1855260-12	L1855260-13	L1855260-14	L1855260-15
		Description	Water	Water	Water	Water	Water
		Sampled Date	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16
		Sampled Time	16:45	16:45	16:45	16:45	16:45
		Client ID	RBT_GH_FR1_576 SO4_W1	RBT_GH_FR1_691 SO4_W1	RBT_GH_FR1_829 SO4_W1	RBT_EV_ER4_995 SO4_W1	RBT_GH_ER2_UN SO4_W1
Grouping	Analyte						
WATER							
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		2.34			2.22	
	Strontium (Sr)-Dissolved (mg/L)		0.194			0.246	
	Sulfur (S)-Dissolved (mg/L)		197			334	
	Tellurium (Te)-Dissolved (mg/L)		<0.00020			<0.00020	
	Thallium (Tl)-Dissolved (mg/L)		<0.000010			<0.000010	
	Thorium (Th)-Dissolved (mg/L)		<0.00010			<0.00010	
	Tin (Sn)-Dissolved (mg/L)		0.00041			<0.00010	
	Titanium (Ti)-Dissolved (mg/L)		<0.00030			<0.00030	
	Tungsten (W)-Dissolved (mg/L)		<0.00010			<0.00010	
	Uranium (U)-Dissolved (mg/L)		0.00241			0.00232	
	Vanadium (V)-Dissolved (mg/L)		<0.00050			<0.00050	
	Zinc (Zn)-Dissolved (mg/L)		0.0017			0.0021	
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030			<0.00030	

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
LPML	Lab-Preserved for Total Metals. Sample received with pH > 2 and preserved at the lab. Total Metals results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1855260-11, -14, -4, -7
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1855260-11, -14, -4, -7
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1855260-11, -14, -4, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1855260-11, -14, -4, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1855260-11, -14, -4, -7
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1855260-11, -14, -4, -7
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855260-1, -10, -12, -13, -15, -2, -3, -5, -6, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855260-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855260-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855260-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855260-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855260-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Phosphorus (P)-Total	MS-B	L1855260-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this 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).			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et			

Reference Information

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NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.



Chain of Custody (COC) / Analytical Request Form



L1855260-COFC

COC Number: 14 -

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Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input checked="" type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P: <u>Nov 14/2016</u>																																																																										
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca			Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																										
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:			<table border="1"> <thead> <tr> <th>Total metals, low level</th> <th>Dissolved metals-low level</th> <th>Chloride</th> <th>Sulphate</th> <th>Alkalinity</th> <th>Nitrate</th> <th>Nitrite</th> <th>Ammonia</th> <th>Phosphorus</th> <th>Total Dissolved Solids</th> <th>Calcium & Magnesium</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>1</td> </tr> <tr> <td>✓</td> <td>✓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>1</td> </tr> <tr> <td></td> <td></td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>1</td> </tr> </tbody> </table>							Total metals, low level	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers			✓	✓	✓	✓	✓	✓	✓	✓	✓	1	✓	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1			↓	↓	↓	↓	↓	↓	↓	↓	↓	1																				
Total metals, low level	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers																																																																				
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ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie Sampler:			<table border="1"> <thead> <tr> <th>ALS Sample # (lab use only)</th> <th>Sample Identification and/or Coordinates (This description will appear on the report)</th> <th>Date (dd-mmm-yy)</th> <th>Time (hh:mm)</th> <th>Sample Type</th> <th>Total metals, low level</th> <th>Dissolved metals-low level</th> <th>Chloride</th> <th>Sulphate</th> <th>Alkalinity</th> <th>Nitrate</th> <th>Nitrite</th> <th>Ammonia</th> <th>Phosphorus</th> <th>Total Dissolved Solids</th> <th>Calcium & Magnesium</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td></td> <td>RBT_GH_FR1_829SO4_w2</td> <td>8-Nov-16</td> <td>15:30</td> <td>Water</td> <td></td> <td></td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>✓</td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_995SO4_w2</td> <td>8-Nov-16</td> <td></td> <td>Water</td> <td>✓</td> <td>✓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>1</td> </tr> <tr> <td></td> <td>RBT_GH_ER2_unSO4_w2</td> <td>8-Nov-16</td> <td></td> <td>Water</td> <td></td> <td></td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>↓</td> <td>1</td> </tr> </tbody> </table>							ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals, low level	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers		RBT_GH_FR1_829SO4_w2	8-Nov-16	15:30	Water			✓	✓	✓	✓	✓	✓	✓	✓	✓	1		RBT_EV_ER4_995SO4_w2	8-Nov-16		Water	✓	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	1		RBT_GH_ER2_unSO4_w2	8-Nov-16		Water			↓	↓	↓	↓	↓	↓	↓	↓	↓	1
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Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) For metals (total & dissolved)-low level analysis please <u>Results Nov 14/2016</u>			SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: <u>15/15/17</u>																																																																										
SHIPMENT RELEASE (client use) Released by: <u>[Signature]</u> Date: <u>Nov 8/2016</u> Time: <u>17:30</u>		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____			FINAL SHIPMENT RECEPTION (lab use only) Received by: <u>SF</u> Date: <u>Nov 8</u> Time: <u>3:50 PM</u>																																																																										

Priority processing
RUSH



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

Date Received: 10-NOV-16
Report Date: 18-NOV-16 17:01 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1856738
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1856738-1	L1856738-2	L1856738-3	L1856738-4	L1856738-5
		Description	WATER	WATER	WATER	WATER	WATER
		Sampled Date	09-NOV-16	09-NOV-16	09-NOV-16	09-NOV-16	09-NOV-16
		Sampled Time	13:30	13:30	13:30	13:30	13:30
		Client ID	RBT_EV_ER4_UN_AR2	RBT_EV_ER4_400_SO4_AR2	RBT_EV_ER4_480_SO4_AR2	RBT_EV_ER4_576_SO4_AR2	RBT_EV_ER4_691_SO4_AR2
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	2.87					
	Sulfate (SO4) (mg/L)	75.3	400	471	576	690	
Total Metals	Calcium (Ca)-Total (mg/L)	67.9	153	171	200	232	
	Magnesium (Mg)-Total (mg/L)	21.1	55.0	61.2	72.8	84.9	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1856738-6 WATER 09-NOV-16 13:30 RBT_EV_ER4_829 SO4_AR2	L1856738-7 WATER 09-NOV-16 13:30 RBT_EV_ER4_995 SO4_AR2	L1856738-8 WATER 09-NOV-16 13:30 RBT_GH_FR1_UN _AR2	L1856738-9 WATER 09-NOV-16 13:30 RBT_GH_FR1_400 SO4_AR2	L1856738-10 WATER 09-NOV-16 13:30 RBT_GH_FR1_480 SO4_AR2
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)			9.45		
	Sulfate (SO4) (mg/L)	817	996	217	388	474
Total Metals	Calcium (Ca)-Total (mg/L)	259	304	104	149	171
	Magnesium (Mg)-Total (mg/L)	98.1	114	49.9	67.0	76.4

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID		L1856738-11 WATER 09-NOV-16 13:30 RBT_GH_FR1_576 SO4_AR2	L1856738-12 WATER 09-NOV-16 13:30 RBT_GH_FR1_691 SO4_AR2	L1856738-13 WATER 09-NOV-16 13:30 RBT_GH_FR1_829 SO4_AR2	L1856738-14 WATER 09-NOV-16 13:30 RBT_GH_FR1_995 SO4_AR2	L1856738-15 WATER 09-NOV-16 13:30 RBT_GH_ER2_UN _AR2
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)					0.104
	Sulfate (SO4) (mg/L)	564	696	822	994	25.2
Total Metals	Calcium (Ca)-Total (mg/L)	193	228	259	304	51.7
	Magnesium (Mg)-Total (mg/L)	86.1	97.7	112	130	12.0

* 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	L1856738-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1856738-8
Matrix Spike	Nitrate (as N)	MS-B	L1856738-8
Matrix Spike	Sulfate (SO4)	MS-B	L1856738-10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Sulfate (SO4)	MS-B	L1856738-10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -9

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**
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
<p>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).</p>			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			

** 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
ATTN: Bonnie Lo
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 18-NOV-16
Report Date: 29-NOV-16 17:41 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1860115
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1860115-1	L1860115-2	L1860115-3	L1860115-4	L1860115-5
		Description	WATER	WATER	WATER	WATER	WATER
		Sampled Date	16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16
		Sampled Time	13:00	13:00	13:00	13:00	13:00
		Client ID	RBT_EV_ER4_UN_AR3	RBT_EV_ER4_400_SO4_AR3	RBT_EV_ER4_480_SO4_AR3	RBT_EV_ER4_576_SO4_AR3	RBT_EV_ER4_691_SO4_AR3
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	3.04					
	Sulfate (SO4) (mg/L)	77.7	410	486	606	723	
Total Metals	Calcium (Ca)-Total (mg/L)	67.5	151	172	201	228	
	Magnesium (Mg)-Total (mg/L)	20.4	51.6	61.3	70.2	82.4	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1860115-6	L1860115-7	L1860115-8	L1860115-9	L1860115-10
		Description	WATER	WATER	WATER	WATER	WATER
		Sampled Date	16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16
		Sampled Time	13:00	13:00	13:00	13:00	13:00
		Client ID	RBT_EV_ER4_829 SO4_AR3	RBT_EV_ER4_995 SO4_AR3	RBT_GH_FR1_UN _AR3	RBT_GH_FR1_400 SO4_AR3	RBT_GH_FR1_480 SO4_AR3
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)				357		
	Sulfate (SO4) (mg/L)	825	1040	221	403	476	
Total Metals	Calcium (Ca)-Total (mg/L)	252	302	105	152	175	
	Magnesium (Mg)-Total (mg/L)	95.5	109	48.0	66.2	74.6	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1860115-11	L1860115-12	L1860115-13	L1860115-14	L1860115-16
		Description	WATER	WATER	WATER	WATER	
		Sampled Date	16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16	
		Sampled Time	13:00	13:00	13:00	13:00	
		Client ID	RBT_GH_FR1_576 SO4_AR3	RBT_GH_FR1_691 SO4_AR3	RBT_GH_FR1_829 SO4_AR3	RBT_GH_FR1_995 SO4_AR3	RBT_GH_ER2_UN _AR3
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)						0.0777
	Sulfate (SO4) (mg/L)		564	678	811	1010	21.3
Total Metals	Calcium (Ca)-Total (mg/L)		196	226	253	302	54.0
	Magnesium (Mg)-Total (mg/L)		82.9	93.9	107	124	11.3

* 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)
Method Blank	Calcium (Ca)-Total	B	L1860115-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -9
Method Blank	Magnesium (Mg)-Total	B	L1860115-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Calcium (Ca)-Total	MS-B	L1860115-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1860115-1, -10, -11, -12, -13, -14, -2, -3, -4, -5, -6, -7, -9
Matrix Spike	Nitrate (as N)	MS-B	L1860115-1, -8
Matrix Spike	Nitrate (as N)	MS-B	L1860115-1, -8

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
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**
MET-TOT-ICP-VA	Water	Total Metals in Water by ICPOES	EPA SW-846 3005A/6010B
<p>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).</p>			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
<p>Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.</p>			

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Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

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mg/kg - milligrams per kilogram based on dry weight of sample.

mg/kg wwt - milligrams per kilogram based on wet weight of sample.

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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.

Short Holding Time / Analytical
Rush Processing

668 9878



Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:	
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		Calcium & Magnesium Sulphate Nitrate	
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie Sampler: YYL/KL		Number of Containers	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	
	RBT-EV-ERY-UN-AR3	Nov 16/16	1300	water	2
	RBT-EV-ERY-400504-AR3				
	RBT-EV-ERY-480504-AR3				
	RBT-EV-ERY-576504-AR3				
	RBT-EV-ERY-691504-AR3				
	RBT-EV-ERY-829504-AR3				
	RBT-EV-ERY-995504-AR3				
	RBT-GH-FR1-UN-AR3				
	RBT-GH-FR1-400504-AR3				
	RBT-GH-FR1-480504-AR3				
	RBT-GH-FR1-576504-AR3				
	RBT-GH-FR1-691504-AR3				
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use)		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C: 7	
SHIPMENT RELEASE (client use) Released by: [Signature] Date: Nov 18/16 Time: 1130		INITIAL SHIPMENT RECEPTION (lab use only) Received by: Date: Time:		FINAL SHIPMENT RECEPTION (lab use only) Received by: [Signature] Date: NOV 18 Date: Time: 11:35AM	



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1860115-COFC

COC Number: 14 -

Page 2 of 2

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Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:	
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		Number of Containers	
ALS Lab Work Order # (lab use only):		ALS Contact: Heather McKenzie Sampler: YYL/KL		Calcium + Magnesium Sulfate Nitrate	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Number of Containers
	RBT_GH_FR1_829504-AR3	NOV 16/16	1300	Water	2
	RBT_GH_FR1_995504-AR3	↓	↓	↓	2
	RBT_GH_FR1-un-AR3	↓	↓	↓	2

Short Holding Time
 0 Rush Processing

Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use)		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 7	
SHIPMENT RELEASE (client use) Released by: [Signature] Date: Nov 18/16 Time: 1130		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____		FINAL SHIPMENT RECEPTION (lab use only) Received by: JC Date: NOV 16 2016 Time: 11:35 AM	



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

Date Received: 25-NOV-16
Report Date: 06-DEC-16 17:55 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1862905
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1862905-1	L1862905-2	L1862905-3	L1862905-4	L1862905-5
		Description	WATER	WATER	WATER	WATER	WATER
		Sampled Date	23-NOV-16	23-NOV-16	23-NOV-16	23-NOV-16	23-NOV-16
		Sampled Time	13:00	13:00	13:00	13:00	13:00
		Client ID	RBT_EV_ER4_UN_AR3	RBT_EV_ER4_400_SO4_AR4	RBT_EV_ER4_480_SO4_AR4	RBT_EV_ER4_576_SO4_AR4	RBT_EV_ER4_691_SO4_AR4
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	2.87					
	Sulfate (SO4) (mg/L)	74.2	411	465	561	681	
Total Metals	Calcium (Ca)-Total (mg/L)	66.9	150	170	194	223	
	Magnesium (Mg)-Total (mg/L)	20.8	53.7	60.1	71.0	82.9	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862905-6 WATER 23-NOV-16 13:00 RBT_EV_ER4_829 SO4_AR4	L1862905-7 WATER 23-NOV-16 13:00 RBT_GH_FR1_UN _AR4	L1862905-8 WATER 23-NOV-16 13:00 RBT_GH_FR1_400 SO4_AR4	L1862905-9 WATER 23-NOV-16 13:00 RBT_GH_FR1_480 SO4_AR4	L1862905-10 WATER 23-NOV-16 13:00 RBT_GH_FR1_576 SO4_AR4
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)		9.74			
	Sulfate (SO4) (mg/L)	816	217	396	480	564
Total Metals	Calcium (Ca)-Total (mg/L)	252	104	150	172	193
	Magnesium (Mg)-Total (mg/L)	93.4	48.3	66.5	74.6	81.9

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862905-11 WATER 23-NOV-16 13:00 RBT_GH_FR1_691 SO4_AR4	L1862905-12 WATER 23-NOV-16 13:00 RBT_GH_FR1_829 SO4_AR4	L1862905-13 WATER 23-NOV-16 13:00 RBT_GH_FR1_995 SO4_AR4	L1862905-14 WATER 23-NOV-16 13:00 RBT_GH_ER2_UN _AR4	L1862905-15 WATER 23-NOV-16 13:00 RBT_EV_ER4_995 SO4_AR4
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)				0.0908	
	Sulfate (SO4) (mg/L)	662	825	1010	22.3	1010
Total Metals	Calcium (Ca)-Total (mg/L)	220	259	292	50.3	308
	Magnesium (Mg)-Total (mg/L)	93.9	108	119	11.4	113

* 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	L1862905-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1862905-1, -14, -7
Matrix Spike	Nitrate (as N)	MS-B	L1862905-1, -14, -7

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**
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).
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level) Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)
SO4-IC-N-VA	Water	Sulfate in Water by IC Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)

** 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
ATTN: Bonnie Lo
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 02-DEC-16
Report Date: 09-DEC-16 18:14 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1865796
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1865796-6	L1865796-7	L1865796-8	L1865796-9	L1865796-10
					WATER	WATER	WATER	WATER	WATER
		29-NOV-16	10:00		29-NOV-16	29-NOV-16	29-NOV-16	29-NOV-16	29-NOV-16
					10:00	10:00	10:00	10:00	10:00
					RBT_EV_ER4_829	RBT_EV_ER4_995	GH_FR1_UN_TER	RBT_GH_FR1_400	RBT_GH_FR1_480
					SO4_TERM	SO4_TERM	M	SO4_TERM	SO4_TERM
Grouping	Analyte								
WATER									
Anions and Nutrients	Sulfate (SO4) (mg/L)				827	1020	220	404	488

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1865796-11 WATER 29-NOV-16 10:00 RBT_GH_FR1_576 SO4_TERM	L1865796-12 WATER 29-NOV-16 10:00 RBT_GH_FR1_691 SO4_TERM	L1865796-13 WATER 29-NOV-16 10:00 RBT_GH_FR1_829 SO4_TERM	L1865796-14 WATER 29-NOV-16 10:00 RBT_GH_FR1_995 SO4_TERM	L1865796-15 WATER 29-NOV-16 10:00 RBT_GH_ER2_UN _TERM
Grouping	Analyte					
WATER						
Anions and Nutrients	Sulfate (SO4) (mg/L)	568	690	849	998	23.4

* 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	Sulfate (SO4)	MS-B	L1865796-1, -10, -11, -12, -13, -14, -15, -2, -3, -4, -5, -6, -7, -8, -9

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**
SO4-IC-N-VA	Water	Sulfate in Water by IC Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.	EPA 300.1 (mod)

** 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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1865796-COFC

COC Number: 14 -

Page 1 of 2

www.alsglobal.com

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)												
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)												
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT												
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT												
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge												
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:												
		Email 2			Analysis Request												
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX															
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca															
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca															
Contact: Bonnie Lo																	
Project Information		Oil and Gas Required Fields (client use)															
ALS Quote #:		Approver ID:															
Job #:		GL Account:															
PO / AFE:		Activity Code:															
LSD:		Location:															
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler: KL/YL												
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Number of Containers										
	RBT-EV-ER4-un-term			Nov 29/16	1000h	water	1										
	RBT-EV-ER4-400504-term																
	RBT-EV-ER4-480504-term																
	RBT-EV-ER4-576504-term																
	RBT-EV-ER4-691504-term																
	RBT-EV-ER4-829504-term																
	RBT-EV-ER4-995504-term																
	GH-FRI-un-term																
	RBT-GH-FRI-400504-term																
	RBT-GH-FRI-480504-term																
	RBT-GH-FRI-576504-term																
	RBT-GH-FRI-691504-term																
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)															
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		[Redacted]															
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No																	
		SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			SAMPLE CONDITION AS RECEIVED (lab use only)									
Released by: [Signature]		Date: Dec 01/16	Time: 1400h	Received by:	Date:	Time:	Frozen <input type="checkbox"/>	SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>	Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/>	Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>	Cooling Initiated <input type="checkbox"/>	INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C				
													6°C				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326a-009 Form 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1865796-COFC

COC Number: 14 -

Page 2 of 2

www.alsglobal.com

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:												
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca			Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:			Cost Center: Routing Code: ALS Contact: Heather McKenzie Sampler: KL/YL			Number of Containers									
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie Sampler: KL/YL			Number of Containers												
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Number of Containers										
	RBT-GH-FR1-829504-term			Nov 29/16	1000h	Water	1										
	RBT-GH-FR1-995504-term			↓	↓	↓	↓										
	RBT-GH-ER2-un-term			↓	↓	↓	↓										
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) _____			SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations: Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs: Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact: Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 6°C												
SHIPMENT RELEASE (client use) Released by: _____ Date: Dec 01/16 Time: 1400h		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____			FINAL SHIPMENT RECEPTION (lab use only) Received by: ST Date: Dec Time: 3pm												

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0226a-105 Form 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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

Date Received: 03-NOV-16
Report Date: 17-NOV-16 19:38 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1853450
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1853450-1	L1853450-2	L1853450-3	L1853450-4	L1853450-5
					Water	Water	Water	Water	Water
					01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16	01-NOV-16
					14:30	14:30	14:30	14:30	14:30
					RBT_EV_ER4_5N O3_AR1	RBT_EV_ER4_9N O3_AR1	RBT_EV_ER4_15N O3_AR1	RBT_EV_ER4_25N O3_AR1	RBT_EV_ER4_43N O3_AR1
Grouping	Analyte								
WATER									
Anions and Nutrients	Nitrate (as N) (mg/L)				5.07	9.07	15.2	26.0 ^{HTD}	44.3

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853450-6 Water 01-NOV-16 14:30 RBT_EV_ER4_72N O3_AR1	L1853450-7 Water 01-NOV-16 14:30 RBT_GH_FR1_14N O3_AR1	L1853450-8 Water 01-NOV-16 14:30 RBT_GH_FR1_20N O3_AR1	L1853450-9 Water 01-NOV-16 14:30 RBT_GH_FR1_27N O3_AR1	L1853450-10 Water 01-NOV-16 14:30 RBT_GH_FR1_38N O3_AR1
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	72.3	14.1	20.3	28.1	38.6

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853450-11 Water 01-NOV-16 14:30 RBT_GH_FR1_54N O3_AR1	L1853450-12 Water 01-NOV-16 14:30 RBT_GH_FR1_75N O3_AR1	L1853450-13 Water 01-NOV-16 14:30 RBT_GH_FR1HH_ 15NO3_AR1	L1853450-14 Water 01-NOV-16 14:30 RBT_GH_FR1HH_ 23NO3_AR1	L1853450-15 Water 01-NOV-16 14:30 RBT_GH_FR1HH_ 34NO3_AR1
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	55.5	75.7	15.4	23.8	33.9

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853450-16 Water 01-NOV-16 14:30 RBT_GH_FR1HH_51NO3_AR1	L1853450-17 Water 01-NOV-16 14:30 RBT_GH_FR1HH_76NO3_AR1	L1853450-18 Water 01-NOV-16 14:30 RBT_GH_FR1HH_114NO3_AR1	L1853450-19 Water 01-NOV-16 14:30 RBT_GH_ER2_3NO3_AR1	L1853450-20 Water 01-NOV-16 14:30 RBT_GH_ER2_5NO3_AR1
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	51.1	75.3	109	3.01	5.05

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853450-21 Water 01-NOV-16 14:30 RBT_GH_ER2_9N O3_AR1	L1853450-22 Water 01-NOV-16 14:30 RBT_GH_ER2_15 NO3_AR1	L1853450-23 Water 01-NOV-16 14:30 RBT_GH_ER2_25 NO3_AR1	L1853450-24 Water 01-NOV-16 14:30 RBT_GH_ER2_43 NO3_AR1
Grouping	Analyte				
WATER					
Anions and Nutrients	Nitrate (as N) (mg/L)	8.97	14.7	25.2 ^{HTD}	43.2 ^{HTD}

* 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	Nitrate (as N)	MS-B	L1853450-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -3, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1853450-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -3, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1853450-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -3, -5, -6, -7, -8, -9

Qualifiers for Individual Parameters Listed:

Qualifier	Description
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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.



Chain of Custody (COC) / Analytical Request Form



L1853450-COFC

COC Number: 14 -

Page 1 of 3

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Canada Toll Free: 1 800 668 9878

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: _____ Email 2: _____			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P: _____																																																																																																																																																																											
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca			Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																																																																																																																											
Project Information ALS Quote #: _____ Job #: _____ PO / AFE: _____ LSD: _____		Oil and Gas Required Fields (client use) Approver ID: _____ Cost Center: _____ GL Account: _____ Routing Code: _____ Activity Code: _____ Location: _____			<table border="1"> <tr> <th>ALS Lab Work Order # (lab use only)</th> <th>ALS Contact: Heather McKenzie</th> <th>Sampler: YXL/KL</th> <th colspan="2"></th> <th rowspan="10">Nitrate</th> <th colspan="5"></th> <th rowspan="10">Number of Containers</th> </tr> <tr> <th>ALS Sample # (lab use only)</th> <th>Sample Identification and/or Coordinates (This description will appear on the report)</th> <th>Date (dd-mmm-yy)</th> <th>Time (hh:mm)</th> <th>Sample Type</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> </tr> <tr> <td></td> <td></td> <td></td> <td>1430</td> <td>water</td> <td><input checked="" type="checkbox"/></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_5NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_9NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_15NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_25NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_43NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_72NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_EV_ER4_9NO3_AR2</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_GH_FR1_14 NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_GH_FR1_20NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_GH_FR1_27NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> <tr> <td></td> <td>RBT_GH_FR1_38NO3_AR1</td> <td>Nov 1 2016</td> <td></td> <td>water</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>1</td> </tr> </table>					ALS Lab Work Order # (lab use only)	ALS Contact: Heather McKenzie	Sampler: YXL/KL			Nitrate						Number of Containers	ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type										1430	water	<input checked="" type="checkbox"/>						1		RBT_EV_ER4_5NO3_AR1	Nov 1 2016		water							1		RBT_EV_ER4_9NO3_AR1	Nov 1 2016		water							1		RBT_EV_ER4_15NO3_AR1	Nov 1 2016		water							1		RBT_EV_ER4_25NO3_AR1	Nov 1 2016		water							1		RBT_EV_ER4_43NO3_AR1	Nov 1 2016		water							1		RBT_EV_ER4_72NO3_AR1	Nov 1 2016		water							1		RBT_EV_ER4_9NO3_AR2	Nov 1 2016		water							1		RBT_GH_FR1_14 NO3_AR1	Nov 1 2016		water							1		RBT_GH_FR1_20NO3_AR1	Nov 1 2016		water							1		RBT_GH_FR1_27NO3_AR1	Nov 1 2016		water							1		RBT_GH_FR1_38NO3_AR1	Nov 1 2016		water							1
ALS Lab Work Order # (lab use only)	ALS Contact: Heather McKenzie	Sampler: YXL/KL								Nitrate						Number of Containers																																																																																																																																																																
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Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) _____ _____			SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 9/8 ✓																																																																																																																																																																											
SHIPMENT RELEASE (client use) Released by: _____ Date: Nov 3/16 Time: 7:45		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____			FINAL SHIPMENT RECEPTION (lab use only) Received by: lady Date: Nov 3 Time: 6:55 PM																																																																																																																																																																											

Short Holding Time
 Rush Processing



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1853450-COFC

COC Number: 14 -

Page 2 of 3

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Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)										
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)										
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT										
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT										
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge										
		Email 1 or Fax			Specify Date Required for E2, E or P:										
		Email 2			Analysis Request										
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below										
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX													
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca													
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca													
Contact: Bonnie Lo															
Project Information		Oil and Gas Required Fields (client use)													
ALS Quote #:		Approver ID:			Cost Center:										
Job #:		GL Account:			Routing Code:										
PO / AFE:		Activity Code:													
LSD:		Location:													
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler: YXL/KL										
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Nitrate							Number of Containers	
	RBT_GH_FR1_54NO3_AR1			Nov 1 2016	1436	water	<input checked="" type="checkbox"/>								1
	RBT_GH_FR1_75NO3_AR1			Nov 1 2016		water									1
	XXXXXXXXXXXXXXXXXXXX			2016		water									1
	RBT_GH_FR1HH_15 NO3_AR1			Nov 1 2016		water									1
	RBT_GH_FR1HH_23NO3_AR1			Nov 1 2016		water									1
	RBT_GH_FR1HH_34NO3_AR1			Nov 1 2016		water									1
	RBT_GH_FR1HH_51NO3_AR1			Nov 1 2016		water									1
	RBT_GH_FR1HH_76NO3_AR1			Nov 1 2016		water									1
	RBT_GH_FR1HH_114NO3_AR1			Nov 1 2016		water									1
				Nov 1 2016		water								1	
				Nov 1 2016		water								1	
				Nov 1 2016		water								1	
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)							
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No								Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>							
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No								Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>							
								Cooling Initiated <input type="checkbox"/>							
								INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
												9/8 C			
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)							
Released by: <i>[Signature]</i>		Date: Nov 3/16	Time: 1945	Received by:		Date:	Time:	Received by: <i>[Signature]</i>		Date: Nov 3	Time: 6:55 Pm				

Short Holding Time
Rush Processing

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0226-08 Rev 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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

Date Received: 03-NOV-16
Report Date: 17-NOV-16 19:52 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1853452
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID				
	L1853452-1 Water 01-NOV-16 14:30 GH_FR1_HH_AR1	L1853452-2 Water 01-NOV-16 14:30 RBTCD_GH_ER2_UN_AR1	L1853452-3 Water 01-NOV-16 14:30 RBTCD_EV_ER4_UN_AR1	L1853452-4 Water 01-NOV-16 14:30 RBTCD_GH_FR1_UN_AR1	
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	980			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	192			
	Ammonia, Total (as N) (mg/L)	<0.0050 ^{DLDS}			
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}			
	Nitrate (as N) (mg/L)	10.2	0.0740	2.93	9.71
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}			
	Phosphorus (P)-Total (mg/L)	0.0116			
	Sulfate (SO4) (mg/L)	498	23.7	78.1	222
Total Metals	Aluminum (Al)-Total (mg/L)	0.0061			
	Antimony (Sb)-Total (mg/L)	0.00019			
	Arsenic (As)-Total (mg/L)	0.00012			
	Barium (Ba)-Total (mg/L)	0.101			
	Beryllium (Be)-Total (mg/L)	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.000050			
	Boron (B)-Total (mg/L)	<0.010			
	Cadmium (Cd)-Total (mg/L)	0.0000181			
	Calcium (Ca)-Total (mg/L)	164	48.1	65.5	101
	Cesium (Cs)-Total (mg/L)	<0.000010			
	Chromium (Cr)-Total (mg/L)	0.00013			
	Cobalt (Co)-Total (mg/L)	<0.00010			
	Copper (Cu)-Total (mg/L)	<0.00050			
	Iron (Fe)-Total (mg/L)	0.011			
	Lead (Pb)-Total (mg/L)	0.000101			
	Lithium (Li)-Total (mg/L)	0.0184			
	Magnesium (Mg)-Total (mg/L)	72.7	11.4	20.6	47.4
	Manganese (Mn)-Total (mg/L)	0.00121			
	Molybdenum (Mo)-Total (mg/L)	0.00115			
	Nickel (Ni)-Total (mg/L)	0.00310			
	Phosphorus (P)-Total (mg/L)	<0.050			
	Potassium (K)-Total (mg/L)	1.25			
	Rubidium (Rb)-Total (mg/L)	0.00061			
	Selenium (Se)-Total (mg/L)	0.0478			
	Silicon (Si)-Total (mg/L)	2.19			
	Silver (Ag)-Total (mg/L)	<0.000010			
	Sodium (Na)-Total (mg/L)	2.02			
	Strontium (Sr)-Total (mg/L)	0.183			
	Sulfur (S)-Total (mg/L)	167			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853452-1 Water 01-NOV-16 14:30 GH_FR1_HH_AR1	L1853452-2 Water 01-NOV-16 14:30 RBTCD_GH_ER2_UN_AR1	L1853452-3 Water 01-NOV-16 14:30 RBTCD_EV_ER4_UN_AR1	L1853452-4 Water 01-NOV-16 14:30 RBTCD_GH_FR1_UN_AR1
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			
	Thallium (Tl)-Total (mg/L)	<0.00010			
	Thorium (Th)-Total (mg/L)	<0.00010			
	Tin (Sn)-Total (mg/L)	0.00030			
	Titanium (Ti)-Total (mg/L)	<0.00030			
	Tungsten (W)-Total (mg/L)	<0.00010			
	Uranium (U)-Total (mg/L)	0.00248			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0030			
	Zirconium (Zr)-Total (mg/L)	<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location	LAB			
	Aluminum (Al)-Dissolved (mg/L)	0.0015			
	Antimony (Sb)-Dissolved (mg/L)	0.00017			
	Arsenic (As)-Dissolved (mg/L)	<0.00010			
	Barium (Ba)-Dissolved (mg/L)	0.101			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000136			
	Calcium (Ca)-Dissolved (mg/L)	164			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			
	Chromium (Cr)-Dissolved (mg/L)	<0.00010			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	0.00023			
	Iron (Fe)-Dissolved (mg/L)	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0172			
	Magnesium (Mg)-Dissolved (mg/L)	70.3			
	Manganese (Mn)-Dissolved (mg/L)	0.00069			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00107			
	Nickel (Ni)-Dissolved (mg/L)	0.00302			
	Phosphorus (P)-Dissolved (mg/L)	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.24			
	Rubidium (Rb)-Dissolved (mg/L)	0.00061			
	Selenium (Se)-Dissolved (mg/L)	0.0495			
	Silicon (Si)-Dissolved (mg/L)	2.02			
	Silver (Ag)-Dissolved (mg/L)	<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1853452-1 Water 01-NOV-16 14:30 GH_FR1_HH_AR1	L1853452-2 Water 01-NOV-16 14:30 RBTCD_GH_ER2_UN_AR1	L1853452-3 Water 01-NOV-16 14:30 RBTCD_EV_ER4_UN_AR1	L1853452-4 Water 01-NOV-16 14:30 RBTCD_GH_FR1_UN_AR1
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	1.97			
	Strontium (Sr)-Dissolved (mg/L)	0.180			
	Sulfur (S)-Dissolved (mg/L)	151			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	0.00028			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030			
	Tungsten (W)-Dissolved (mg/L)	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.00240			
	Vanadium (V)-Dissolved (mg/L)	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0015			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030			

* 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)-Dissolved	MS-B	L1853452-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1853452-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1853452-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1853452-1
Matrix Spike	Nitrate (as N)	MS-B	L1853452-1, -2, -3, -4
Matrix Spike	Nitrate (as N)	MS-B	L1853452-1, -2, -3, -4
Matrix Spike	Nitrate (as N)	MS-B	L1853452-1, -2, -3, -4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.			

Reference Information

** 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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1853452-COFC

COC Number: 14 -

Page 1 of 1

www.alsglobal.com

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8864 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:																																																																								
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca			Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																																																								
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:			Cost Center: Routing Code:			<table border="1"> <thead> <tr> <th>Total metals, low level (preserved)</th> <th>Dissolved metals-low level</th> <th>Chloride</th> <th>Sulphate</th> <th>Alkalinity</th> <th>Nitrate</th> <th>Nitrite</th> <th>Ammonia</th> <th>Phosphorus</th> <th>Total Dissolved Solids</th> <th>Calcium & Magnesium</th> <th>Number of Containers</th> </tr> </thead> <tbody> <tr> <td>✓</td> <td></td> <td>3</td> </tr> <tr> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td>✓</td> <td>2</td> </tr> <tr> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td>✓</td> <td>2</td> </tr> <tr> <td></td> <td></td> <td></td> <td>✓</td> <td></td> <td>✓</td> <td></td> <td></td> <td></td> <td></td> <td>✓</td> <td>2</td> </tr> </tbody> </table>										Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		3				✓		✓					✓	2				✓		✓					✓	2				✓		✓					✓	2
Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers																																																																		
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ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie Sampler:			<table border="1"> <thead> <tr> <th>ALS Sample # (lab use only)</th> <th>Sample Identification and/or Coordinates (This description will appear on the report)</th> <th>Date (dd-mmm-yy)</th> <th>Time (hh:mm)</th> <th>Sample Type</th> </tr> </thead> <tbody> <tr> <td></td> <td>GH-FR1-HH-AR1</td> <td>1-Nov-16</td> <td>1430</td> <td>Water</td> </tr> <tr> <td></td> <td>RBT Cd - GH-ER2-UN-AR1</td> <td>1-Nov-16</td> <td>↓</td> <td>Water</td> </tr> <tr> <td></td> <td>ABT Cd - EV-ER4-UN-AR1</td> <td>1-Nov-16</td> <td>↓</td> <td>Water</td> </tr> <tr> <td></td> <td>RBT Cd - GH-FR1-UN-AR1</td> <td>1-Nov-16</td> <td>↓</td> <td>Water</td> </tr> </tbody> </table>								ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type		GH-FR1-HH-AR1	1-Nov-16	1430	Water		RBT Cd - GH-ER2-UN-AR1	1-Nov-16	↓	Water		ABT Cd - EV-ER4-UN-AR1	1-Nov-16	↓	Water		RBT Cd - GH-FR1-UN-AR1	1-Nov-16	↓	Water																																								
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Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) For metals (total & dissolved)-low level analysis please			SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 9/5°C																																																																								
SHIPMENT RELEASE (client use) Released by: <i>Bonnie</i> Date: Nov 3/2016 Time: 17:45		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____			FINAL SHIPMENT RECEPTION (lab use only) Received by: <i>Lady</i> Date: Nov 3 Time: 6:55 PM																																																																								

Short Holding Time
Rush Processing

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-74-0326 v06 Form 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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

Date Received: 08-NOV-16
Report Date: 15-NOV-16 19:50 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1855259
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

15-NOV-16 19:50 (MT)

Version: FINAL

Sample ID Description Sampled Date Sampled Time Client ID	L1855259-1 Water 08-NOV-16 16:30 RBT_EV_ER4_UN NO3_W1	L1855259-2 Water 08-NOV-16 16:30 RBT_EV_ER4_5N O3_W1	L1855259-3 Water 08-NOV-16 16:30 RBT_EV_ER4_9N O3_W1	L1855259-4 Water 08-NOV-16 16:30 RBT_EV_ER4_15N O3_W1	L1855259-5 Water 08-NOV-16 16:30 RBT_EV_ER4_25N O3_W1	
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	312	323	342	375	439
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	170	169	171	168	169
	Ammonia, Total (as N) (mg/L)	0.0077	<0.0050	0.0133	0.0124	0.0126
	Chloride (Cl) (mg/L)	2.58	2.59	2.51	2.47	2.53
	Nitrate (as N) (mg/L)	2.93	5.17	9.21	15.1	26.6 ^{HTD}
	Nitrite (as N) (mg/L)	0.0026	0.0030	0.0027	0.0032	0.0037
	Phosphorus (P)-Total (mg/L)	0.0149	0.0128	0.0224	0.021	0.0201
	Sulfate (SO4) (mg/L)	77.3	77.6	77.6	77.7	77.9
Total Metals	Aluminum (Al)-Total (mg/L)				0.0045	
	Antimony (Sb)-Total (mg/L)				<0.00010	
	Arsenic (As)-Total (mg/L)				0.00018	
	Barium (Ba)-Total (mg/L)				0.0695	
	Beryllium (Be)-Total (mg/L)				<0.00010	
	Bismuth (Bi)-Total (mg/L)				<0.000050	
	Boron (B)-Total (mg/L)				<0.010	
	Cadmium (Cd)-Total (mg/L)				0.0000105	
	Calcium (Ca)-Total (mg/L)	64.3	66.8	67.0	62.3	65.8
	Cesium (Cs)-Total (mg/L)				<0.000010	
	Chromium (Cr)-Total (mg/L)				0.00023	
	Cobalt (Co)-Total (mg/L)				<0.00010	
	Copper (Cu)-Total (mg/L)				<0.00050	
	Iron (Fe)-Total (mg/L)				<0.010	
	Lead (Pb)-Total (mg/L)				<0.000050	
	Lithium (Li)-Total (mg/L)				0.0083	
	Magnesium (Mg)-Total (mg/L)	19.5	20.3	20.5	18.7	20.2
	Manganese (Mn)-Total (mg/L)				0.00036	
	Molybdenum (Mo)-Total (mg/L)				0.00108	
	Nickel (Ni)-Total (mg/L)				<0.00050	
	Phosphorus (P)-Total (mg/L)				<0.050	
	Potassium (K)-Total (mg/L)	<2.0	<2.0	<2.0	0.697	<2.0
	Rubidium (Rb)-Total (mg/L)				0.00031	
	Selenium (Se)-Total (mg/L)				0.00987	
	Silicon (Si)-Total (mg/L)				1.99	
	Silver (Ag)-Total (mg/L)				<0.000010	
	Sodium (Na)-Total (mg/L)	2.7	6.6	14.1	23.0	44.4
	Strontium (Sr)-Total (mg/L)				0.232	
	Sulfur (S)-Total (mg/L)				26.0	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855259-6	L1855259-7	L1855259-8	L1855259-9	L1855259-10
		Description	Water	Water	Water	Water	Water
		Sampled Date	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16
		Sampled Time	16:30	16:30	16:30	16:30	16:30
		Client ID	RBT_EV_ER4_43N O3_W1	RBT_EV_ER4_72N O3_W1	RBT_GH_FR1_UN NO3_W1	RBT_GH_FR1_14N O3_W1	RBT_GH_FR1_20N O3_W1
Grouping	Analyte						
WATER							
Physical Tests	Total Dissolved Solids (mg/L)		536	731	570	580	642
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)		172	170	200	198	201
	Ammonia, Total (as N) (mg/L)		<0.0050	0.0100	0.0154 ^{DLDS}	0.0197 ^{DLDS}	0.0199 ^{DLDS}
	Chloride (Cl) (mg/L)		2.5	2.6	<2.5	<2.5	<2.5
	Nitrate (as N) (mg/L)		42.9	74.0	9.83	14.3	20.2
	Nitrite (as N) (mg/L)		<0.0050 ^{DLDS}	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}	0.0056
	Phosphorus (P)-Total (mg/L)		0.0171	0.0162	0.0166	0.0202	0.0148
	Sulfate (SO4) (mg/L)		77.8	77.7	222	221	222
Total Metals	Aluminum (Al)-Total (mg/L)			0.0037			
	Antimony (Sb)-Total (mg/L)			<0.00010			
	Arsenic (As)-Total (mg/L)			0.00017			
	Barium (Ba)-Total (mg/L)			0.0714			
	Beryllium (Be)-Total (mg/L)			<0.00010			
	Bismuth (Bi)-Total (mg/L)			<0.000050			
	Boron (B)-Total (mg/L)			<0.010			
	Cadmium (Cd)-Total (mg/L)			0.0000115			
	Calcium (Ca)-Total (mg/L)		66.2	65.5	102	101	101
	Cesium (Cs)-Total (mg/L)			<0.000010			
	Chromium (Cr)-Total (mg/L)			0.00024			
	Cobalt (Co)-Total (mg/L)			<0.00010			
	Copper (Cu)-Total (mg/L)			<0.00050			
	Iron (Fe)-Total (mg/L)			<0.010			
	Lead (Pb)-Total (mg/L)			<0.000050			
	Lithium (Li)-Total (mg/L)			0.0088			
	Magnesium (Mg)-Total (mg/L)		20.5	19.7	49.1	48.5	48.7
	Manganese (Mn)-Total (mg/L)			0.00034			
	Molybdenum (Mo)-Total (mg/L)			0.00116			
	Nickel (Ni)-Total (mg/L)			<0.00050			
	Phosphorus (P)-Total (mg/L)			<0.050			
	Potassium (K)-Total (mg/L)		<2.0	0.730	<2.0	<2.0	<2.0
	Rubidium (Rb)-Total (mg/L)			0.00032			
	Selenium (Se)-Total (mg/L)			0.0101			
	Silicon (Si)-Total (mg/L)			2.17			
	Silver (Ag)-Total (mg/L)			<0.000010			
	Sodium (Na)-Total (mg/L)		74.0	125	2.8	10.8	21.4
	Strontium (Sr)-Total (mg/L)			0.242			
	Sulfur (S)-Total (mg/L)			28.4			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-11 Water 08-NOV-16 16:30 RBT_GH_FR1_27N O3_W1	L1855259-12 Water 08-NOV-16 16:30 RBT_GH_FR1_38N O3_W1	L1855259-13 Water 08-NOV-16 16:30 RBT_GH_FR1_54N O3_W1	L1855259-14 Water 08-NOV-16 16:30 RBT_GH_FR1_75N O3_W1	L1855259-15 Water 08-NOV-16 16:30 RBT_GH_FR1HH_ UNNO3_W1
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	673	747	859	964	984
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	200	204	203	200	202
	Ammonia, Total (as N) (mg/L)	0.0268	0.0194	0.0185	0.0297	0.0147
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}				
	Nitrate (as N) (mg/L)	28.0	38.7	53.8	71.3	9.45
	Nitrite (as N) (mg/L)	0.0054	0.0053	<0.0050 ^{DLDS}	<0.0050 ^{DLDS}	0.0062
	Phosphorus (P)-Total (mg/L)	0.0241	0.0239	0.0241	0.0194	0.0112
	Sulfate (SO4) (mg/L)	223	222	222	221	459
	Total Metals	Aluminum (Al)-Total (mg/L)	0.0062			0.0048
	Antimony (Sb)-Total (mg/L)	0.00018			0.00019	
	Arsenic (As)-Total (mg/L)	0.00013			0.00012	
	Barium (Ba)-Total (mg/L)	0.104			0.103	
	Beryllium (Be)-Total (mg/L)	<0.00010			<0.00010	
	Bismuth (Bi)-Total (mg/L)	<0.000050			<0.000050	
	Boron (B)-Total (mg/L)	<0.010			<0.010	
	Cadmium (Cd)-Total (mg/L)	0.0000173			0.0000137	
	Calcium (Ca)-Total (mg/L)	100	103	103	98.1	164
	Cesium (Cs)-Total (mg/L)	<0.000010			<0.000010	
	Chromium (Cr)-Total (mg/L)	0.00015			0.00014	
	Cobalt (Co)-Total (mg/L)	<0.00010			<0.00010	
	Copper (Cu)-Total (mg/L)	<0.00050			<0.00050	
	Iron (Fe)-Total (mg/L)	<0.010			<0.010	
	Lead (Pb)-Total (mg/L)	<0.000050			<0.000050	
	Lithium (Li)-Total (mg/L)	0.0171			0.0167	
	Magnesium (Mg)-Total (mg/L)	44.8	50.1	48.1	45.3	73.2
	Manganese (Mn)-Total (mg/L)	0.00057			0.00062	
	Molybdenum (Mo)-Total (mg/L)	0.00108			0.00103	
	Nickel (Ni)-Total (mg/L)	0.00241			0.00229	
	Phosphorus (P)-Total (mg/L)	<0.050			<0.050	
	Potassium (K)-Total (mg/L)	1.42	<2.0	<2.0	1.41	<2.0
	Rubidium (Rb)-Total (mg/L)	0.00069			0.00062	
	Selenium (Se)-Total (mg/L)	0.0434			0.0409	
	Silicon (Si)-Total (mg/L)	2.26			2.24	
	Silver (Ag)-Total (mg/L)	<0.000010			<0.000010	
	Sodium (Na)-Total (mg/L)	33.0	51.4	77.7	108	2.6
	Strontium (Sr)-Total (mg/L)	0.148			0.144	
	Sulfur (S)-Total (mg/L)	78.5			75.6	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-16 Water 08-NOV-16 16:30 RBT_GH_FR1HH_15NO3_W1	L1855259-17 Water 08-NOV-16 16:30 RBT_GH_FR1HH_23NO3_W1	L1855259-18 Water 08-NOV-16 16:30 RBT_GH_FR1HH_34NO3_W1	L1855259-19 Water 08-NOV-16 16:30 RBT_GH_FR1HH_51NO3_W1	L1855259-20 Water 08-NOV-16 16:30 RBT_GH_FR1HH_76NO3_W1
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	980	1010	1100	1190	1340
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	205	204	203	204	204
	Ammonia, Total (as N) (mg/L)	0.0198	0.0176	0.0158	0.0207	0.0315
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}	<2.5 ^{DLDS}	<2.5 ^{DLDS}	<2.5 ^{DLDS}	<5.0 ^{DLDS}
	Nitrate (as N) (mg/L)	15.1	21.9	36.5	52.1	77.3
	Nitrite (as N) (mg/L)	0.0054	0.0056	0.0059	<0.0050 ^{DLDS}	<0.010 ^{DLDS}
	Phosphorus (P)-Total (mg/L)	0.0145	0.0139	0.0196	0.0177	0.0090
	Sulfate (SO4) (mg/L)	473	468	477	470	478
Total Metals	Aluminum (Al)-Total (mg/L)			0.0031		
	Antimony (Sb)-Total (mg/L)			0.00019		
	Arsenic (As)-Total (mg/L)			0.00015		
	Barium (Ba)-Total (mg/L)			0.103		
	Beryllium (Be)-Total (mg/L)			<0.00010		
	Bismuth (Bi)-Total (mg/L)			<0.000050		
	Boron (B)-Total (mg/L)			<0.010		
	Cadmium (Cd)-Total (mg/L)			0.0000173		
	Calcium (Ca)-Total (mg/L)	167	165	156	167	166
	Cesium (Cs)-Total (mg/L)			<0.000010		
	Chromium (Cr)-Total (mg/L)			0.00014		
	Cobalt (Co)-Total (mg/L)			<0.00010		
	Copper (Cu)-Total (mg/L)			<0.00050		
	Iron (Fe)-Total (mg/L)			<0.010		
	Lead (Pb)-Total (mg/L)			<0.000050		
	Lithium (Li)-Total (mg/L)			0.0165		
	Magnesium (Mg)-Total (mg/L)	74.0	73.7	68.2	74.5	72.0
	Manganese (Mn)-Total (mg/L)			0.00060		
	Molybdenum (Mo)-Total (mg/L)			0.00105		
	Nickel (Ni)-Total (mg/L)			0.00277		
	Phosphorus (P)-Total (mg/L)			<0.050		
	Potassium (K)-Total (mg/L)	<2.0	<2.0	1.41	<2.0	<2.0
	Rubidium (Rb)-Total (mg/L)			0.00070		
	Selenium (Se)-Total (mg/L)			0.0437		
	Silicon (Si)-Total (mg/L)			2.16		
	Silver (Ag)-Total (mg/L)			<0.000010		
	Sodium (Na)-Total (mg/L)	12.2	23.9	46.6	74.1	114
	Strontium (Sr)-Total (mg/L)			0.175		
	Sulfur (S)-Total (mg/L)			160		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-21 Water 08-NOV-16 16:30 RBT_GH_FR1HH_114NO3_W1	L1855259-22 Water 08-NOV-16 16:30 RBT_GH_ER2_UNNO3_W1	L1855259-23 Water 08-NOV-16 16:30 RBT_GH_ER2_3NO3_W1	L1855259-24 Water 08-NOV-16 16:30 RBT_GH_ER2_5NO3_W1	L1855259-25 Water 08-NOV-16 16:30 RBT_GH_ER2_9NO3_W1
Grouping	Analyte					
WATER						
Physical Tests	Total Dissolved Solids (mg/L)	1560	198	212	227	234
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	195	148	146	145	147
	Ammonia, Total (as N) (mg/L)	0.0134	0.0218	0.0151	0.0194	0.0068
	Chloride (Cl) (mg/L)	<5.0 ^{DLDS}	0.79	0.98	0.95	0.97
	Nitrate (as N) (mg/L)	107	0.0949	3.17	5.04	8.95
	Nitrite (as N) (mg/L)	<0.010 ^{DLDS}	0.0019	0.0035	0.0028	0.0038
	Phosphorus (P)-Total (mg/L)	0.0189	0.0117	0.0147	0.0119	0.0068
	Sulfate (SO4) (mg/L)	484	23.7	23.6	23.6	23.6
Total Metals	Aluminum (Al)-Total (mg/L)	0.0044				0.0038
	Antimony (Sb)-Total (mg/L)	0.00018				<0.00010
	Arsenic (As)-Total (mg/L)	0.00016				0.00013
	Barium (Ba)-Total (mg/L)	0.103				0.0462
	Beryllium (Be)-Total (mg/L)	<0.00010				<0.00010
	Bismuth (Bi)-Total (mg/L)	<0.000050				<0.000050
	Boron (B)-Total (mg/L)	<0.010				<0.010
	Cadmium (Cd)-Total (mg/L)	0.0000204				0.0000052
	Calcium (Ca)-Total (mg/L)	156	50.3	50.0	49.6	45.5
	Cesium (Cs)-Total (mg/L)	<0.000010				<0.000010
	Chromium (Cr)-Total (mg/L)	0.00014				0.00023
	Cobalt (Co)-Total (mg/L)	<0.00010				<0.00010
	Copper (Cu)-Total (mg/L)	<0.00050				<0.00050
	Iron (Fe)-Total (mg/L)	<0.010				<0.010
	Lead (Pb)-Total (mg/L)	0.000053				<0.000050
	Lithium (Li)-Total (mg/L)	0.0162				0.0018
	Magnesium (Mg)-Total (mg/L)	67.4	11.2	11.0	11.0	10.5
	Manganese (Mn)-Total (mg/L)	0.00061				0.00027
	Molybdenum (Mo)-Total (mg/L)	0.00104				0.000951
	Nickel (Ni)-Total (mg/L)	0.00283				<0.00050
	Phosphorus (P)-Total (mg/L)	<0.050				<0.050
	Potassium (K)-Total (mg/L)	1.47	<2.0	<2.0	<2.0	0.443
	Rubidium (Rb)-Total (mg/L)	0.00068				<0.00020
	Selenium (Se)-Total (mg/L)	0.0450				0.000892
	Silicon (Si)-Total (mg/L)	2.25				1.78
	Silver (Ag)-Total (mg/L)	<0.000010				<0.000010
	Sodium (Na)-Total (mg/L)	160	<2.0	6.8	9.9	15.5
	Strontium (Sr)-Total (mg/L)	0.173				0.221
	Sulfur (S)-Total (mg/L)	167				7.81

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-26 Water 08-NOV-16 16:30 RBT_GH_ER2_15 NO3_W1	L1855259-27 Water 08-NOV-16 16:30 RBT_GH_ER2_25 NO3_W1	L1855259-28 Water 08-NOV-16 16:30 RBT_GH_ER2_43 NO3_W1	
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	282	346	465	
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	147	146	146	
	Ammonia, Total (as N) (mg/L)	0.0136	0.0112	<0.0050	
	Chloride (Cl) (mg/L)	0.98	0.91	1.02	
	Nitrate (as N) (mg/L)	14.8	25.8 ^{HTD}	44.4 ^{HTD}	
	Nitrite (as N) (mg/L)	0.0037	0.0037	0.0037	
	Phosphorus (P)-Total (mg/L)	0.0169	0.0073	0.0265	
	Sulfate (SO4) (mg/L)	23.8	23.8	23.7	
Total Metals	Aluminum (Al)-Total (mg/L)			0.0048	
	Antimony (Sb)-Total (mg/L)			<0.00010	
	Arsenic (As)-Total (mg/L)			0.00013	
	Barium (Ba)-Total (mg/L)			0.0468	
	Beryllium (Be)-Total (mg/L)			<0.00010	
	Bismuth (Bi)-Total (mg/L)			<0.000050	
	Boron (B)-Total (mg/L)			<0.010	
	Cadmium (Cd)-Total (mg/L)			0.0000113	
	Calcium (Ca)-Total (mg/L)	50.1	50.4	47.7	
	Cesium (Cs)-Total (mg/L)			0.000011	
	Chromium (Cr)-Total (mg/L)			0.00027	
	Cobalt (Co)-Total (mg/L)			<0.00010	
	Copper (Cu)-Total (mg/L)			<0.00050	
	Iron (Fe)-Total (mg/L)			<0.010	
	Lead (Pb)-Total (mg/L)			<0.000050	
	Lithium (Li)-Total (mg/L)			0.0019	
	Magnesium (Mg)-Total (mg/L)	11.0	11.0	11.3	
	Manganese (Mn)-Total (mg/L)			0.00041	
	Molybdenum (Mo)-Total (mg/L)			0.00108	
	Nickel (Ni)-Total (mg/L)			<0.00050	
	Phosphorus (P)-Total (mg/L)			<0.050	
	Potassium (K)-Total (mg/L)	<2.0	<2.0	0.444	
	Rubidium (Rb)-Total (mg/L)			<0.00020	
	Selenium (Se)-Total (mg/L)			0.000910	
	Silicon (Si)-Total (mg/L)			1.87	
	Silver (Ag)-Total (mg/L)			<0.000010	
	Sodium (Na)-Total (mg/L)	26.8	45.4	76.1	
	Strontium (Sr)-Total (mg/L)			0.238	
	Sulfur (S)-Total (mg/L)			8.18	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-1 Water 08-NOV-16 16:30 RBT_EV_ER4_UN NO3_W1	L1855259-2 Water 08-NOV-16 16:30 RBT_EV_ER4_5N O3_W1	L1855259-3 Water 08-NOV-16 16:30 RBT_EV_ER4_9N O3_W1	L1855259-4 Water 08-NOV-16 16:30 RBT_EV_ER4_15N O3_W1	L1855259-5 Water 08-NOV-16 16:30 RBT_EV_ER4_25N O3_W1
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)				<0.00020	
	Thallium (Tl)-Total (mg/L)				<0.000010	
	Thorium (Th)-Total (mg/L)				<0.00010	
	Tin (Sn)-Total (mg/L)				0.00227	
	Titanium (Ti)-Total (mg/L)				<0.00030	
	Tungsten (W)-Total (mg/L)				<0.00010	
	Uranium (U)-Total (mg/L)				0.00119	
	Vanadium (V)-Total (mg/L)				<0.00050	
	Zinc (Zn)-Total (mg/L)				<0.0030	
	Zirconium (Zr)-Total (mg/L)				<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location				LAB	
	Aluminum (Al)-Dissolved (mg/L)				0.0015	
	Antimony (Sb)-Dissolved (mg/L)				<0.00010	
	Arsenic (As)-Dissolved (mg/L)				0.00016	
	Barium (Ba)-Dissolved (mg/L)				0.0697	
	Beryllium (Be)-Dissolved (mg/L)				<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)				<0.000050	
	Boron (B)-Dissolved (mg/L)				<0.010	
	Cadmium (Cd)-Dissolved (mg/L)				0.0000064	
	Calcium (Ca)-Dissolved (mg/L)				62.9	
	Cesium (Cs)-Dissolved (mg/L)				<0.000010	
	Chromium (Cr)-Dissolved (mg/L)				0.00020	
	Cobalt (Co)-Dissolved (mg/L)				<0.00010	
	Copper (Cu)-Dissolved (mg/L)				0.00027	
	Iron (Fe)-Dissolved (mg/L)				<0.010	
	Lead (Pb)-Dissolved (mg/L)				<0.000050	
	Lithium (Li)-Dissolved (mg/L)				0.0083	
	Magnesium (Mg)-Dissolved (mg/L)				18.6	
	Manganese (Mn)-Dissolved (mg/L)				0.00010	
	Molybdenum (Mo)-Dissolved (mg/L)				0.00109	
	Nickel (Ni)-Dissolved (mg/L)				<0.00050	
	Phosphorus (P)-Dissolved (mg/L)				<0.050	
	Potassium (K)-Dissolved (mg/L)				0.702	
	Rubidium (Rb)-Dissolved (mg/L)				0.00038	
	Selenium (Se)-Dissolved (mg/L)				0.0103	
	Silicon (Si)-Dissolved (mg/L)				1.92	
	Silver (Ag)-Dissolved (mg/L)				<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-6 Water 08-NOV-16 16:30 RBT_EV_ER4_43N O3_W1	L1855259-7 Water 08-NOV-16 16:30 RBT_EV_ER4_72N O3_W1	L1855259-8 Water 08-NOV-16 16:30 RBT_GH_FR1_UN NO3_W1	L1855259-9 Water 08-NOV-16 16:30 RBT_GH_FR1_14N O3_W1	L1855259-10 Water 08-NOV-16 16:30 RBT_GH_FR1_20N O3_W1
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)		<0.00020			
	Thallium (Tl)-Total (mg/L)		<0.000010			
	Thorium (Th)-Total (mg/L)		<0.00010			
	Tin (Sn)-Total (mg/L)		0.00229			
	Titanium (Ti)-Total (mg/L)		<0.00030			
	Tungsten (W)-Total (mg/L)		<0.00010			
	Uranium (U)-Total (mg/L)		0.00123			
	Vanadium (V)-Total (mg/L)		<0.00050			
	Zinc (Zn)-Total (mg/L)		<0.0030			
	Zirconium (Zr)-Total (mg/L)		<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location		LAB			
	Aluminum (Al)-Dissolved (mg/L)		0.0015			
	Antimony (Sb)-Dissolved (mg/L)		<0.00010			
	Arsenic (As)-Dissolved (mg/L)		0.00017			
	Barium (Ba)-Dissolved (mg/L)		0.0697			
	Beryllium (Be)-Dissolved (mg/L)		<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050			
	Boron (B)-Dissolved (mg/L)		<0.010			
	Cadmium (Cd)-Dissolved (mg/L)		0.0000102			
	Calcium (Ca)-Dissolved (mg/L)		64.5			
	Cesium (Cs)-Dissolved (mg/L)		<0.000010			
	Chromium (Cr)-Dissolved (mg/L)		0.00020			
	Cobalt (Co)-Dissolved (mg/L)		<0.00010			
	Copper (Cu)-Dissolved (mg/L)		0.00025			
	Iron (Fe)-Dissolved (mg/L)		<0.010			
	Lead (Pb)-Dissolved (mg/L)		<0.000050			
	Lithium (Li)-Dissolved (mg/L)		0.0085			
	Magnesium (Mg)-Dissolved (mg/L)		19.3			
	Manganese (Mn)-Dissolved (mg/L)		0.00012			
	Molybdenum (Mo)-Dissolved (mg/L)		0.00109			
	Nickel (Ni)-Dissolved (mg/L)		<0.00050			
	Phosphorus (P)-Dissolved (mg/L)		<0.050			
	Potassium (K)-Dissolved (mg/L)		0.731			
	Rubidium (Rb)-Dissolved (mg/L)		0.00032			
	Selenium (Se)-Dissolved (mg/L)		0.0103			
	Silicon (Si)-Dissolved (mg/L)		2.06			
	Silver (Ag)-Dissolved (mg/L)		<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1855259-11	L1855259-12	L1855259-13	L1855259-14	L1855259-15
		Description	Water	Water	Water	Water	Water
		Sampled Date	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16
		Sampled Time	16:30	16:30	16:30	16:30	16:30
		Client ID	RBT_GH_FR1_27N O3_W1	RBT_GH_FR1_38N O3_W1	RBT_GH_FR1_54N O3_W1	RBT_GH_FR1_75N O3_W1	RBT_GH_FR1HH_ UNNO3_W1
Grouping	Analyte						
WATER							
Total Metals	Tellurium (Te)-Total (mg/L)		<0.00020			<0.00020	
	Thallium (Tl)-Total (mg/L)		<0.000010			<0.000010	
	Thorium (Th)-Total (mg/L)		<0.00010			<0.00010	
	Tin (Sn)-Total (mg/L)		<0.00010			0.00012	
	Titanium (Ti)-Total (mg/L)		<0.00030			<0.00030	
	Tungsten (W)-Total (mg/L)		<0.00010			<0.00010	
	Uranium (U)-Total (mg/L)		0.00235			0.00236	
	Vanadium (V)-Total (mg/L)		<0.00050			<0.00050	
	Zinc (Zn)-Total (mg/L)		<0.0030			<0.0030	
	Zirconium (Zr)-Total (mg/L)		<0.00030			<0.00030	
Dissolved Metals	Dissolved Metals Filtration Location		LAB			LAB	
	Aluminum (Al)-Dissolved (mg/L)		0.0016			0.0014	
	Antimony (Sb)-Dissolved (mg/L)		0.00015			0.00016	
	Arsenic (As)-Dissolved (mg/L)		<0.00010			<0.00010	
	Barium (Ba)-Dissolved (mg/L)		0.0916			0.0946	
	Beryllium (Be)-Dissolved (mg/L)		<0.00010			<0.00010	
	Bismuth (Bi)-Dissolved (mg/L)		<0.000050			<0.000050	
	Boron (B)-Dissolved (mg/L)		<0.010			<0.010	
	Cadmium (Cd)-Dissolved (mg/L)		0.0000140			0.0000155	
	Calcium (Ca)-Dissolved (mg/L)		93.0			96.5	
	Cesium (Cs)-Dissolved (mg/L)		<0.000010			<0.000010	
	Chromium (Cr)-Dissolved (mg/L)		<0.00010			0.00011	
	Cobalt (Co)-Dissolved (mg/L)		<0.00010			<0.00010	
	Copper (Cu)-Dissolved (mg/L)		0.00028			0.00033	
	Iron (Fe)-Dissolved (mg/L)		<0.010			<0.010	
	Lead (Pb)-Dissolved (mg/L)		<0.000050			<0.000050	
	Lithium (Li)-Dissolved (mg/L)		0.0164			0.0164	
	Magnesium (Mg)-Dissolved (mg/L)		40.2			42.7	
	Manganese (Mn)-Dissolved (mg/L)		0.00014			0.00020	
	Molybdenum (Mo)-Dissolved (mg/L)		0.00102			0.000992	
	Nickel (Ni)-Dissolved (mg/L)		0.00202			0.00208	
	Phosphorus (P)-Dissolved (mg/L)		<0.050			<0.050	
	Potassium (K)-Dissolved (mg/L)		1.27			1.35	
	Rubidium (Rb)-Dissolved (mg/L)		0.00062			0.00065	
	Selenium (Se)-Dissolved (mg/L)		0.0464			0.0433	
	Silicon (Si)-Dissolved (mg/L)		2.12			2.10	
	Silver (Ag)-Dissolved (mg/L)		<0.000010			<0.000010	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-16 Water 08-NOV-16 16:30 RBT_GH_FR1HH_15NO3_W1	L1855259-17 Water 08-NOV-16 16:30 RBT_GH_FR1HH_23NO3_W1	L1855259-18 Water 08-NOV-16 16:30 RBT_GH_FR1HH_34NO3_W1	L1855259-19 Water 08-NOV-16 16:30 RBT_GH_FR1HH_51NO3_W1	L1855259-20 Water 08-NOV-16 16:30 RBT_GH_FR1HH_76NO3_W1
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)			<0.00020		
	Thallium (Tl)-Total (mg/L)			<0.000010		
	Thorium (Th)-Total (mg/L)			<0.00010		
	Tin (Sn)-Total (mg/L)			0.00033		
	Titanium (Ti)-Total (mg/L)			<0.00030		
	Tungsten (W)-Total (mg/L)			<0.00010		
	Uranium (U)-Total (mg/L)			0.00230		
	Vanadium (V)-Total (mg/L)			<0.00050		
	Zinc (Zn)-Total (mg/L)			<0.0030		
	Zirconium (Zr)-Total (mg/L)			<0.00030		
Dissolved Metals	Dissolved Metals Filtration Location			LAB		
	Aluminum (Al)-Dissolved (mg/L)			0.0011		
	Antimony (Sb)-Dissolved (mg/L)			0.00016		
	Arsenic (As)-Dissolved (mg/L)			0.00013		
	Barium (Ba)-Dissolved (mg/L)			0.103		
	Beryllium (Be)-Dissolved (mg/L)			<0.00010		
	Bismuth (Bi)-Dissolved (mg/L)			<0.000050		
	Boron (B)-Dissolved (mg/L)			<0.010		
	Cadmium (Cd)-Dissolved (mg/L)			0.0000160		
	Calcium (Ca)-Dissolved (mg/L)			156		
	Cesium (Cs)-Dissolved (mg/L)			<0.000010		
	Chromium (Cr)-Dissolved (mg/L)			0.00012		
	Cobalt (Co)-Dissolved (mg/L)			<0.00010		
	Copper (Cu)-Dissolved (mg/L)			0.00035		
	Iron (Fe)-Dissolved (mg/L)			<0.010		
	Lead (Pb)-Dissolved (mg/L)			<0.000050		
	Lithium (Li)-Dissolved (mg/L)			0.0165		
	Magnesium (Mg)-Dissolved (mg/L)			64.8		
	Manganese (Mn)-Dissolved (mg/L)			0.00028		
	Molybdenum (Mo)-Dissolved (mg/L)			0.00104		
	Nickel (Ni)-Dissolved (mg/L)			0.00262		
	Phosphorus (P)-Dissolved (mg/L)			<0.050		
	Potassium (K)-Dissolved (mg/L)			1.39		
	Rubidium (Rb)-Dissolved (mg/L)			0.00067		
	Selenium (Se)-Dissolved (mg/L)			0.0475		
	Silicon (Si)-Dissolved (mg/L)			2.08		
	Silver (Ag)-Dissolved (mg/L)			<0.000010		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-21 Water 08-NOV-16 16:30 RBT_GH_FR1HH_114NO3_W1	L1855259-22 Water 08-NOV-16 16:30 RBT_GH_ER2_UNNO3_W1	L1855259-23 Water 08-NOV-16 16:30 RBT_GH_ER2_3NO3_W1	L1855259-24 Water 08-NOV-16 16:30 RBT_GH_ER2_5NO3_W1	L1855259-25 Water 08-NOV-16 16:30 RBT_GH_ER2_9NO3_W1
Grouping	Analyte					
WATER						
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020				<0.00020
	Thallium (Tl)-Total (mg/L)	<0.000010				<0.000010
	Thorium (Th)-Total (mg/L)	<0.00010				<0.00010
	Tin (Sn)-Total (mg/L)	0.00050				0.00078
	Titanium (Ti)-Total (mg/L)	<0.00030				<0.00030
	Tungsten (W)-Total (mg/L)	<0.00010				<0.00010
	Uranium (U)-Total (mg/L)	0.00227				0.000732
	Vanadium (V)-Total (mg/L)	<0.00050				<0.00050
	Zinc (Zn)-Total (mg/L)	<0.0030				0.0102
	Zirconium (Zr)-Total (mg/L)	<0.00030				<0.00030
Dissolved Metals	Dissolved Metals Filtration Location	LAB				LAB
	Aluminum (Al)-Dissolved (mg/L)	<0.0010				0.0026
	Antimony (Sb)-Dissolved (mg/L)	0.00016				<0.00010
	Arsenic (As)-Dissolved (mg/L)	0.00011				0.00010
	Barium (Ba)-Dissolved (mg/L)	0.0987				0.0475
	Beryllium (Be)-Dissolved (mg/L)	<0.00010				<0.00010
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050				<0.000050
	Boron (B)-Dissolved (mg/L)	<0.010				<0.010
	Cadmium (Cd)-Dissolved (mg/L)	0.0000178				0.0000054
	Calcium (Ca)-Dissolved (mg/L)	158				46.3
	Cesium (Cs)-Dissolved (mg/L)	<0.000010				<0.000010
	Chromium (Cr)-Dissolved (mg/L)	0.00010				0.00022
	Cobalt (Co)-Dissolved (mg/L)	<0.00010				<0.00010
	Copper (Cu)-Dissolved (mg/L)	0.00042				0.00025
	Iron (Fe)-Dissolved (mg/L)	<0.010				<0.010
	Lead (Pb)-Dissolved (mg/L)	<0.000050				<0.000050
	Lithium (Li)-Dissolved (mg/L)	0.0165				0.0018
	Magnesium (Mg)-Dissolved (mg/L)	65.4				11.0
	Manganese (Mn)-Dissolved (mg/L)	0.00029				0.00019
	Molybdenum (Mo)-Dissolved (mg/L)	0.00103				0.000964
	Nickel (Ni)-Dissolved (mg/L)	0.00262				<0.00050
	Phosphorus (P)-Dissolved (mg/L)	<0.050				<0.050
	Potassium (K)-Dissolved (mg/L)	1.43				0.439
	Rubidium (Rb)-Dissolved (mg/L)	0.00068				<0.00020
	Selenium (Se)-Dissolved (mg/L)	0.0473				0.000953
	Silicon (Si)-Dissolved (mg/L)	2.11				1.73
	Silver (Ag)-Dissolved (mg/L)	<0.000010				<0.000010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-26 Water 08-NOV-16 16:30 RBT_GH_ER2_15 NO3_W1	L1855259-27 Water 08-NOV-16 16:30 RBT_GH_ER2_25 NO3_W1	L1855259-28 Water 08-NOV-16 16:30 RBT_GH_ER2_43 NO3_W1
Grouping	Analyte			
WATER				
Total Metals	Tellurium (Te)-Total (mg/L)			<0.00020
	Thallium (Tl)-Total (mg/L)			<0.000010
	Thorium (Th)-Total (mg/L)			<0.00010
	Tin (Sn)-Total (mg/L)			0.00070
	Titanium (Ti)-Total (mg/L)			<0.00030
	Tungsten (W)-Total (mg/L)			<0.00010
	Uranium (U)-Total (mg/L)			0.000803
	Vanadium (V)-Total (mg/L)			<0.00050
	Zinc (Zn)-Total (mg/L)			0.0110
	Zirconium (Zr)-Total (mg/L)			<0.00030
Dissolved Metals	Dissolved Metals Filtration Location			LAB
	Aluminum (Al)-Dissolved (mg/L)			0.0025
	Antimony (Sb)-Dissolved (mg/L)			<0.00010
	Arsenic (As)-Dissolved (mg/L)			0.00010
	Barium (Ba)-Dissolved (mg/L)			0.0461
	Beryllium (Be)-Dissolved (mg/L)			<0.00010
	Bismuth (Bi)-Dissolved (mg/L)			<0.000050
	Boron (B)-Dissolved (mg/L)			<0.010
	Cadmium (Cd)-Dissolved (mg/L)			0.0000075
	Calcium (Ca)-Dissolved (mg/L)			47.1
	Cesium (Cs)-Dissolved (mg/L)			<0.000010
	Chromium (Cr)-Dissolved (mg/L)			0.00021
	Cobalt (Co)-Dissolved (mg/L)			<0.00010
	Copper (Cu)-Dissolved (mg/L)			0.00023
	Iron (Fe)-Dissolved (mg/L)			<0.010
	Lead (Pb)-Dissolved (mg/L)			<0.000050
	Lithium (Li)-Dissolved (mg/L)			0.0018
	Magnesium (Mg)-Dissolved (mg/L)			11.1
	Manganese (Mn)-Dissolved (mg/L)			0.00023
	Molybdenum (Mo)-Dissolved (mg/L)			0.00100
	Nickel (Ni)-Dissolved (mg/L)			<0.00050
	Phosphorus (P)-Dissolved (mg/L)			<0.050
	Potassium (K)-Dissolved (mg/L)			0.442
	Rubidium (Rb)-Dissolved (mg/L)			<0.00020
	Selenium (Se)-Dissolved (mg/L)			0.000907
	Silicon (Si)-Dissolved (mg/L)			1.78
	Silver (Ag)-Dissolved (mg/L)			<0.000010

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-1 Water 08-NOV-16 16:30 RBT_EV_ER4_UN NO3_W1	L1855259-2 Water 08-NOV-16 16:30 RBT_EV_ER4_5N O3_W1	L1855259-3 Water 08-NOV-16 16:30 RBT_EV_ER4_9N O3_W1	L1855259-4 Water 08-NOV-16 16:30 RBT_EV_ER4_15N O3_W1	L1855259-5 Water 08-NOV-16 16:30 RBT_EV_ER4_25N O3_W1
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)				22.6	
	Strontium (Sr)-Dissolved (mg/L)				0.233	
	Sulfur (S)-Dissolved (mg/L)				24.6	
	Tellurium (Te)-Dissolved (mg/L)				<0.00020	
	Thallium (Tl)-Dissolved (mg/L)				<0.000010	
	Thorium (Th)-Dissolved (mg/L)				<0.00010	
	Tin (Sn)-Dissolved (mg/L)				0.00231	
	Titanium (Ti)-Dissolved (mg/L)				<0.00030	
	Tungsten (W)-Dissolved (mg/L)				<0.00010	
	Uranium (U)-Dissolved (mg/L)				0.00118	
	Vanadium (V)-Dissolved (mg/L)				<0.00050	
	Zinc (Zn)-Dissolved (mg/L)				0.0015	
	Zirconium (Zr)-Dissolved (mg/L)				<0.00030	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-6 Water 08-NOV-16 16:30 RBT_EV_ER4_43N O3_W1	L1855259-7 Water 08-NOV-16 16:30 RBT_EV_ER4_72N O3_W1	L1855259-8 Water 08-NOV-16 16:30 RBT_GH_FR1_UN NO3_W1	L1855259-9 Water 08-NOV-16 16:30 RBT_GH_FR1_14N O3_W1	L1855259-10 Water 08-NOV-16 16:30 RBT_GH_FR1_20N O3_W1
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)		122			
	Strontium (Sr)-Dissolved (mg/L)		0.233			
	Sulfur (S)-Dissolved (mg/L)		26.7			
	Tellurium (Te)-Dissolved (mg/L)		<0.00020			
	Thallium (Tl)-Dissolved (mg/L)		<0.000010			
	Thorium (Th)-Dissolved (mg/L)		<0.00010			
	Tin (Sn)-Dissolved (mg/L)		0.00217			
	Titanium (Ti)-Dissolved (mg/L)		<0.00030			
	Tungsten (W)-Dissolved (mg/L)		<0.00010			
	Uranium (U)-Dissolved (mg/L)		0.00120			
	Vanadium (V)-Dissolved (mg/L)		<0.00050			
	Zinc (Zn)-Dissolved (mg/L)		0.0016			
	Zirconium (Zr)-Dissolved (mg/L)		<0.00030			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-11 Water 08-NOV-16 16:30 RBT_GH_FR1_27N O3_W1	L1855259-12 Water 08-NOV-16 16:30 RBT_GH_FR1_38N O3_W1	L1855259-13 Water 08-NOV-16 16:30 RBT_GH_FR1_54N O3_W1	L1855259-14 Water 08-NOV-16 16:30 RBT_GH_FR1_75N O3_W1	L1855259-15 Water 08-NOV-16 16:30 RBT_GH_FR1HH_ UNNO3_W1
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	29.6			102	
	Strontium (Sr)-Dissolved (mg/L)	0.141			0.142	
	Sulfur (S)-Dissolved (mg/L)	72.4			69.7	
	Tellurium (Te)-Dissolved (mg/L)	<0.00020			<0.00020	
	Thallium (Tl)-Dissolved (mg/L)	<0.000010			<0.000010	
	Thorium (Th)-Dissolved (mg/L)	<0.00010			<0.00010	
	Tin (Sn)-Dissolved (mg/L)	<0.00010			0.00012	
	Titanium (Ti)-Dissolved (mg/L)	<0.00030			<0.00030	
	Tungsten (W)-Dissolved (mg/L)	<0.00010			<0.00010	
	Uranium (U)-Dissolved (mg/L)	0.00227			0.00231	
	Vanadium (V)-Dissolved (mg/L)	<0.00050			<0.00050	
	Zinc (Zn)-Dissolved (mg/L)	0.0015			0.0018	
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030			<0.00030	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID	L1855259-16	L1855259-17	L1855259-18	L1855259-19	L1855259-20
Description	Water	Water	Water	Water	Water	Water
Sampled Date	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16	08-NOV-16
Sampled Time	16:30	16:30	16:30	16:30	16:30	16:30
Client ID	RBT_GH_FR1HH_15NO3_W1	RBT_GH_FR1HH_23NO3_W1	RBT_GH_FR1HH_34NO3_W1	RBT_GH_FR1HH_51NO3_W1	RBT_GH_FR1HH_76NO3_W1	RBT_GH_FR1HH_76NO3_W1
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)			44.4		
	Strontium (Sr)-Dissolved (mg/L)			0.177		
	Sulfur (S)-Dissolved (mg/L)			153		
	Tellurium (Te)-Dissolved (mg/L)			<0.00020		
	Thallium (Tl)-Dissolved (mg/L)			<0.000010		
	Thorium (Th)-Dissolved (mg/L)			<0.00010		
	Tin (Sn)-Dissolved (mg/L)			0.00033		
	Titanium (Ti)-Dissolved (mg/L)			<0.00030		
	Tungsten (W)-Dissolved (mg/L)			<0.00010		
	Uranium (U)-Dissolved (mg/L)			0.00234		
	Vanadium (V)-Dissolved (mg/L)			<0.00050		
	Zinc (Zn)-Dissolved (mg/L)			0.0015		
	Zirconium (Zr)-Dissolved (mg/L)			<0.00030		

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1855259-21 Water 08-NOV-16 16:30 RBT_GH_FR1HH_114NO3_W1	L1855259-22 Water 08-NOV-16 16:30 RBT_GH_ER2_UNNO3_W1	L1855259-23 Water 08-NOV-16 16:30 RBT_GH_ER2_3NO3_W1	L1855259-24 Water 08-NOV-16 16:30 RBT_GH_ER2_5NO3_W1	L1855259-25 Water 08-NOV-16 16:30 RBT_GH_ER2_9NO3_W1
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	154				16.0
	Strontium (Sr)-Dissolved (mg/L)	0.175				0.229
	Sulfur (S)-Dissolved (mg/L)	158				7.41
	Tellurium (Te)-Dissolved (mg/L)	<0.00020				<0.00020
	Thallium (Tl)-Dissolved (mg/L)	<0.000010				<0.000010
	Thorium (Th)-Dissolved (mg/L)	<0.00010				<0.00010
	Tin (Sn)-Dissolved (mg/L)	0.00053				0.00078
	Titanium (Ti)-Dissolved (mg/L)	<0.00030				<0.00030
	Tungsten (W)-Dissolved (mg/L)	<0.00010				<0.00010
	Uranium (U)-Dissolved (mg/L)	0.00230				0.000780
	Vanadium (V)-Dissolved (mg/L)	<0.00050				<0.00050
	Zinc (Zn)-Dissolved (mg/L)	0.0015				0.0098
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030				<0.00030

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID		
L1855259-26	Water	08-NOV-16	16:30	RBT_GH_ER2_15 NO3_W1		
L1855259-27	Water	08-NOV-16	16:30	RBT_GH_ER2_25 NO3_W1		
L1855259-28	Water	08-NOV-16	16:30	RBT_GH_ER2_43 NO3_W1		
Grouping	Analyte					
WATER						
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)					75.4
	Strontium (Sr)-Dissolved (mg/L)					0.229
	Sulfur (S)-Dissolved (mg/L)					7.87
	Tellurium (Te)-Dissolved (mg/L)					<0.00020
	Thallium (Tl)-Dissolved (mg/L)					<0.000010
	Thorium (Th)-Dissolved (mg/L)					<0.00010
	Tin (Sn)-Dissolved (mg/L)					0.00066
	Titanium (Ti)-Dissolved (mg/L)					<0.00030
	Tungsten (W)-Dissolved (mg/L)					<0.00010
	Uranium (U)-Dissolved (mg/L)					0.000770
	Vanadium (V)-Dissolved (mg/L)					<0.00050
	Zinc (Zn)-Dissolved (mg/L)					0.0098
	Zirconium (Zr)-Dissolved (mg/L)					<0.00030

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

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
LPML	Lab-Preserved for Total Metals. Sample received with pH > 2 and preserved at the lab. Total Metals results may be biased low.

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Method Blank	Alkalinity, Total (as CaCO3)	B	L1855259-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Barium (Ba)-Dissolved	MS-B	L1855259-11, -14, -18, -21, -25, -28, -4, -7
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1855259-11, -14, -18, -21, -25, -28, -4, -7
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1855259-11, -14, -18, -21, -25, -28, -4, -7
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1855259-11, -14, -18, -21, -25, -28, -4, -7
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1855259-11, -14, -18, -21, -25, -28, -4, -7
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1855259-11, -14, -18, -21, -25, -28, -4, -7
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855259-21, -25, -28
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1855259-21, -25, -28
Matrix Spike	Manganese (Mn)-Total	MS-B	L1855259-21, -25, -28
Matrix Spike	Sodium (Na)-Total	MS-B	L1855259-21, -25, -28
Matrix Spike	Strontium (Sr)-Total	MS-B	L1855259-21, -25, -28
Matrix Spike	Calcium (Ca)-Total	MS-B	L1855259-1, -10, -12, -13, -15, -16, -17, -19, -2, -20, -3, -5, -6, -8, -9
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1855259-1, -10, -12, -13, -15, -16, -17, -19, -2, -20, -3, -5, -6, -8, -9
Matrix Spike	Sodium (Na)-Total	MS-B	L1855259-1, -10, -12, -13, -15, -16, -17, -19, -2, -20, -3, -5, -6, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855259-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -3, -4, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855259-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -3, -4, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855259-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -3, -4, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855259-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -3, -4, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855259-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -3, -4, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1855259-27, -28, -5
Matrix Spike	Nitrate (as N)	MS-B	L1855259-27, -28, -5
Matrix Spike	Phosphorus (P)-Total	MS-B	L1855259-4

Qualifiers for Individual Parameters Listed:

Qualifier	Description
B	Method Blank exceeds ALS DQO. All associated sample results are at least 5 times greater than blank levels and are considered reliable.
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
HTD	Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)

Reference Information

Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

MET-T-CCMS-VA Water Total Metals in Water by CRC ICPMS EPA 200.2/6020A (mod)

Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.

Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this 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).

NH3-F-VA Water Ammonia in Water by Fluorescence APHA 4500 NH3-NITROGEN (AMMONIA)

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NH3-F-VA Water Ammonia in Water by Fluorescence J. ENVIRON. MONIT., 2005, 7, 37-42, RSC

This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.

NO2-L-IC-N-VA Water Nitrite in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

NO3-L-IC-N-VA Water Nitrate in Water by IC (Low Level) EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

P-T-PRES-COL-VA Water Total P in Water by Colour APHA 4500-P Phosphorus

This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

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:

Reference Information

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.



89
23

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)														
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)														
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input checked="" type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT														
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT														
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge														
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P: <u>Monday Nov 14 / 2016</u>														
		Email 2			Analysis Request														
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below														
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																	
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca																	
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca																	
Contact: Bonnie Lo																			
Project Information		Oil and Gas Required Fields (client use)																	
ALS Quote #:		Approver ID:																	
Job #:		GL Account:																	
PO / AFE:		Routing Code:																	
LSD:		Activity Code:																	
		Location:																	
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler:														
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers	
	RBT_EV_ER4_UnNO3 w1			8-Nov-16	15:15	Water			✓	✓	✓	✓	✓	✓	✓	✓	✓	1	
	RBT_EV_ER4_5NO3 w1			8-Nov-16	15:15	Water											✓	1	
	RBT_EV_ER4_9NO3 w1			8-Nov-16		Water											✓	1	
	RBT_EV_ER4_15NO3 w1			8-Nov-16		Water	✓	✓									✓	1	
	RBT_EV_ER4_25NO3 w1			8-Nov-16		Water											✓	1	
	RBT_EV_ER4_43NO3 w1			8-Nov-16		Water											✓	1	
	RBT_EV_ER4_72NO3 w1			8-Nov-16		Water	✓	✓									✓	1	
	RBT_GH_FR1_unNO3 w1			8-Nov-16		Water											✓	1	
	RBT_GH_FR1_14 NO3 w1			8-Nov-16		Water											✓	1	
	RBT_GH_FR1_20NO3 w1			8-Nov-16		Water											✓	1	
	RBT_GH_FR1_27NO3 w1			8-Nov-16		Water	✓	✓									✓	1	
	RBT_GH_FR1_38NO3 w1			8-Nov-16		Water											✓	1	
Drinking Water (DW) Samples¹ (client use)				Special Instructions / Specify Criteria to add on report (client Use)						SAMPLE CONDITION AS RECEIVED (lab use only)									
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No				For metals (total & dissolved)-low level analysis please <u>Results by Monday Nov 14 / 2016</u>						Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>									
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No										Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>									
										Cooling Initiated <input type="checkbox"/>									
										INITIAL COOLER TEMPERATURES °C									
										FINAL COOLER TEMPERATURES °C <u>15/15/17</u>									
SHIPMENT RELEASE (client use)				INITIAL SHIPMENT RECEPTION (lab use only)						FINAL SHIPMENT RECEPTION (lab use only)									
Released by: <u>Promo</u> Date: <u>8 Nov 16</u> Time: <u>4:50</u>				Received by: <u>ST</u> Date: <u>Nov 8</u> Time: <u>5:50 pm</u>															



www.alsglobal.com

Chain of Custody

RUSH

Priority processing



L1855259-COFC

COC Number: 14 -

Page 1 of 3

3/3

ORL

Report To
 Company: Nautilus Environmental
 Contact: Bonnie Lo
 Address: 8664 Commerce Court
 Burnaby, BC
 Phone: 604-420-8773

Report Format / Distribution
 Select Report Format: PDF EXCEL EDD (DIGITAL)
 Quality Control (QC) Report with Report Yes No
 Criteria on Report - provide details below if box checked
 Select Distribution: EMAIL MAIL FAX
 Email 1 or Fax: bonnie@nautilusenvironmental.ca
 Email 2:

Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
 R Regular (Standard TAT if received by 3 pm - business days)
 P Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
 E Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
 E2 Same day or weekend emergency - contact ALS to confirm TAT and surcharge
 Specify Date Required for E2,E or P: Nov 14 2016

Invoice To Same as Report To Yes No
 Copy of Invoice with Report Yes No
 Company: Nautilus Environmental
 Contact: Bonnie Lo

Invoice Distribution
 Select Invoice Distribution: EMAIL MAIL FAX
 Email 1 or Fax: bonnie@nautilusenvironmental.ca
 Email 2: lise@nautilusenvironmental.ca

Analysis Request
 Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

Project Information
 ALS Quote #:
 Job #:
 PO / AFE:
 LSD:

Oil and Gas Required Fields (client use)
 Approver ID:
 Cost Center:
 GL Account:
 Routing Code:
 Activity Code:
 Location:

Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Calcium & Magnesium	Number of Containers
											1
											1
											1
											1
											1
											1
											1
											1

ALS Lab Work Order # (lab use only):

ALS Contact: Heather McKenzie
 Sampler:

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mm-yy)	Time (hh:mm)	Sample Type
	RBT_GH_ER2_unNO3 <u>w2</u>	8-Nov-16	05:55:1630	Water
	RBT_GH_ER2_3NO3 <u>w2</u>	8-Nov-16		Water
	RBT_GH_ER2_5NO3 <u>w2</u>	8-Nov-16		Water
	RBT_GH_ER2_9NO3 <u>w2</u>	8-Nov-16		Water
	RBT_GH_ER2_15NO3 <u>w2</u>	8-Nov-16		Water
	RBT_GH_ER2_25NO3 <u>w2</u>	8-Nov-16		Water
	RBT_GH_ER2_43NO3 <u>w2</u>	8-Nov-16		Water

Drinking Water (DW) Samples¹ (client use)
 Are samples taken from a Regulated DW System?
 Yes No
 Are samples for human drinking water use?
 Yes No

Special Instructions / Specify Criteria to add on report (client Use)
 For metals (total & dissolved)-low level analysis please
Results by Nov 14 / 2016

SAMPLE CONDITION AS RECEIVED (lab use only)
 Frozen SIF Observations: Yes No
 Ice packs Yes No Custody seal intact Yes No
 Cooling initiated
 INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: 15/13/11

SHIPMENT RELEASE (client use)
 Released by: [Signature] Date: Nov 8/16 Time: 1:30

INITIAL SHIPMENT RECEPTION (lab use only)
 Received by: _____ Date: _____ Time: _____

FINAL SHIPMENT RECEPTION (lab use only)
 Received by: [Signature] Date: Nov 8 Time: 5:50 pm



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

Date Received: 10-NOV-16
Report Date: 18-NOV-16 13:10 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1856743
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1856743-1 WATER 09-NOV-16 13:00 RBT_GH_ER2_3N O3_AR2	L1856743-2 WATER 09-NOV-16 13:00 RBT_GH_ER2_5N O3_AR2	L1856743-3 WATER 09-NOV-16 13:00 RBT_GH_ER2_9N O3_AR2	L1856743-4 WATER 09-NOV-16 13:00 RBT_GH_ER2_15 NO3_AR2	L1856743-5 WATER 09-NOV-16 13:00 RBT_GH_ER2_25 NO3_AR2
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	3.00	5.05	10.3	15.3	27.0

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1856743-6	L1856743-7	L1856743-8	L1856743-9	L1856743-10
		Description	WATER	WATER	WATER	WATER	WATER
		Sampled Date	09-NOV-16	09-NOV-16	09-NOV-16	09-NOV-16	09-NOV-16
		Sampled Time	13:00	13:00	13:00	13:00	13:00
		Client ID	RBT_GH_ER2_43 NO3_AR2	RBT_EV_ER4_5N O3_AR2	RBT_EV_ER4_9N O3_AR2	RBT_EV_ER4_15N O3_AR2	RBT_EV_ER4_25N O3_AR2
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	46.0	5.05	9.03	13.5	13.8	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1856743-11 WATER 09-NOV-16 13:00 RBT_EV_ER4_43N O3_AR2	L1856743-12 WATER 09-NOV-16 13:00 RBT_EV_ER4_72N O3_AR2	L1856743-13 WATER 09-NOV-16 13:00 RBT_GH_FR1_14N O3_AR2	L1856743-14 WATER 09-NOV-16 13:00 RBT_GH_FR1_20N O3_AR2	L1856743-15 WATER 09-NOV-16 13:00 RBT_GH_FR1_27N O3_AR2
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	39.7	64.6	14.0	19.5	29.9

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1856743-16 WATER 09-NOV-16 13:00 RBT_GH_FR1_38N O3_AR2	L1856743-17 WATER 09-NOV-16 13:00 RBT_GH_FR1_54N O3_AR2	L1856743-18 WATER 09-NOV-16 13:00 RBT_GH_FR1_75N O3_AR2	L1856743-19 WATER 09-NOV-16 13:00 RBT_GH_FR1_HH _15NO3_AR2	L1856743-20 WATER 09-NOV-16 13:00 RBT_GH_FR1_HH _23NO3_AR2
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	37.5	55.1	71.2	13.9	21.4

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1856743-21 WATER 09-NOV-16 13:00 RBT_GH_FR1_HH _34NO3_AR2	L1856743-22 WATER 09-NOV-16 13:00 RBT_GH_FR1_HH _51NO3_AR2	L1856743-23 WATER 09-NOV-16 13:00 RBT_GH_FR1_HH _76NO3_AR2	L1856743-24 WATER 09-NOV-16 13:00 RBT_GH_FR1_HH _114NO3_AR2	
Grouping	Analyte				
WATER					
Anions and Nutrients	Nitrate (as N) (mg/L)	34.1	47.9	67.4	102

* 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	Nitrate (as N)	MS-B	L1856743-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1856743-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -3, -4, -5, -6, -7, -8, -9

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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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.



Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)				
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)				
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT				
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT				
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge				
		Email 1 or Fax <u>bonnie@nautilusenvironmental.ca</u>			Specify Date Required for E2, E or P:				
		Email 2			Analysis Request				
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below				
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			Filtered (F) Preserved (P) Filtered and Preserved (F/P)				
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax <u>bonnie@nautilusenvironmental.ca</u>							
Company: Nautilus Environmental		Email 2 <u>lise@nautilusenvironmental.ca</u>							
Contact: Bonnie Lo		Project Information							
		Oil and Gas Required Fields (client use)							
ALS Quote #:		Approver ID:							
Job #:		GL Account:							
PO / AFE:		Activity Code:							
LSD:		Location:							
ALS Lab Work Order # (lab use only)		ALS Contact: <u>Heather McKenzie</u>		Sampler: <u>YYL/KL</u>					
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mmm-yy)	Time (hh:mm)	Sample Type			
		RBT - GHER2 - 3NO3 - AR2		<u>Nov 9/16</u>	<u>1300</u>	<u>water</u>			
		<u>RBT - GHER2 - 3NO3 - AR2</u>							
		<u>RBT - GHER2 - 5NO3 - AR2</u>							
		<u>RBT - GHER2 - 9NO3 - AR2</u>							
		<u>RBT - GHER2 - 15NO3 - AR2</u>							
		<u>RBT - GHER2 - 25NO3 - AR2</u>							
		<u>RBT - GHER2 - 43NO3 - AR2</u>							
		<u>RBT - EV - ER4 - 5NO3 - AR2</u>							
		<u>RBT - EV - ER4 - 9NO3 - AR2</u>							
		<u>RBT - EV - ER4 - 15NO3 - AR2</u>							
		<u>RBT - EV - ER4 - 25NO3 - AR2</u>							
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)				
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No					Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>				
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>				
					Cooling Initiated <input type="checkbox"/>				
					INITIAL COOLER TEMPERATURES °C: <u>10</u> FINAL COOLER TEMPERATURES °C:				
SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)			
Released by: <u>[Signature]</u>		Date: <u>Nov 10/2016</u>	Time: <u>1330</u>	Received by: <u>[Signature]</u>		Date: <u>11/10</u>	Time: <u>17:50</u>		

Short Holding Time
Rush Processing



Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)							
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)							
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT							
Address: 8664 Commerce Court Bumaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT							
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge							
		Email 1 or Fax: <u>bonnie@nautilusenvironmental.ca</u>			Specify Date Required for E2, E or P:							
		Email 2:			Analysis Request							
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below							
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below (Vertical grid area with handwritten notes: Sulfate, Nitrate)							
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: <u>bonnie@nautilusenvironmental.ca</u>										
Company: Nautilus Environmental		Email 2: <u>lise@nautilusenvironmental.ca</u>										
Project Information		Oil and Gas Required Fields (client use)										
ALS Quote #:		Approver ID:										
Job #:		Cost Center:										
PO / AFE:		GL Account:										
LSD:		Routing Code:										
ALS Lab Work Order # (lab use only)		Activity Code:										
		Location:										
		ALS Contact: <u>Heather McKenzie</u>		Sampler: <u>YSL/HZ</u>								
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Number of Containers (Vertical grid area with handwritten notes: Sulfate, Nitrate)					
	<u>RBT-EV-ER4-43NO3-AR2</u>			<u>Nov 9/16</u>	<u>13:00</u>	<u>Water</u>						
	<u>RBT-EV-ER4-72NO3-AR2</u>											
	RBT-EV-ER4-72NO3-AR2											
	<u>RBT-GH-FR1-14NO3-AR2</u>											
	<u>RBT-GH-FR1-20NO3-AR2</u>											
	<u>RBT-GH-FR1-27NO3-AR2</u>											
	<u>RBT-GH-FR1-38NO3-AR2</u>											
	<u>RBT-GH-FR1-54NO3-AR2</u>											
	<u>RBT-GH-FR1-75NO3-AR2</u>											
	RBT-GH-FR1-75NO3-AR2											
	<u>RBT-GH-FR1-HH-15NO3-AR2</u>											
	<u>RBT-GH-FR1-HH-23NO3-AR2</u>											
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)							
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No					Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>							
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>							
					Cooling Initiated <input type="checkbox"/>							
					INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C							
					INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: <u>10</u>							
SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)						
Released by: <u>[Signature]</u>		Date: <u>Nov 10/16</u>	Time: <u>1330</u>	Received by: _____		Date: _____	Time: _____	Received by: <u>[Signature]</u>				
								Date: <u>11/10</u> Time: <u>14:50</u>				



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

Date Received: 10-NOV-16
Report Date: 18-NOV-16 13:41 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1856736
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID				
	L1856736-1 WATER 09-NOV-16 13:30 RBT_GH_FR1_HH _AR2				
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	931			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	195			
	Ammonia, Total (as N) (mg/L)	<0.0050			
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}			
	Nitrate (as N) (mg/L)	10.0			
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}			
	Phosphorus (P)-Total (mg/L)	0.0188			
	Sulfate (SO4) (mg/L)	488			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0114			
	Antimony (Sb)-Total (mg/L)	0.00025			
	Arsenic (As)-Total (mg/L)	0.00016			
	Barium (Ba)-Total (mg/L)	0.105			
	Beryllium (Be)-Total (mg/L)	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.000050			
	Boron (B)-Total (mg/L)	<0.010			
	Cadmium (Cd)-Total (mg/L)	0.0000242			
	Calcium (Ca)-Total (mg/L)	169			
	Cesium (Cs)-Total (mg/L)	<0.000010			
	Chromium (Cr)-Total (mg/L)	0.00017			
	Cobalt (Co)-Total (mg/L)	<0.00010			
	Copper (Cu)-Total (mg/L)	<0.00050			
	Iron (Fe)-Total (mg/L)	0.015			
	Lead (Pb)-Total (mg/L)	0.000109			
	Lithium (Li)-Total (mg/L)	0.0181			
	Magnesium (Mg)-Total (mg/L)	71.6			
	Manganese (Mn)-Total (mg/L)	0.00160			
	Molybdenum (Mo)-Total (mg/L)	0.00116			
	Nickel (Ni)-Total (mg/L)	0.00311			
	Phosphorus (P)-Total (mg/L)	<0.050			
	Potassium (K)-Total (mg/L)	1.35			
	Rubidium (Rb)-Total (mg/L)	0.00068			
	Selenium (Se)-Total (mg/L)	0.0466			
	Silicon (Si)-Total (mg/L)	2.27			
	Silver (Ag)-Total (mg/L)	<0.000010			
	Sodium (Na)-Total (mg/L)	2.19			
	Strontium (Sr)-Total (mg/L)	0.185			
	Sulfur (S)-Total (mg/L)	166			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1856736-1 WATER 09-NOV-16 13:30 RBT_GH_FR1_HH _AR2			
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			
	Thallium (Tl)-Total (mg/L)	<0.000010			
	Thorium (Th)-Total (mg/L)	<0.00010			
	Tin (Sn)-Total (mg/L)	0.00021			
	Titanium (Ti)-Total (mg/L)	0.00032			
	Tungsten (W)-Total (mg/L)	<0.00010			
	Uranium (U)-Total (mg/L)	0.00249			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0030			
	Zirconium (Zr)-Total (mg/L)	<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location	LAB			
	Aluminum (Al)-Dissolved (mg/L)	0.0022			
	Antimony (Sb)-Dissolved (mg/L)	0.00019			
	Arsenic (As)-Dissolved (mg/L)	0.00011			
	Barium (Ba)-Dissolved (mg/L)	0.108			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000225			
	Calcium (Ca)-Dissolved (mg/L)	170			
	Cesium (Cs)-Dissolved (mg/L)	0.000011			
	Chromium (Cr)-Dissolved (mg/L)	0.00013			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	<0.00020			
	Iron (Fe)-Dissolved (mg/L)	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0174			
	Magnesium (Mg)-Dissolved (mg/L)	76.7			
	Manganese (Mn)-Dissolved (mg/L)	0.00033			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00106			
	Nickel (Ni)-Dissolved (mg/L)	0.00301			
	Phosphorus (P)-Dissolved (mg/L)	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.30			
	Rubidium (Rb)-Dissolved (mg/L)	0.00069			
	Selenium (Se)-Dissolved (mg/L)	0.0498			
	Silicon (Si)-Dissolved (mg/L)	2.21			
	Silver (Ag)-Dissolved (mg/L)	<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID				
	L1856736-1 WATER 09-NOV-16 13:30 RBT_GH_FR1_HH _AR2				
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	2.17			
	Strontium (Sr)-Dissolved (mg/L)	0.178			
	Sulfur (S)-Dissolved (mg/L)	164			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	0.00018			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030			
	Tungsten (W)-Dissolved (mg/L)	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.00227			
	Vanadium (V)-Dissolved (mg/L)	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0020			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030			

* 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	Barium (Ba)-Dissolved	MS-B	L1856736-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1856736-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1856736-1
Matrix Spike	Selenium (Se)-Dissolved	MS-B	L1856736-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1856736-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1856736-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1856736-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
EC-SCREEN-VA	Water	Conductivity Screen (Internal Use Only)	APHA 2510
Qualitative analysis of conductivity where required during preparation of other tests - e.g. TDS, metals, etc.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.			

Reference Information

** 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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1856736-COFC

COC Number: 14 -

Page 1 of 1

www.alsglobal.com

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: <u>bonnie@nautilusenvironmental.ca</u> Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:																							
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: <u>bonnie@nautilusenvironmental.ca</u> Email 2: <u>lise@nautilusenvironmental.ca</u>		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																							
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: Cost Center: GL Account: Routing Code: Activity Code: Location:		<table border="1"> <tr> <td>Total Metals (lowlevel) P</td> <td>Total Dissolved Metals (lowlevel)</td> <td>Total dissolved solids</td> <td>Alkalinity</td> <td>Ammonia</td> <td>Nitrate</td> <td>Nitrite</td> <td>Phosphorus</td> <td>Chloride</td> <td>Sulfonate</td> <td rowspan="2">Number of Containers</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>3</td> </tr> </table>		Total Metals (lowlevel) P	Total Dissolved Metals (lowlevel)	Total dissolved solids	Alkalinity	Ammonia	Nitrate	Nitrite	Phosphorus	Chloride	Sulfonate	Number of Containers	<input checked="" type="checkbox"/>	3									
Total Metals (lowlevel) P	Total Dissolved Metals (lowlevel)	Total dissolved solids	Alkalinity	Ammonia	Nitrate	Nitrite	Phosphorus	Chloride	Sulfonate	Number of Containers																	
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		3																
ALS Lab Work Order # (lab use only)		ALS Contact: <u>Heather McKenzie</u>		Sampler: <u>YXL/KL</u>																							
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																							
	<u>RBLGH-FRI-HH-AR2</u>	<u>Nov 16</u>	<u>1330</u>	<u>Water</u>																							
<div style="background-color: black; color: white; padding: 10px; border-radius: 10px; display: inline-block;"> Short Holding Time Rush Processing </div>																											
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) <u>Metals: low level pls.</u>		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: _____																							
SHIPMENT RELEASE (client use) Released by: <u>[Signature]</u> Date: <u>Nov 10/2016</u> Time: <u>1330</u>		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____		FINAL SHIPMENT RECEPTION (lab use only) Received by: <u>[Signature]</u> Date: <u>11/16</u> Time: <u>14:50</u>																							

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FRM 0276-103 Rev04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



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

Date Received: 19-NOV-16
Report Date: 28-NOV-16 17:59 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1860111
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1860111-1 WATER 16-NOV-16 13:00 RBT_EV_ER4_43N O3_AR3	L1860111-2 WATER 16-NOV-16 13:00 RBT_EV_ER4_72N O3_AR3	L1860111-3 WATER 16-NOV-16 13:00 RBT_GH_FR1_14N O3_AR3	L1860111-4 WATER 16-NOV-16 13:00 RBT_GH_FR1_20N O3_AR3	L1860111-5 WATER 16-NOV-16 13:00 RBT_GH_FR1_27N O3_AR3
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	46.0	70.8	14.5	21.5	28.6

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1860111-6 WATER 16-NOV-16 13:00 RBT_GH_FR1_38N O3_AR3	L1860111-7 WATER 16-NOV-16 13:00 RBT_GH_FR1_54N O3_AR3	L1860111-8 WATER 16-NOV-16 13:00 RBT_GH_FR1_75N O3_AR3	L1860111-9 WATER 16-NOV-16 13:00 RBT_GH_FR1_HH _15NO3_AR3	L1860111-10 WATER 16-NOV-16 13:00 RBT_GH_FR1_HH _23NO3_AR3
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	39.3	54.6	77.3	15.2	22.6

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1860111-16	L1860111-17	L1860111-18	L1860111-19	L1860111-20
					WATER	WATER	WATER	WATER	WATER
		16-NOV-16	13:00		16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16
					13:00	13:00	13:00	13:00	13:00
					RBT_EV_ER4_9N O3_AR3	RBT_EV_ER4_15N O3_AR3	RBT_EV_ER4_25N O3_AR3	RBT_GH_ER2_3N O3_AR3	RBT_GH_ER2_5N O3_AR3
Grouping	Analyte								
WATER									
Anions and Nutrients	Nitrate (as N) (mg/L)				8.94	15.0	26.4	3.19	5.46

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1860111-21	L1860111-22	L1860111-23	L1860111-24
		Description	WATER	WATER	WATER	WATER
		Sampled Date	16-NOV-16	16-NOV-16	16-NOV-16	16-NOV-16
		Sampled Time	13:00	13:00	13:00	13:00
		Client ID	RBT_GH_ER2_9N O3_AR3	RBT_GH_ER2_15 NO3_AR3	RBT_GH_ER2_25 NO3_AR3	RBT_GH_ER2_43 NO3_AR3
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	8.85	14.4	24.6	47.5	

* 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	Nitrate (as N)	MS-B	L1860111-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1860111-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -3, -4, -5, -6, -7, -8, -9

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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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

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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).

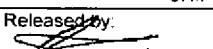
N/A - Result not available. Refer to qualifier code and definition for explanation.

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.



Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)											
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDO (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)											
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT											
Address: 8684 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT											
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge											
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:											
		Email 2:			Analysis Request											
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below											
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX														
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca														
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca														
Contact: Bonnie Lo		Oil and Gas Required Fields (client use)														
Project Information		Approver ID:			Cost Center:							Number of Containers				
ALS Quote #:		GL Account:			Routing Code:											
Job #:		Activity Code:														
PO / AFE:		Location:														
LSD:		ALS Contact: Heather McKenzie			Sampler: YL/KL											
ALS Lab Work Order # (lab use only)																
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Nitrate									
	RBT-EV-ERY-43NO ₃ -AR3			Nov 16/16	1300	water					1					
	RBT-EV-ERY-72NO ₃ -AR3															
	RBT-GH-FRI-14NO ₃ -AR3															
	RBT-GH-FRI-20NO ₃ -AR3															
	RBT-GH-FRI-27NO ₃ -AR3															
	RBT-GH-FRI-38NO ₃ -AR3															
	RBT-GH-FRI-54NO ₃ -AR3															
	RBT-GH-FRI-75NO ₃ -AR3															
	RBT-GH-FRI-HH-15NO ₃ -AR3															
	RBT-GH-FRI-HH-15NO₃-AR3															
	RBT-GH-FRI-HH-23NO ₃ -AR3															
	RBT-GH-FRI-HH-34NO ₃ -AR3															
Drinking Water (DW) Samples¹ (client use)		SAMPLE CONDITION AS RECEIVED (lab use only)														
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use)			Frozen: <input type="checkbox"/>					SIF Observations: Yes <input type="checkbox"/> No <input type="checkbox"/>						
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs: Yes <input type="checkbox"/> No <input type="checkbox"/>					Custody seal intact: Yes <input type="checkbox"/> No <input type="checkbox"/>						
		Cooling Initiated: <input type="checkbox"/>					INITIAL COOLER TEMPERATURES °C					FINAL COOLER TEMPERATURES °C				
												7				
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)											
Released by: 		Date: Nov 18/16	Time: 1130	Received by:	Date: NOV 18 2016	Time: 11:35 AM	Received by: JC				Date: NOV 18 2016			Time: 11:35 AM		



Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:		
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below		
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		Number of Containers		
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie Sampler: YOL/KL				
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type		
	RBT-GH-FRI-HH-51NO3-AR3	Nov 16/16	1300	WDRN		1
	RBT-GH-FRI-HH-76NO3-AR3					1
	RBT-FRI-HH-114NO3-AR3					1
	RBT-EV-ER4-5NO3-AR3					1
	RBT-EV-ER4-9NO3-AR3					1
	RBT-EV-ER4-15NO3-AR3					1
	RBT-EV-ER4-25NO3-AR3					1
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use)		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C: 7		
SHIPMENT RELEASE (client use) Released by:  Date: Nov 18/16 Time: 1130		INITIAL SHIPMENT RECEPTION (lab use only) Received by: Date: Time:		FINAL SHIPMENT RECEPTION (lab use only) Received by: SC Date: NOV 18 2016 Time: 11:35AM		



Short Holding Time

Rush Processing

C) / Analytical
firm
00 668 9876



L1860111-COFC

COC Number: 14 -

Page 3 of 3

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)							
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)							
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT							
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT							
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge							
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:							
		Email 2:			Analysis Request							
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below							
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX										
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca										
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca										
Contact: Bonnie Lo												
Project Information		Oil and Gas Required Fields (client use)										
ALS Quote #:		Approver ID:										
Job #:		GL Account:										
PO / AFE:		Activity Code:										
LSD:		Location:										
ALS Lab Work Order # (lab use only):		ALS Contact: Heather McKenzie		Sampler: YL/KL		Nitrate					Number of Containers	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)							Sample Type
	RBT-GHER2-3NO3-AR3			Nov 16/16	1300							water
	RBT-GHER2-5NO3-AR3			↓	↓							↓
	RBT-GHER2 9NO3-AR3			↓	↓							↓
	RBT-GHER2 15NO3-AR3			↓	↓							↓
	RBT-GHER2 25NO3-AR3											
	RBT-GHER2-43NO3-AR3											
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)							
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No					Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>							
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>							
					Cooling Initiated <input type="checkbox"/>							
					INITIAL COOLER TEMPERATURES °C							
					FINAL COOLER TEMPERATURES °C							
					7							
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)							
Released by:		Received by:			Received by: JC NOV 16 2016							
Date: Nov 16/16		Date: Nov 16/16			Date: Nov 16 2016							
Time: 1130		Time: 1130			Time: 11:35 AM							



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

Date Received: 18-NOV-16
Report Date: 25-NOV-16 17:43 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1860118
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1860118-1 WATER 16-NOV-16 13:00 RBT_GH_FR1_HH _AR3			
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	941			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	196			
	Ammonia, Total (as N) (mg/L)	<0.0050			
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}			
	Nitrate (as N) (mg/L)	10.1			
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}			
	Phosphorus (P)-Total (mg/L)	0.0041			
	Sulfate (SO4) (mg/L)	475			
	Total Metals	Aluminum (Al)-Total (mg/L)	0.0054		
	Antimony (Sb)-Total (mg/L)	0.00031			
	Arsenic (As)-Total (mg/L)	0.00015			
	Barium (Ba)-Total (mg/L)	0.102			
	Beryllium (Be)-Total (mg/L)	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.000050			
	Boron (B)-Total (mg/L)	<0.010			
	Cadmium (Cd)-Total (mg/L)	0.0000220			
	Calcium (Ca)-Total (mg/L)	157			
	Cesium (Cs)-Total (mg/L)	<0.000010			
	Chromium (Cr)-Total (mg/L)	0.00016			
	Cobalt (Co)-Total (mg/L)	<0.00010			
	Copper (Cu)-Total (mg/L)	<0.00050			
	Iron (Fe)-Total (mg/L)	0.014			
	Lead (Pb)-Total (mg/L)	0.000105			
	Lithium (Li)-Total (mg/L)	0.0180			
	Magnesium (Mg)-Total (mg/L)	70.8			
	Manganese (Mn)-Total (mg/L)	0.00112			
	Molybdenum (Mo)-Total (mg/L)	0.00111			
	Nickel (Ni)-Total (mg/L)	0.00326			
	Phosphorus (P)-Total (mg/L)	<0.050			
	Potassium (K)-Total (mg/L)	1.22			
	Rubidium (Rb)-Total (mg/L)	0.00058			
	Selenium (Se)-Total (mg/L)	0.0452			
	Silicon (Si)-Total (mg/L)	2.20			
	Silver (Ag)-Total (mg/L)	0.000093			
	Sodium (Na)-Total (mg/L)	2.02			
	Strontium (Sr)-Total (mg/L)	0.180			
	Sulfur (S)-Total (mg/L)	172			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1860118-1 WATER 16-NOV-16 13:00 RBT_GH_FR1_HH _AR3			
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			
	Thallium (Tl)-Total (mg/L)	<0.000010			
	Thorium (Th)-Total (mg/L)	<0.00010			
	Tin (Sn)-Total (mg/L)	0.00011			
	Titanium (Ti)-Total (mg/L)	<0.00030			
	Tungsten (W)-Total (mg/L)	<0.00010			
	Uranium (U)-Total (mg/L)	0.00250			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	<0.0030			
	Zirconium (Zr)-Total (mg/L)	<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location	LAB			
	Aluminum (Al)-Dissolved (mg/L)	<0.0010			
	Antimony (Sb)-Dissolved (mg/L)	0.00015			
	Arsenic (As)-Dissolved (mg/L)	<0.00010			
	Barium (Ba)-Dissolved (mg/L)	0.100			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000194			
	Calcium (Ca)-Dissolved (mg/L)	151			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			
	Chromium (Cr)-Dissolved (mg/L)	0.00012			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	<0.00020			
	Iron (Fe)-Dissolved (mg/L)	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0150			
	Magnesium (Mg)-Dissolved (mg/L)	65.1			
	Manganese (Mn)-Dissolved (mg/L)	0.00041			
	Molybdenum (Mo)-Dissolved (mg/L)	0.000970			
	Nickel (Ni)-Dissolved (mg/L)	0.00307			
	Phosphorus (P)-Dissolved (mg/L)	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.21			
	Rubidium (Rb)-Dissolved (mg/L)	0.00059			
	Selenium (Se)-Dissolved (mg/L)	0.0480			
	Silicon (Si)-Dissolved (mg/L)	2.07			
	Silver (Ag)-Dissolved (mg/L)	<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1860118-1 WATER 16-NOV-16 13:00 RBT_GH_FR1_HH _AR3			
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	1.95			
	Strontium (Sr)-Dissolved (mg/L)	0.160			
	Sulfur (S)-Dissolved (mg/L)	159			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030			
	Tungsten (W)-Dissolved (mg/L)	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.00219			
	Vanadium (V)-Dissolved (mg/L)	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0053			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030			

* 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	Barium (Ba)-Total	MS-B	L1860118-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L1860118-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1860118-1
Matrix Spike	Potassium (K)-Total	MS-B	L1860118-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1860118-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1860118-1
Matrix Spike	Nitrate (as N)	MS-B	L1860118-1
Matrix Spike	Nitrate (as N)	MS-B	L1860118-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.

Reference Information

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.



Report To		Report Format / Dis			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)															
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			<input checked="" type="radio"/> Regular (Standard TAT if received by 3 pm - business days)															
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			<input checked="" type="radio"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT															
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			<input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT															
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			<input checked="" type="radio"/> E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge															
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:															
		Email 2:			Analysis Request															
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below															
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX																		
Copy of invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca																		
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca																		
Contact: Bonnie Lo																				
Project Information		Oil and Gas Required Fields (client use)																		
ALS Quote #:		Approver ID:																		
Job #:		GL Account:																		
PO / AFE:		Activity Code:																		
LSD:		Location:																		
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler: YL/KL															
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)				Date (dd-mmm-yy)		Time (hh:mm)		Sample Type	Total metals, low level (preserved)	Dissolved metals-low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Number of Containers
	RBT-GH-FRI-HH-AR3				Nov 16/16		13:00		Water	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3
									Water											3
									Water											3
																				5

Short Holding Time

Rush Processing

Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)				SAMPLE CONDITION AS RECEIVED (lab use only)					
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		For metals (total & dissolved) low level analysis please Results by Friday November 18th 2016 please				Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>					
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Metals: low levels pls				Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>					
						Cooling Initiated <input type="checkbox"/>					
						INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
									7		
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)					
Released by: <i>[Signature]</i>		Date: Nov 18/16		Time: 1130		Received by:		Date: NOV 18 2016		Time: 11:35 AM	



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

Date Received: 25-NOV-16
Report Date: 05-DEC-16 18:11 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1862900
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
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ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862900-1 WATER 23-NOV-16 13:00 RBT_GH_ER2_3N O3_AR4	L1862900-2 WATER 23-NOV-16 13:00 RBT_GH_ER2_5N O3_AR4	L1862900-3 WATER 23-NOV-16 13:00 RBT_GH_ER2_9N O3_AR4	L1862900-4 WATER 23-NOV-16 13:00 RBT_GH_ER2_15 NO3_AR4	L1862900-5 WATER 23-NOV-16 13:00 RBT_GH_ER2_25 NO3_AR4
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	3.02	4.96	7.89	14.2	26.2

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1862900-6 WATER 23-NOV-16 13:00 RBT_GH_ER2_43 NO3_AR4	L1862900-7 WATER 23-NOV-16 13:00 RBT_EV_ER4_5N O3_AR4	L1862900-8 WATER 23-NOV-16 13:00 RBT_EV_ER4_9N O3_AR4	L1862900-9 WATER 23-NOV-16 13:00 RBT_EV_ER4_15N O3_AR4	L1862900-10 WATER 23-NOV-16 13:00 RBT_EV_ER4_25N O3_AR4	
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	42.6	5.04	8.63	14.9	26.2

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862900-11 WATER 23-NOV-16 13:00 RBT_EV_ER4_43N O3_AR4	L1862900-12 WATER 23-NOV-16 13:00 RBT_EV_ER4_72N O3_AR4	L1862900-13 WATER 23-NOV-16 13:00 RBT_GH_FR1_14N O3_AR4	L1862900-14 WATER 23-NOV-16 13:00 RBT_GH_FR1_20N O3_AR4	L1862900-15 WATER 23-NOV-16 13:00 RBT_GH_FR1_27N O3_AR4
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	41.0	64.6	13.8	19.0	24.6

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1862900-16	L1862900-17	L1862900-18	L1862900-19	L1862900-20
					WATER	WATER	WATER	WATER	WATER
		23-NOV-16	13:00		23-NOV-16	23-NOV-16	23-NOV-16	23-NOV-16	23-NOV-16
					13:00	13:00	13:00	13:00	13:00
					RBT_GH_FR1_38N O3_AR4	RBT_GH_FR1_54N O3_AR4	RBT_GH_FR1_75N O3_AR4	RBT_GH_FR1_HH _15NO3_AR4	RBT_GH_FR1_HH _23NO3_AR4
Grouping	Analyte								
WATER									
Anions and Nutrients	Nitrate (as N) (mg/L)				37.7	53.8	74.5	14.8	21.5

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862900-21 WATER 23-NOV-16 13:00 RBT_GH_FR1_HH _34NO3_AR4	L1862900-22 WATER 23-NOV-16 13:00 RBT_GH_FR1_HH _51NO3_AR4	L1862900-23 WATER 23-NOV-16 13:00 RBT_GH_FR1_HH _76NO3_AR4	L1862900-24 WATER 23-NOV-16 13:00 RBT_GH_FR1_HH _114NO3_AR4
Grouping	Analyte				
WATER					
Anions and Nutrients	Nitrate (as N) (mg/L)	33.8	45.8	74.3	111

* 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	Nitrate (as N)	MS-B	L1862900-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1862900-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -3, -4, -5, -6, -7, -8, -9

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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

** 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.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1862900-COFC

COC Number: 14 -

Page 1 of 2

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B

www.alsglobal.com

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:				
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below				
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		Cost Center: Routing Code:		Number of Containers 1		
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie		Sampler: JS/KL/YL				
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type				
	RBT-GH-ER2-3NO ₃ -AR4	23-11-16	13:00	Water	✓			
	RBT-GH-ER2-5NO ₃ -AR4				↓			
	RBT-GH-ER2-9NO ₃ -AR4				↓			
	RBT-GH-ER2-15NO ₃ -AR4				↓			
	RBT-GH-ER2-25NO ₃ -AR4				↓			
	RBT-GH-ER2-43NO ₃ -AR4				↓			
	RBT-EV-ER4-5NO ₃ -AR4				↓			
	RBT-EV-ER4-9NO ₃ -AR4				↓			
	RBT-EV-ER4-15NO ₃ -AR4				↓			
	RBT-EV-ER4-25NO ₃ -AR4				↓			
	RBT-EV-ER4-43NO ₃ -AR4				↓			
	RBT-EV-ER4-72NO ₃ -AR4				↓			
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) <div style="background-color: black; width: 100%; height: 20px;"></div>		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: FINAL COOLER TEMPERATURES °C: 7.0				
SHIPMENT RELEASE (client use) Released by: <i>[Signature]</i> Date: 25 Nov 2016 Time: 12:00		INITIAL SHIPMENT RECEPTION (lab use only) Received by: Date: Time:		FINAL SHIPMENT RECEPTION (lab use only) Received by: <i>[Signature]</i> Date: 25 Nov Time: 4:45 PM				

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0276a v09 From 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



L1862900-COFC

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)							
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)							
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT							
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT							
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge							
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2,E or P:							
		Email 2			Analysis Request							
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below							
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX										
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca										
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca										
Contact: Bonnie Lo												
Project Information		Oil and Gas Required Fields (client use)										
ALS Quote #:		Approver ID:										
Job #:		GL Account:										
PO / AFE:		Activity Code:										
LSD:		Location:										
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie			Sampler: JSK/YYL							
ALS Sample # (lab use only)		Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)		Time (hh:mm)		Sample Type		Number of Containers	
		RBT-GH-FRI-14NO ₃ -AR4			Nov 23-11-16		1300		water		1	
		RBT-GH-FRI-20NO ₃ -AR4										
		RBT-GH-FRI-27NO ₃ -AR4										
		RBT-GH-FRI-38NO ₃ -AR4										
		RBT-GH-FRI-54NO ₃ -AR4										
		RBT-GH-FRI-75NO ₃ -AR4										
		RBT-GH-FRI-HH-15NO ₃ -AR4										
		RBT-GH-FRI-HH-23NO ₃ -AR4										
		RBT-GH-FRI-HH-34NO ₃ -AR4										
		RBT-GH-FRI-HH-51NO ₃ -AR4										
		RBT-GH-FRI-HH-76NO ₃ -AR4										
		RBT-GH-FRI-HH-114NO ₃ -AR4										
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)										
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No												
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No												
		SAMPLE CONDITION AS RECEIVED (lab use only)										
		Frozen <input type="checkbox"/>		SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>		Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/>		Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>		Cooling Initiated <input type="checkbox"/>		
		INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C				7C		
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)				FINAL SHIPMENT RECEPTION (lab use only)						
Released by: <i>[Signature]</i>		Date: 25 Nov 25/16		Time: 1200		Received by: <i>[Signature]</i>		Date: Nov 25		Time: 4:45pm		



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

Date Received: 25-NOV-16
Report Date: 07-DEC-16 14:46 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1862943
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862943-1 WATER 23-NOV-16 13:00 RBT_GH_FR1_HH _AR4			
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	926			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	189			
	Ammonia, Total (as N) (mg/L)	<0.0050			
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}			
	Nitrate (as N) (mg/L)	9.88			
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}			
	Phosphorus (P)-Total (mg/L)	0.0031			
	Sulfate (SO4) (mg/L)	456			
	Total Metals	Aluminum (Al)-Total (mg/L)	0.0067		
	Antimony (Sb)-Total (mg/L)	0.00018			
	Arsenic (As)-Total (mg/L)	0.00014			
	Barium (Ba)-Total (mg/L)	0.107			
	Beryllium (Be)-Total (mg/L)	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.000050			
	Boron (B)-Total (mg/L)	<0.010			
	Cadmium (Cd)-Total (mg/L)	0.0000247			
	Calcium (Ca)-Total (mg/L)	162			
	Cesium (Cs)-Total (mg/L)	<0.000010			
	Chromium (Cr)-Total (mg/L)	0.00021			
	Cobalt (Co)-Total (mg/L)	<0.00010			
	Copper (Cu)-Total (mg/L)	<0.00050			
	Iron (Fe)-Total (mg/L)	0.019			
	Lead (Pb)-Total (mg/L)	0.000865			
	Lithium (Li)-Total (mg/L)	0.0183			
	Magnesium (Mg)-Total (mg/L)	73.1			
	Manganese (Mn)-Total (mg/L)	0.00144			
	Molybdenum (Mo)-Total (mg/L)	0.00111			
	Nickel (Ni)-Total (mg/L)	0.00345			
	Phosphorus (P)-Total (mg/L)	<0.050			
	Potassium (K)-Total (mg/L)	1.44			
	Rubidium (Rb)-Total (mg/L)	0.00072			
	Selenium (Se)-Total (mg/L)	0.0488			
	Silicon (Si)-Total (mg/L)	2.35			
	Silver (Ag)-Total (mg/L)	<0.000010			
	Sodium (Na)-Total (mg/L)	2.33			
	Strontium (Sr)-Total (mg/L)	0.185			
	Sulfur (S)-Total (mg/L)	169			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1862943-1 WATER 23-NOV-16 13:00 RBT_GH_FR1_HH _AR4			
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			
	Thallium (Tl)-Total (mg/L)	<0.000010			
	Thorium (Th)-Total (mg/L)	<0.00010			
	Tin (Sn)-Total (mg/L)	<0.00010			
	Titanium (Ti)-Total (mg/L)	<0.00030			
	Tungsten (W)-Total (mg/L)	<0.00010			
	Uranium (U)-Total (mg/L)	0.00247			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	0.0038			
	Zirconium (Zr)-Total (mg/L)	<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location	LAB			
	Aluminum (Al)-Dissolved (mg/L)	0.0017			
	Antimony (Sb)-Dissolved (mg/L)	0.00016			
	Arsenic (As)-Dissolved (mg/L)	0.00011			
	Barium (Ba)-Dissolved (mg/L)	0.102			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000216			
	Calcium (Ca)-Dissolved (mg/L)	163			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			
	Chromium (Cr)-Dissolved (mg/L)	0.00016			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	0.00020			
	Iron (Fe)-Dissolved (mg/L)	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0184			
	Magnesium (Mg)-Dissolved (mg/L)	68.8			
	Manganese (Mn)-Dissolved (mg/L)	0.00035			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00114			
	Nickel (Ni)-Dissolved (mg/L)	0.00315			
	Phosphorus (P)-Dissolved (mg/L)	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.35			
	Rubidium (Rb)-Dissolved (mg/L)	0.00068			
	Selenium (Se)-Dissolved (mg/L)	0.0539			
	Silicon (Si)-Dissolved (mg/L)	2.28			
	Silver (Ag)-Dissolved (mg/L)	<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID				
	L1862943-1 WATER 23-NOV-16 13:00 RBT_GH_FR1_HH _AR4				
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	2.17			
	Strontium (Sr)-Dissolved (mg/L)	0.187			
	Sulfur (S)-Dissolved (mg/L)	168			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	<0.00010			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030			
	Tungsten (W)-Dissolved (mg/L)	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.00249			
	Vanadium (V)-Dissolved (mg/L)	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0028			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030			

* 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	Barium (Ba)-Dissolved	MS-B	L1862943-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1862943-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1862943-1
Matrix Spike	Selenium (Se)-Dissolved	MS-B	L1862943-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1862943-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1862943-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1862943-1
Matrix Spike	Nitrate (as N)	MS-B	L1862943-1
Matrix Spike	Nitrate (as N)	MS-B	L1862943-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
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.

Reference Information

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
ATTN: Bonnie Lo
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 02-DEC-16
Report Date: 09-DEC-16 17:58 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1865785
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1865785-1 WATER 30-NOV-16 10:00 RBT_GH_ER2_3N O3_AR5	L1865785-2 WATER 30-NOV-16 10:00 RBT_GH_ER2_5N O3_AR5	L1865785-3 WATER 30-NOV-16 10:00 RBT_GH_ER2_9N O3_AR5	L1865785-4 WATER 30-NOV-16 10:00 RBT_GH_ER2_15 NO3_AR5	L1865785-5 WATER 30-NOV-16 10:00 RBT_GH_ER2_25 NO3_AR5
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	3.19	5.29	8.85	14.7	26.7

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1865785-6 WATER 30-NOV-16 10:00 RBT_GH_ER2_43 NO3_AR5	L1865785-7 WATER 30-NOV-16 10:00 RBT_EV_ER4_5N O3_AR5	L1865785-8 WATER 30-NOV-16 10:00 RBT_EV_ER4_9N O3_AR5	L1865785-9 WATER 30-NOV-16 10:00 RBT_EV_ER4_15N O3_AR5	L1865785-10 WATER 30-NOV-16 10:00 RBT_EV_ER4_25N O3_AR5
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	47.1	4.98	9.05	14.7	25.0

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1865785-11 WATER 30-NOV-16 10:00 RBT_EV_ER4_43N O3_AR5	L1865785-12 WATER 30-NOV-16 10:00 RBT_EV_ER4_72N O3_AR5	L1865785-13 WATER 30-NOV-16 10:00 RBT_GH_FR1_14N O3_AR5	L1865785-14 WATER 30-NOV-16 10:00 RBT_GH_FR1_20N O3_AR5	L1865785-15 WATER 30-NOV-16 10:00 RBT_GH_FR1_27N O3_AR5	
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	42.6	69.2	14.2	20.3	28.1

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1865785-16 WATER 30-NOV-16 10:00 RBT_GH_FR1_38N O3_AR5	L1865785-17 WATER 30-NOV-16 10:00 RBT_GH_FR1_54N O3_AR5	L1865785-18 WATER 30-NOV-16 10:00 RBT_GH_FR1_75N O3_AR5	L1865785-19 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _15NO3_AR5	L1865785-20 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _23NO3_AR5
Grouping	Analyte				
WATER					
Anions and Nutrients	Nitrate (as N) (mg/L)	38.2	52.1	73.7	15.0

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1865785-21 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _34NO3_AR5	L1865785-22 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _51NO3_AR5	L1865785-23 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _76NO3_AR5	L1865785-24 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _114NO3_AR5	L1865785-25 WATER 30-NOV-16 10:00 RBT_GH_FR1_UN _AR5
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	34.7	48.2	73.6	109	10.2

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1865785-26	L1865785-27			
		Description	WATER	WATER			
		Sampled Date	30-NOV-16	30-NOV-16			
		Sampled Time	10:00	10:00			
		Client ID	RBT_EV_ER4_UN _AR5	RBT_GH_ER2_UN _AR5			
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	2.86	0.0818				

* 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	Nitrate (as N)	MS-B	L1865785-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Nitrate (as N)	MS-B	L1865785-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -6, -7, -8, -9

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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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.



Chain of Custody (COC) / Analytical Request Form



L1865785-COFC

COC Number: 14 -

Page 1 of 3

Canada Toll Free: 1 800 668 9878

www.alsglobal.com

Report To Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2,E or P:	
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Company: Nautilus Environmental Contact: Bonnie Lo		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below	
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: Cost Center: GL Account: Routing Code: Activity Code: Location:		Number of Containers	
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie		Sampler: KL/YL	
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Nitrate <input checked="" type="checkbox"/>
	RBT-GH-ER2-3NO ₃ -ARS	Nov 30/16	1000h	Water	1
	RBT-GH-ER2-5NO ₃ -ARS				
	RBT-GH-ER2-9NO ₃ -ARS				
	RBT-GH-ER2-15NO ₃ -ARS				
	RBT-GH-ER2-25NO ₃ -ARS				
	RBT-GH-ER2-43NO ₃ -ARS				
	RBT-EV-ER4-5NO ₃ -ARS				
	RBT-EV-ER4-9NO ₃ -ARS				
	RBT-EV-ER4-15NO ₃ -ARS				
	RBT-EV-ER4-25NO ₃ -ARS				
	RBT-EV-ER4-43NO ₃ -ARS				
	RBT-EV-ER4-72NO ₃ -ARS				
Drinking Water (DW) Samples (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use) [Redacted]		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: [6] FINAL COOLER TEMPERATURES °C: [6]	
SHIPMENT RELEASE (client use) Released by: [Signature] Date: Dec 01/16 Time: 1900h		INITIAL SHIPMENT RECEPTION (lab use only) Received by: [Signature] Date: Dec 2 Time: 3pm		FINAL SHIPMENT RECEPTION (lab use only) Received by: [Signature] Date: Dec 2 Time: 3pm	

Short Holding Time
 Rush Processing

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

ALS-FM-0378a v08 F10/04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.



Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878



L1865785-COFC

COC Number: 14 -

Page 3 of 3

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Report To	Report Format / Distribution	Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)
Company: Nautilus Environmental	Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)	R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)
Contact: Bonnie Lo	Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT
Address: 8664 Commerce Court Burnaby, BC	<input type="checkbox"/> Criteria on Report - provide details below if box checked	E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT
Phone: 604-420-8773	Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge
	Email 1 or Fax: bonnie@nautilusenvironmental.ca	Specify Date Required for E2, E or P:
	Email 2:	

Invoice To	Invoice Distribution	Analysis Request
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX	Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Email 1 or Fax: bonnie@nautilusenvironmental.ca	
Company: Nautilus Environmental	Email 2: lise@nautilusenvironmental.ca	
Contact: Bonnie Lo		
Project Information		
ALS Quote #:	Approver ID:	Obs. Center:
Job #:	GL Account:	Routing Code:
PO / AFE:	Activity Code:	
LSD:	Location:	

ALS Lab Work Order # (lab use only)	ALS Contact: Heather McKenzie	Sampler: KL/YYL	Nitrate											Number of Containers		
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)		Time (hh:mm)	Sample Type											
	RBT-GH-FR1-HH-76NO3-ARS	Nov 30/16		1000h	water											
	RBT-GH-FR1-HH-114NO3-ARS	↓		↓	↓											
	RBT-GH-FR1-un-ARS	↓		↓	↓											

Drinking Water (DW) Samples¹ (client use)	Special Instructions / Specify Criteria to add on report (client Use)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No		Frozen <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> SIF Observations: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Ice packs: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact: <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/>
		Cooling initiated: <input type="checkbox"/>
		INITIAL COOLER TEMPERATURES °C: <input type="checkbox"/> FINAL COOLER TEMPERATURES °C: <input type="checkbox"/>

SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)		FINAL SHIPMENT RECEPTION (lab use only)	
Released by:	Date: Dec 01/16	Time: 1400h	Received by:	Date: Dec 01/16	Time: 3pm



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

Date Received: 02-DEC-16
Report Date: 09-DEC-16 18:23 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1865801
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1865801-1 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _AR5			
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	895			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	198			
	Ammonia, Total (as N) (mg/L)	<0.0050			
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}			
	Nitrate (as N) (mg/L)	10.1			
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}			
	Phosphorus (P)-Total (mg/L)	0.0216			
	Sulfate (SO4) (mg/L)	437			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0041			
	Antimony (Sb)-Total (mg/L)	0.00019			
	Arsenic (As)-Total (mg/L)	0.00011			
	Barium (Ba)-Total (mg/L)	0.106			
	Beryllium (Be)-Total (mg/L)	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.000050			
	Boron (B)-Total (mg/L)	<0.010			
	Cadmium (Cd)-Total (mg/L)	0.0000227			
	Calcium (Ca)-Total (mg/L)	172			
	Cesium (Cs)-Total (mg/L)	<0.000010			
	Chromium (Cr)-Total (mg/L)	0.00022			
	Cobalt (Co)-Total (mg/L)	<0.00010			
	Copper (Cu)-Total (mg/L)	<0.00050			
	Iron (Fe)-Total (mg/L)	<0.010			
	Lead (Pb)-Total (mg/L)	0.000091			
	Lithium (Li)-Total (mg/L)	0.0196			
	Magnesium (Mg)-Total (mg/L)	70.2			
	Manganese (Mn)-Total (mg/L)	0.00121			
	Molybdenum (Mo)-Total (mg/L)	0.00121			
	Nickel (Ni)-Total (mg/L)	0.00342			
	Phosphorus (P)-Total (mg/L)	<0.050			
	Potassium (K)-Total (mg/L)	1.32			
	Rubidium (Rb)-Total (mg/L)	0.00060			
	Selenium (Se)-Total (mg/L)	0.0480			
	Silicon (Si)-Total (mg/L)	2.33			
	Silver (Ag)-Total (mg/L)	<0.000010			
Sodium (Na)-Total (mg/L)	2.15				
Strontium (Sr)-Total (mg/L)	0.197				
Sulfur (S)-Total (mg/L)	160				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1865801-1 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _AR5			
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			
	Thallium (Tl)-Total (mg/L)	<0.00010			
	Thorium (Th)-Total (mg/L)	<0.00010			
	Tin (Sn)-Total (mg/L)	0.00011			
	Titanium (Ti)-Total (mg/L)	<0.00030			
	Tungsten (W)-Total (mg/L)	<0.00010			
	Uranium (U)-Total (mg/L)	0.00256			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	0.0032			
	Zirconium (Zr)-Total (mg/L)	<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location	LAB			
	Aluminum (Al)-Dissolved (mg/L)	<0.0010			
	Antimony (Sb)-Dissolved (mg/L)	0.00016			
	Arsenic (As)-Dissolved (mg/L)	<0.00010			
	Barium (Ba)-Dissolved (mg/L)	0.109			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000192			
	Calcium (Ca)-Dissolved (mg/L)	157			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			
	Chromium (Cr)-Dissolved (mg/L)	0.00011			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	0.00023			
	Iron (Fe)-Dissolved (mg/L)	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0191			
	Magnesium (Mg)-Dissolved (mg/L)	66.4			
	Manganese (Mn)-Dissolved (mg/L)	0.00044			
	Molybdenum (Mo)-Dissolved (mg/L)	0.00107			
	Nickel (Ni)-Dissolved (mg/L)	0.00302			
	Phosphorus (P)-Dissolved (mg/L)	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.35			
	Rubidium (Rb)-Dissolved (mg/L)	0.00063			
	Selenium (Se)-Dissolved (mg/L)	0.0507			
	Silicon (Si)-Dissolved (mg/L)	2.03			
	Silver (Ag)-Dissolved (mg/L)	<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID				
	L1865801-1 WATER 30-NOV-16 10:00 RBT_GH_FR1_HH _AR5				
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L)	2.05			
	Strontium (Sr)-Dissolved (mg/L)	0.176			
	Sulfur (S)-Dissolved (mg/L)	150			
	Tellurium (Te)-Dissolved (mg/L)	<0.00020			
	Thallium (Tl)-Dissolved (mg/L)	<0.000010			
	Thorium (Th)-Dissolved (mg/L)	<0.00010			
	Tin (Sn)-Dissolved (mg/L)	0.00012			
	Titanium (Ti)-Dissolved (mg/L)	<0.00030			
	Tungsten (W)-Dissolved (mg/L)	<0.00010			
	Uranium (U)-Dissolved (mg/L)	0.00243			
	Vanadium (V)-Dissolved (mg/L)	<0.00050			
	Zinc (Zn)-Dissolved (mg/L)	0.0018			
	Zirconium (Zr)-Dissolved (mg/L)	<0.00030			

* 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	Barium (Ba)-Dissolved	MS-B	L1865801-1
Matrix Spike	Boron (B)-Dissolved	MS-B	L1865801-1
Matrix Spike	Calcium (Ca)-Dissolved	MS-B	L1865801-1
Matrix Spike	Magnesium (Mg)-Dissolved	MS-B	L1865801-1
Matrix Spike	Potassium (K)-Dissolved	MS-B	L1865801-1
Matrix Spike	Sodium (Na)-Dissolved	MS-B	L1865801-1
Matrix Spike	Strontium (Sr)-Dissolved	MS-B	L1865801-1
Matrix Spike	Sulfur (S)-Dissolved	MS-B	L1865801-1
Matrix Spike	Nitrate (as N)	MS-B	L1865801-1
Matrix Spike	Nitrate (as N)	MS-B	L1865801-1
Matrix Spike	Phosphorus (P)-Total	MS-B	L1865801-1
Matrix Spike	Sulfate (SO4)	MS-B	L1865801-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-TITR-VA	Water	Alkalinity Species by Titration	APHA 2320 Alkalinity
This analysis is carried out using procedures adapted from APHA Method 2320 "Alkalinity". Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.			
CL-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-PRES-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			
SO4-IC-N-VA	Water	Sulfate in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
TDS-VA	Water	Total Dissolved Solids by Gravimetric	APHA 2540 C - GRAVIMETRIC

Reference Information

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.



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

Date Received: 09-DEC-16
Report Date: 20-DEC-16 18:04 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1868551
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1868551-6 WATER 07-DEC-16 12:00 RBT_GH_ER2_43 NO3_AR6	L1868551-7 WATER 07-DEC-16 12:00 RBT_GH_ER2_UN _AR6	L1868551-8 WATER 07-DEC-16 12:00 RBT_EV_ER4_5N O3_AR6	L1868551-9 WATER 07-DEC-16 12:00 RBT_EV_ER4_9N O3_AR6	L1868551-10 WATER 07-DEC-16 12:00 RBT_EV_ER4_15N O3_AR6
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	44.1	0.0973	5.03	8.67	14.4

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1868551-11 WATER 07-DEC-16 12:00 RBT_EV_ER4_25N O3_AR6	L1868551-12 WATER 07-DEC-16 12:00 RBT_EV_ER4_43N O3_AR6	L1868551-13 WATER 07-DEC-16 12:00 RBT_EV_ER4_72N O3_AR6	L1868551-14 WATER 07-DEC-16 12:00 RBT_EV_ER4_UN _AR6	L1868551-15 WATER 07-DEC-16 12:00 RBT_GH_FR1_14N O3_AR6
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	23.0	41.1	68.0	2.89	13.8

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID	Description	Sampled Date	Sampled Time	Client ID	L1868551-16	L1868551-17	L1868551-18	L1868551-19	L1868551-20
					WATER	WATER	WATER	WATER	WATER
					07-DEC-16	07-DEC-16	07-DEC-16	07-DEC-16	07-DEC-16
					12:00	12:00	12:00	12:00	12:00
					RBT_GH_FR1_20N O3_AR6	RBT_GH_FR1_27N O3_AR6	RBT_GH_FR1_38N O3_AR6	RBT_GH_FR1_54N O3_AR6	RBT_GH_FR1_75N O3_AR6
Grouping	Analyte								
WATER									
Anions and Nutrients	Nitrate (as N) (mg/L)	20.0	25.4	38.2	51.2	75.8			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1868551-21	L1868551-22	L1868551-23	L1868551-24	L1868551-25
		Description	WATER	WATER	WATER	WATER	WATER
		Sampled Date	07-DEC-16	07-DEC-16	07-DEC-16	07-DEC-16	07-DEC-16
		Sampled Time	12:00	12:00	12:00	12:00	12:00
		Client ID	RBT_GH_FR1_UN_AR6	RBT_GH_FR1_HH_15NO3_AR6	RBT_GH_FR1_HH_23NO3_AR6	RBT_GH_FR1_HH_34NO3_AR6	RBT_GH_FR1_HH_51NO3_AR6
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)	11.4	14.8	22.0	35.4	50.2	

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

		Sample ID	L1868551-26	L1868551-27			
		Description	WATER	WATER			
		Sampled Date	07-DEC-16	07-DEC-16			
		Sampled Time	12:00	12:00			
		Client ID	RBT_GH_FR1_HH _76NO3_AR6	RBT_GH_FR1_HH _114NO3_AR6			
Grouping	Analyte						
WATER							
Anions and Nutrients	Nitrate (as N) (mg/L)		70.1	118			

* 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	Nitrate (as N)	MS-B	L1868551-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -3, -4, -5, -6, -7, -8, -9

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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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.



Short Holding Time



Rush Processing

Custody (COC) / Analytical Request Form



L1868551-COFC

COC Number: 14 -

Page 1 of 3

1-800-668-9878

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)																																																																																																								
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)																																																																																																								
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT																																																																																																								
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT																																																																																																								
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge																																																																																																								
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		ALS Contact: Heather McKenzie	Sampler: YYL/AWD	Nitrates																																																																																																									
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Nitrates	Number of Containers																																																																																																					
RBT-GH-ER2-3NO3-ARG				Dec 7/16	12:00	water	✓	1																																																																																																					
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Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client use)			SAMPLE CONDITION AS RECEIVED (lab use only)																																																																																																								
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No					Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																								
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>																																																																																																								
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NAUTILUS ENVIRONMENTAL
ATTN: Bonnie Lo
8664 Commerce Court
Imperial Square Lake City
Burnaby BC V5A 4N7

Date Received: 09-DEC-16
Report Date: 20-DEC-16 18:12 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1868558
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

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ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1868558-1 WATER 07-DEC-16 12:00 RBT_GH_FR1_HH _AR6			
Grouping	Analyte				
WATER					
Physical Tests	Total Dissolved Solids (mg/L)	992			
Anions and Nutrients	Alkalinity, Total (as CaCO3) (mg/L)	203			
	Ammonia, Total (as N) (mg/L)	<0.0050			
	Chloride (Cl) (mg/L)	<2.5 ^{DLDS}			
	Nitrate (as N) (mg/L)	11.0			
	Nitrite (as N) (mg/L)	<0.0050 ^{DLDS}			
	Phosphorus (P)-Total (mg/L)	0.0032			
	Sulfate (SO4) (mg/L)	478			
Total Metals	Aluminum (Al)-Total (mg/L)	0.0051			
	Antimony (Sb)-Total (mg/L)	0.00016			
	Arsenic (As)-Total (mg/L)	0.00023			
	Barium (Ba)-Total (mg/L)	0.106			
	Beryllium (Be)-Total (mg/L)	<0.00010			
	Bismuth (Bi)-Total (mg/L)	<0.000050			
	Boron (B)-Total (mg/L)	<0.010			
	Cadmium (Cd)-Total (mg/L)	0.0000200			
	Calcium (Ca)-Total (mg/L)	164			
	Cesium (Cs)-Total (mg/L)	<0.000010			
	Chromium (Cr)-Total (mg/L)	0.00014			
	Cobalt (Co)-Total (mg/L)	<0.00010			
	Copper (Cu)-Total (mg/L)	<0.00050			
	Iron (Fe)-Total (mg/L)	<0.010			
	Lead (Pb)-Total (mg/L)	0.000106			
	Lithium (Li)-Total (mg/L)	0.0192			
	Magnesium (Mg)-Total (mg/L)	63.7			
	Manganese (Mn)-Total (mg/L)	0.00118			
	Molybdenum (Mo)-Total (mg/L)	0.000963			
	Nickel (Ni)-Total (mg/L)	0.00242			
	Phosphorus (P)-Total (mg/L)	<0.050			
	Potassium (K)-Total (mg/L)	1.17			
	Rubidium (Rb)-Total (mg/L)	0.00052			
	Selenium (Se)-Total (mg/L)	0.0464			
	Silicon (Si)-Total (mg/L)	2.20			
Silver (Ag)-Total (mg/L)	<0.000010				
Sodium (Na)-Total (mg/L)	2.04				
Strontium (Sr)-Total (mg/L)	0.183				
Sulfur (S)-Total (mg/L)	165				

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1868558-1 WATER 07-DEC-16 12:00 RBT_GH_FR1_HH _AR6			
Grouping	Analyte				
WATER					
Total Metals	Tellurium (Te)-Total (mg/L)	<0.00020			
	Thallium (Tl)-Total (mg/L)	<0.000010			
	Thorium (Th)-Total (mg/L)	<0.00010			
	Tin (Sn)-Total (mg/L)	0.00031			
	Titanium (Ti)-Total (mg/L)	<0.00030			
	Tungsten (W)-Total (mg/L)	<0.00010			
	Uranium (U)-Total (mg/L)	0.00236			
	Vanadium (V)-Total (mg/L)	<0.00050			
	Zinc (Zn)-Total (mg/L)	0.0077			
	Zirconium (Zr)-Total (mg/L)	<0.00030			
Dissolved Metals	Dissolved Metals Filtration Location	LAB			
	Aluminum (Al)-Dissolved (mg/L)	0.0021			
	Antimony (Sb)-Dissolved (mg/L)	0.00014			
	Arsenic (As)-Dissolved (mg/L)	0.00012			
	Barium (Ba)-Dissolved (mg/L)	0.104			
	Beryllium (Be)-Dissolved (mg/L)	<0.00010			
	Bismuth (Bi)-Dissolved (mg/L)	<0.000050			
	Boron (B)-Dissolved (mg/L)	<0.010			
	Cadmium (Cd)-Dissolved (mg/L)	0.0000214			
	Calcium (Ca)-Dissolved (mg/L)	162			
	Cesium (Cs)-Dissolved (mg/L)	<0.000010			
	Chromium (Cr)-Dissolved (mg/L)	<0.00010			
	Cobalt (Co)-Dissolved (mg/L)	<0.00010			
	Copper (Cu)-Dissolved (mg/L)	<0.00020			
	Iron (Fe)-Dissolved (mg/L)	<0.010			
	Lead (Pb)-Dissolved (mg/L)	<0.000050			
	Lithium (Li)-Dissolved (mg/L)	0.0191			
	Magnesium (Mg)-Dissolved (mg/L)	62.0			
	Manganese (Mn)-Dissolved (mg/L)	0.00056			
	Molybdenum (Mo)-Dissolved (mg/L)	0.000920			
	Nickel (Ni)-Dissolved (mg/L)	0.00222			
	Phosphorus (P)-Dissolved (mg/L)	<0.050			
	Potassium (K)-Dissolved (mg/L)	1.16			
	Rubidium (Rb)-Dissolved (mg/L)	0.00056			
	Selenium (Se)-Dissolved (mg/L)	0.0497			
	Silicon (Si)-Dissolved (mg/L)	2.08			
	Silver (Ag)-Dissolved (mg/L)	<0.000010			

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID				
	L1868558-1 WATER 07-DEC-16 12:00 RBT_GH_FR1_HH _AR6				
Grouping	Analyte				
WATER					
Dissolved Metals	Sodium (Na)-Dissolved (mg/L) Strontium (Sr)-Dissolved (mg/L) Sulfur (S)-Dissolved (mg/L) Tellurium (Te)-Dissolved (mg/L) Thallium (Tl)-Dissolved (mg/L) Thorium (Th)-Dissolved (mg/L) Tin (Sn)-Dissolved (mg/L) Titanium (Ti)-Dissolved (mg/L) Tungsten (W)-Dissolved (mg/L) Uranium (U)-Dissolved (mg/L) Vanadium (V)-Dissolved (mg/L) Zinc (Zn)-Dissolved (mg/L) Zirconium (Zr)-Dissolved (mg/L)	1.98 0.180 156 <0.00020 <0.000010 <0.00010 0.00028 <0.00030 <0.00010 0.00232 <0.00050 0.0071 <0.00030			

* 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	Aluminum (Al)-Total	MS-B	L1868558-1
Matrix Spike	Barium (Ba)-Total	MS-B	L1868558-1
Matrix Spike	Boron (B)-Total	MS-B	L1868558-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L1868558-1
Matrix Spike	Copper (Cu)-Total	MS-B	L1868558-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1868558-1
Matrix Spike	Manganese (Mn)-Total	MS-B	L1868558-1
Matrix Spike	Molybdenum (Mo)-Total	MS-B	L1868558-1
Matrix Spike	Potassium (K)-Total	MS-B	L1868558-1
Matrix Spike	Rubidium (Rb)-Total	MS-B	L1868558-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1868558-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1868558-1
Matrix Spike	Sulfur (S)-Total	MS-B	L1868558-1
Matrix Spike	Nitrate (as N)	MS-B	L1868558-1
Matrix Spike	Phosphorus (P)-Total	MS-B	L1868558-1

Qualifiers for Individual Parameters Listed:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.
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-IC-N-VA	Water	Chloride in Water by IC	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
MET-D-CCMS-VA	Water	Dissolved Metals in Water by CRC ICPMS	APHA 3030B/6020A (mod)
Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
MET-T-CCMS-VA	Water	Total Metals in Water by CRC ICPMS	EPA 200.2/6020A (mod)
Water samples are digested with nitric and hydrochloric acids, and analyzed by CRC ICPMS.			
Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	APHA 4500 NH3-NITROGEN (AMMONIA)
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NH3-F-VA	Water	Ammonia in Water by Fluorescence	J. ENVIRON. MONIT., 2005, 7, 37-42, RSC
This analysis is carried out, on sulfuric acid preserved samples, using procedures modified from J. Environ. Monit., 2005, 7, 37 - 42, The Royal Society of Chemistry, "Flow-injection analysis with fluorescence detection for the determination of trace levels of ammonium in seawater", Roslyn J. Waston et al.			
NO2-L-IC-N-VA	Water	Nitrite in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			
P-T-COL-VA	Water	Total P in Water by Colour	APHA 4500-P Phosphorus
This analysis is carried out using procedures adapted from APHA Method 4500-P "Phosphorus". Total Phosphorus is determined colourimetrically after persulphate digestion of the sample.			

Reference Information

SO4-IC-N-VA Water Sulfate in Water by IC EPA 300.1 (mod)

Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

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.



Chain of Custody (COC) / Analytical Request Form



L1868558-COFC

COC Number: 14 -

Page 1 of 1

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Report To		Report Format / Distribution			Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)												
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)												
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT												
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT												
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge												
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:												
		Email 2			Analysis Request												
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below												
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX															
Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca															
Company: Nautilus Environmental		Email 2: ilse@nautilusenvironmental.ca															
Contact: Bonnie Lo																	
Project Information		<input checked="" type="checkbox"/> Oil and Gas Required Fields (client use)															
ALS Quote #:		Approver ID:															
Job #:		GL Account:															
PO / AFE:		Activity Code:															
LSD:		Location:															
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie		Sampler: YYL/AWD													
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total metals (low level preserved)	Dissolved metals - low level	Chloride	Sulphate	Alkalinity	Nitrate	Nitrite	Ammonia	Phosphorus	Total Dissolved Solids	Number of Containers
	RBT_GH-FR1-HH-AR6			Dec 7/16	12:00h	water	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3
						</											



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

Date Received: 09-DEC-16
Report Date: 20-DEC-16 17:06 (MT)
Version: FINAL

Client Phone: 604-420-8773

Certificate of Analysis

Lab Work Order #: L1868537
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Heather McKenzie
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 8081 Lougheed Hwy, Suite 100, Burnaby, BC V5A 1W9 Canada | Phone: +1 604 253 4188 | Fax: +1 604 253 6700
ALS CANADA LTD Part of the ALS Group A Campbell Brothers Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1868537-1 WATER 09-DEC-16 12:00 RBT_GH_ER2_3N O3_TERM	L1868537-2 WATER 09-DEC-16 12:00 RBT_GH_ER2_5N O3_TERM	L1868537-3 WATER 09-DEC-16 12:00 RBT_GH_ER2_9N O3_TERM	L1868537-4 WATER 09-DEC-16 12:00 RBT_GH_ER2_15 NO3_TERM	L1868537-5 WATER 09-DEC-16 12:00 RBT_GH_ER2_25 NO3_TERM
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	3.19	5.02	8.76	13.8	26.6

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1868537-6 WATER 09-DEC-16 12:00 RBT_GH_ER2_43 NO3_TERM	L1868537-7 WATER 09-DEC-16 12:00 RBT_GH_ER2_UN _TERM	L1868537-8 WATER 09-DEC-16 12:00 RBT_EV_ER4_5N O3_TERM	L1868537-9 WATER 09-DEC-16 12:00 RBT_EV_ER4_9N O3_TERM	L1868537-10 WATER 09-DEC-16 12:00 RBT_EV_ER4_15N O3_TERM
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	45.5	0.101	5.13	9.11	14.9

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1868537-11 WATER 09-DEC-16 12:00 RBT_EV_ER4_25N O3_TERM	L1868537-12 WATER 09-DEC-16 12:00 RBT_EV_ER4_43N O3_TERM	L1868537-13 WATER 09-DEC-16 12:00 RBT_EV_ER4_72N O3_TERM	L1868537-14 WATER 09-DEC-16 12:00 RBT_EV_ER4_UN _TERM	L1868537-15 WATER 09-DEC-16 12:00 RBT_GH_FR1_14N O3_TERM
Grouping	Analyte				
WATER					
Anions and Nutrients	Nitrate (as N) (mg/L)				
	24.6	44.1	70.8	3.00	14.4

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1868537-16 WATER 09-DEC-16 12:00 RBT_GH_FR1_20N O3_TERM	L1868537-17 WATER 09-DEC-16 12:00 RBT_GH_FR1_27N O3_TERM	L1868537-18 WATER 09-DEC-16 12:00 RBT_GH_FR1_38N O3_TERM	L1868537-19 WATER 09-DEC-16 12:00 RBT_GH_FR1_54N O3_TERM	L1868537-20 WATER 09-DEC-16 12:00 RBT_GH_FR1_75N O3_TERM	
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	20.6	27.3	38.6	52.4	76.5

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

	Sample ID Description Sampled Date Sampled Time Client ID	L1868537-21 WATER 09-DEC-16 12:00 RBT_GH_FR1_UN _TERM	L1868537-22 WATER 09-DEC-16 12:00 RBT_GH_FR1_HH _15NO3_TERM	L1868537-23 WATER 09-DEC-16 12:00 RBT_GH_FR1_HH _23NO3_TERM	L1868537-24 WATER 09-DEC-16 12:00 RBT_GH_FR1_HH _34NO3_TERM	L1868537-25 WATER 09-DEC-16 12:00 RBT_GH_FR1_HH _51NO3_TERM
Grouping	Analyte					
WATER						
Anions and Nutrients	Nitrate (as N) (mg/L)	11.0	15.3	22.7	35.9	49.4

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample ID Description Sampled Date Sampled Time Client ID	L1868537-26 WATER 09-DEC-16 12:00 RBT_GH_FR1_HH _76NO3_TERM	L1868537-27 WATER 09-DEC-16 12:00 RBT_GH_FR1_HH _114NO3_TERM	L1868537-28 WATER 09-DEC-16 12:00 RBT_GH_FR1_HH _UN_TERM		
Grouping	Analyte				
WATER					
Anions and Nutrients	Nitrate (as N) (mg/L)	70.3	117	10.9	

* 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	Nitrate (as N)	MS-B	L1868537-1, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -2, -20, -21, -22, -23, -24, -25, -26, -27, -28, -3, -4, -5, -6, -7, -8, -9

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**
NO3-L-IC-N-VA	Water	Nitrate in Water by IC (Low Level)	EPA 300.1 (mod)
Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.			

** 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.



Short Holding Time

Custody (COC) / Analytical Request Form



COC Number: 14 -

Page 1 of 3

Rush Processing

Toll Free: 1 800 668 9878

L1868537-COFC

Report To		Report Format / Distribution			Below (Rush Turnaround Time (TAT) is not available for all tests)										
Company: Nautilus Environmental		Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL)			R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days)										
Contact: Bonnie Lo		Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No			P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT										
Address: 8664 Commerce Court Burnaby, BC		<input type="checkbox"/> Criteria on Report - provide details below if box checked			E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT										
Phone: 604-420-8773		Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX			E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge										
		Email 1 or Fax: bonnie@nautilusenvironmental.ca			Specify Date Required for E2, E or P:										
		Email 2			Analysis Request										
Invoice To		Invoice Distribution			Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below										
Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX													
Copy of invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Email 1 or Fax: bonnie@nautilusenvironmental.ca													
Company: Nautilus Environmental		Email 2: lise@nautilusenvironmental.ca													
Contact: Bonnie Lo															
Project Information		Oil and Gas Required Fields (client use)													
ALS Quote #:		Approver ID:			Cost Center:										
Job #:		GL Account:			Routing Code:										
PO / AFE:		Activity Code:													
LSD:		Location:													
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie		Sampler: YL/KL/AND											
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)			Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Nitrate				Number of Containers				
	RBT_GH_ER2-3NO3-term			Dec 9/16	1200h	water	✓				1				
	RBT_GH_ER2-5NO3-term														
	RBT_GH_ER2-9NO3-term														
	RBT_GH_ER2-15NO3-term														
	RBT_GH_ER2-25NO3-term														
	RBT_GH_ER2-43NO3-term														
	RBT_GH_ER2-un-term														
	RBT_EV_ER4-5NO3-term														
	RBT_EV_ER4-9NO3-term														
	RBT_EV_ER4-15NO3-term														
	RBT_EV_ER4-25NO3-term														
	RBT_EV_ER4-43NO3-term														
Drinking Water (DW) Samples¹ (client use)		Special Instructions / Specify Criteria to add on report (client Use)			SAMPLE CONDITION AS RECEIVED (lab use only)										
Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No					Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/>										
Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No					Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/>										
					Cooling initiated <input type="checkbox"/>					INITIAL COOLER TEMPERATURES °C					
										FINAL COOLER TEMPERATURES °C					
										11					
SHIPMENT RELEASE (client use)		INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)										
Released by:		Date:	Time:	Received by:	Date:	Time:	Received by: J.C. DEQ				Date: 9 2016	Time: 15:25			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-4-03206-108 Form 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Short Holding Time

in of Custody (COC) / Analytical Request Form



COC Number: 14 -

L1868537-COFC

Page 2 of 3

Rush Processing

Canada Toll Free: 1 800 668 9878

Report # Company: Nautilus Environmental Contact: Bonnie Lo Address: 8664 Commerce Court, Burnaby, BC Phone: 604-420-8773		Report Format / Distribution Select Report Format: <input checked="" type="checkbox"/> PDF <input checked="" type="checkbox"/> EXCEL <input type="checkbox"/> EDD (DIGITAL) Quality Control (QC) Report with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Criteria on Report - provide details below if box checked Select Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2:		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests) R <input checked="" type="checkbox"/> Regular (Standard TAT if received by 3 pm - business days) P <input type="checkbox"/> Priority (2-4 bus. days if received by 3pm) 50% surcharge - contact ALS to confirm TAT E <input type="checkbox"/> Emergency (1-2 bus. days if received by 3pm) 100% surcharge - contact ALS to confirm TAT E2 <input type="checkbox"/> Same day or weekend emergency - contact ALS to confirm TAT and surcharge Specify Date Required for E2, E or P:																																													
Invoice To Same as Report To <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Copy of Invoice with Report <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No		Invoice Distribution Select Invoice Distribution: <input checked="" type="checkbox"/> EMAIL <input type="checkbox"/> MAIL <input type="checkbox"/> FAX Email 1 or Fax: bonnie@nautilusenvironmental.ca Email 2: lise@nautilusenvironmental.ca		Analysis Request Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below																																													
Project Information ALS Quote #: Job #: PO / AFE: LSD:		Oil and Gas Required Fields (client use) Approver ID: GL Account: Activity Code: Location:		<table border="1"> <tr> <td colspan="4"></td> <td rowspan="10" style="writing-mode: vertical-rl; text-orientation: mixed;">Nitrate</td> <td rowspan="10" style="writing-mode: vertical-rl; text-orientation: mixed;">Number of Containers</td> </tr> <tr> <td></td><td></td><td></td><td></td> </tr> </table>								Nitrate	Number of Containers																																				
								Nitrate	Number of Containers																																								
ALS Lab Work Order # (lab use only)		ALS Contact: Heather McKenzie		Sampler: YXL/KL/AWD																																													
ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type																																													
	RBT_EV-ER4-72NO ₃ -term	Dec 9/16	1200h	water	1																																												
	RBT_EV-ER4-un-term																																																
	RBT_GH-FRI-14NO ₃ -term																																																
	RBT_GH-FRI-20NO ₃ -term																																																
	RBT_GH-FRI-24NO ₃ -term																																																
	RBT_GH-FRI-38NO ₃ -term																																																
	RBT_GH-FRI-54NO ₃ -term																																																
	RBT_GH-FRI-75NO ₃ -term																																																
	RBT_GH-FRI-un-term																																																
	RBT_GH-FRI-HH-15NO ₃ -term																																																
	RBT_GH-FRI-HH-23NO ₃ -term																																																
	RBT_GH-FRI-HH-34NO ₃ -term																																																
Drinking Water (DW) Samples¹ (client use) Are samples taken from a Regulated DW System? <input type="checkbox"/> Yes <input type="checkbox"/> No Are samples for human drinking water use? <input type="checkbox"/> Yes <input type="checkbox"/> No		Special Instructions / Specify Criteria to add on report (client Use)		SAMPLE CONDITION AS RECEIVED (lab use only) Frozen <input type="checkbox"/> SIF Observations Yes <input type="checkbox"/> No <input type="checkbox"/> Ice packs Yes <input type="checkbox"/> No <input type="checkbox"/> Custody seal intact Yes <input type="checkbox"/> No <input type="checkbox"/> Cooling Initiated <input type="checkbox"/> INITIAL COOLER TEMPERATURES °C: _____ FINAL COOLER TEMPERATURES °C: _____																																													
SHIPMENT RELEASE (client use) Released by: _____ Date: Dec 9/16 Time: 1230h		INITIAL SHIPMENT RECEPTION (lab use only) Received by: _____ Date: _____ Time: _____		FINAL SHIPMENT RECEPTION (lab use only) Received by: JC Date: DEC - 9 2016 Time: 15:25																																													

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-7-0229a-08 Form 04 January 2014

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

APPENDIX E – Chain-of-custody forms

Teck

COC ID: 20161025N		TURNAROUND TIME:				RUSH:							
PROJECT/CLIENT INFO				LABORATORY				OTHER INFO					
Facility Name / Job# Elkview Operations				Lab Name Nautilus Environmental				Report Format / Distribution					
Job Description SA Chronic Toxicity Sampling				Lab Contact Krysta Peraey				Email 1: Michael.Moore@teck.com		Excel	PDF	EDD	
Project Manager Michael Moore				Email krysta@nautilusenvironmental.ca				Email 2: teckcoal@equisonline.com		X	X	X	
Email Michael.Moore@teck.com				Address 8664 Commerce Court				Email 3: James.Boyd@teck.com		X	X	X	
Address RR#1 HWY# 3				Imperial Square, Lake City				Email 4: Cameron.Griffin@teck.com		X	X	X	
City Sparwood Province BC				City Burnaby Province BC				Email 5:					
Postal Code VIC 4C3 Country Canada				Postal Code V5A 4N7 Country Canada				PO number 432106					
Phone Number 1-250-865-5289				Phone Number									
SAMPLE DETAILS						ANALYSIS REQUESTED							
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage PF CARBOYS	30 d rainbow trout early life stage NO3/SO4 - CARBOYS	30 d rainbow trout early life stage NO3/SO4 - BARRELS	FD C. dubia NO3/SO4	Temp °C
EV_ER4_WS_2016-10-25_N	EV_ER4	WS	N	10/25/2016	8:35	G	3			X	X		4.2
									Woff	16/183	16/182		3x2c
					Total		3						
ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS				RELINQUISHED BY/AFFILIATION				ACCEPTED BY/AFFILIATION					
Nitrate/Sulphate Testing Program								Nautilus - Burnaby					
								NY - Nari Yamamoto					
								Oct 26/16 @ 08:44					
NB OF BOTTLES RETURNED/DESCRIPTION													
Regular (default) X				Sampler's Name				Mobile #					
Priority (2-3 business days) - 50% surcharge				Sampler's Signature				Date/Time					
Emergency (1 Business Day) - 100% surcharge								25 Oct 2016					
For Emergency <1 Day, ASAP or Weekend - Contact ALS													

① Clear, colourless, odourless, some particulates

COC ID: Nov 1 Q4 Tox Week 3

TURNAROUND TIME: regular

RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO							
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:							
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com		EQUIS:	GHO			
Email	leigh.stickney@teck.com			Email				Report Format / Distribution							
Address	PO Box 5000			Address	8664 Commence Court			Yes	PDF	Yes	Excel				
City	Elkford			Province	BC			Imperial Square Lake City							
Postal Code	VOB 1H0			Country	Canada			City	Burnaby		Province	BC			
Phone Number	250 865 3274			Postal Code	V5A 4N7			Country	Can		Email 1:	leigh.stickney@teck.com			
				Phone Number				Email 2:	sean.beswick@teck.com			Email 3:	jevin.wolchuk@teck.com		
								PO number	359182						

SAMPLE DETAILS

ANALYSIS REQUESTED

Please indicate below Filtered, Preserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS																
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A					
								96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7d C. dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H. azteca	28 Day Hyalella P/F	32d FHM P/F (conducted in Calgary)							
GH_FR1_WS_2016-11-01_N	GH_FR1	WS	N	1-Nov-16	10:00	G	4					X		X		X	X							
GH_ERC_WS_2016-11-01_N	GH_ERC	WS	N	1-Nov-16	12:45	G	3							X										
GH_ER2_WS_2016-11-01_N	GH_ER2	WS	N	1-Nov-16	11:45	G	4					X		X										

TOL
6.0
5.4
7.0

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION

Date Time Accepted By/Affiliation Date Time

① Clear, colourless, no odours, some particulates

John Wolchuk

Nov/16

13:15

SERVICE REQUEST (rush - subject to availability)

Regular (default) X	Priority (2-3 business days) - 50% surcharge	Emergency (1 Business Day) - 100% surcharge	For Emergency <1 Day, ASAP or Weekend - Contact ALS	Sampler's Name	Mobile #	Sampler's Signature	Date/Time
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Nautilus - Burnaby
rec'd Nov 2/16 @ 1030r
- refresh samples - BT

Teck

COC ID:	20161101N			TURNAROUND TIME:		RUSH:	
PROJECT/CLIENT INFO				LABORATORY		OTHER INFO	
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental		Report Format / Distribution
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Peracy		Excel
Project Manager	Michael Moore			Email	krysta@nautilusenvironmental.ca		PDF
Email	Michael.Moore@teck.com			Address	8664 Commerce Court		EDD
Address	RR#1 HWY# 3			City	Imperial Square, Lake City		
City	Sparwood	Province	BC	City	Burnaby	Province	BC
Postal Code	VIC 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada
Phone Number	1-250-865-5289			Phone Number			

SAMPLE DETAILS								ANALYSIS REQUESTED						
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS						
EV_ER4_WS_2016-11-01_N	EV_ER4	WS	N	11/1/2016		G	3	30-day rainbow trout early life stage P/F CARBOYS						
								39 d rainbow trout early life stage NO3/SO4 - CARBOYS						
								39 d rainbow trout early life stage NO3/SO4 - BARRELS						
							Total							
							3							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS				RELINQUISHED BY/AFFILIATION				DATE/TIME		ACCEPTED BY/AFFILIATION		DATE/TIME	
39 d Rainbow Trout early life stage NO3/SO4										Nautilus		Nov 02/16 @ 10:30	
① Clear odorless, odorless, some particulates										NY - Nan Yamamoto		- refresh sample -	
NB OF BOTTLES RETURNED/DESCRIPTION				Sampler's Name				Mobile #		Date/Time			
Regular (default) X				Cameron Griffin						1 NOV 2016			
Priority (2-3 business days) - 50% surcharge				Sampler's Signature									
Emergency (1 Business Day) - 100% surcharge													
For Emergency <1 Day, ASAP or Weekend - Contact ALS													

Temp °C

3x200L 7.0

WO # 161183

COC ID: Q4 Tox Refresh Nov 8 **TURNAROUND TIME:** regular **RUSH:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO					
Facility Name	Greenhills Operations			Lab Name	Nautilus Environmental			EDD delivery:					
Project Manager	Leigh Stickney			Lab Contact	Krysta Pearcy			Site:	leigh.stickney@teck.com		EQuIS:	GHO	
Email	leigh.stickney@teck.com			Email				Report Format / Distribution					
Address	PO Box 5000			Address	8664 Commence Court			Yes	PDF	Yes	Excel		
City	Elkford		Province	BC		City	Burnaby		Province	BC		Email 1:	leigh.stickney@teck.com
Postal Code	V0B 1H0		Country	Canada		Postal Code	V5A 4N7		Country	Can		Email 2:	sean.beswick@teck.com
Phone Number	250 865 3274			Phone Number				PO number	359182				

SAMPLE DETAILS								ANALYSIS REQUESTED																
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Please indicate below Filtered, Perserved or both (F, P, F/P)																
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A					
								96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7d C.dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyalella P/F	32d FHM P/F conducted in Calgary							
GH_FR1_WS_2016-11-08_N	GH_FR1	WS	N	8-Nov-16	08:45	G	4					X		X		X	X						6.0	4x200
GH_ERC_WS_2016-11-08_N	GH_ERC	WS	N	8-Nov-16	09:00	G	3							X									6.7	3x2
GH_ER2_WS_2016-11-08_N	GH_ER2	WS	N	8-Nov-16	10:15	G	4					X		X									6.0	3x201
																							5.3	1x200

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
① see clear, colourless, odourless, some particulates	Jevin Wolchuk	Nov 9/16	10:30	Nautilus - Burnaby	Nov 09/16	10:00
				NY - Kevin Yamasaki		

SERVICE REQUEST (rush - subject to availability)			
Regular (default) X	Priority (2-3 business days) - 50% surcharge	Emergency (1 Business Day) - 100% surcharge	For Emergency <1 Day, ASAP or Weekend - Contact ALS
Sampler's Name	Jevin Wolchuk	Mobile #	250.425.5310
Sampler's Signature		Date/Time	

= refresh sample =

Teck

COC ID:	20161108N			TURNAROUND TIME:		RUSH:	
PROJECT/CLIENT INFO				LABORATORY		OTHER INFO	
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental		
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Peracy		
Project Manager	Michael Moore			Email	krysta@nautilusenvironmental.ca		
Email	Michael.Moore@teck.com			Address	8664 Commerce Court		
Address	RR#1 HWY# 3				Imperial Square, Lake City		
City	Sparwood	Province	BC	City	Burnaby	Province	BC
Postal Code	VIC 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada
Phone Number	1-250-865-5289			Phone Number			

SAMPLE DETAILS								ANALYSIS REQUESTED									
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage P/F CARBOYS	39 d rainbow trout early life stage NO3/SO4 - CARBOYS	39 d rainbow trout early life stage NO3/SO4 - BARRELS						
EV_ER4_WS_2016-11-08_N	EV_ER4	WS	N	11/8/2016	9:00	G	3				3						
Total							3										

wo# 161183

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS				RELINQUISHED BY/AFFILIATION				DATE/TIME		ACCEPTED BY/AFFILIATION				DATE/TIME	
39 d Rainbow Trout early life stage NO3/SO4										Nautilus - Burnaby				Nov 09/16 @ 10:00	
① Clear, colorless, odorless, some particulates										NY - Mai Yamamoto					
										Temp - 5.5°C 3x200L					
NB OF BOTTLES RETURNED/DESCRIPTION															
Regular (default)															
Priority (2-3 business days) - 50% surcharge															
Emergency (1 Business Day) - 100% surcharge															
For Emergency <1 Day, ASAP or Weekend - Contact ALS															
				Sampler's Name				<i>Cam Griffin</i>		Mobile #					
				Sampler's Signature				<i>[Signature]</i>		Date/Time				8:00 2016	

COC ID: Q4 Tox Refresh Nov 15 **TURNAROUND TIME:** regular **RUSH:**

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name: Greenhills Operations				Lab Name: Nautilus Environmental				EDD delivery:			
Project Manager: Leigh Stickney				Lab Contact: Krysta Pearcy				Site: leigh.stickney@teck.com		EQuIS: GHO	
Email: leigh.stickney@teck.com				Email:				Report Format / Distribution			
Address: PO Box 5000				Address: 8664 Commence Court				Yes PDF		Yes Excel	
City: Elkford				Province: BC		Imperial Square Lake City				Email 1: leigh.stickney@teck.com	
Postal Code: V0B 1H0				Country: Canada		City: Burnaby		Province: BC		Email 2: sean.beswick@teck.com	
Phone Number: 250 865 3274				Postal Code: V5A 4N7				Country: Can		Email 3: jevin.wolchuk@teck.com	
				Phone Number:				PO number: 359182			

SAMPLE DETAILS								ANALYSIS REQUESTED																						
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Please indicate below Filtered, Preserved or both (F, P, F/P)																						
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A											
GH_FR1_WS_2016-11-15_N	GH_FR1	WS	N	15-Nov-16	9:30	G	7	96 hr Rainbow trout (pass/fail)		48 hr daphnia (pass/fail)		48 hr daphnia @ 10 deg C (pass/fail)		7d C.dubia NO3/SO4		30 d rainbow trout early life stage NO3/SO4	X	72 hr P Subcapitata		30 day rainbow trout early life stage P/F	X	28 day H azteca		28 Day Hyaltila P/F		32d FHM P/F Calgary	X	Temp °C	3.2	
GH_ERC_WS_2016-11-15_N	GH_ERC	WS	N	15-Nov-16	14:00	G	3																						4.8	
GH_ER2_WS_2016-11-15_N	GH_ER2	WS	N	15-Nov-16	12:00	G	4										X				X								4.4	

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS: ①, ②, ③; clean colourless, colourless, some particulates

RELINQUISHED BY/AFFILIATION: S. Ewins (Calgary) Date: 15-Nov-16 Time: 14:00

Accepted By/Affiliation: Nautilus - Burnaby Date: Nov 16/16 Time: 10:00

NY - Nautilus Yamamoto

= refresh sample =

SERVICE REQUEST (rush - subject to availability)			
Regular (default) <input checked="" type="checkbox"/>	Sampler's Name	Jevin Wolchuk	Mobile #
Priority (2-3 business days) - 50% surcharge	Sampler's Signature		250.425.5310
Emergency (1 Business Day) - 100% surcharge			Date/Time
For Emergency <1 Day, ASAP or Weekend - Contact ALS			

Teck

COC ID: 201611015N		TURNAROUND TIME:				RUSH:					
PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job# Elkview Operations		Lab Name Nautilus Environmental		Report Format / Distribution		Excel	PDF	EDD			
Job Description SA Chronic Toxicity Sampling		Lab Contact Krysta Peracy		Email 1: Michael.Moore@teck.com		X	X	X			
Project Manager Michael Moore		Email krysta@nautilusenvironmental.ca		Email 2: teckcoal@equisonline.com				X			
Email Michael.Moore@teck.com		Address 8664 Commerce Court		Email 3: James.Bokit@teck.com		X	X	X			
Address RR#1 HWY#3		Imperial Square, Lake City		Email 4: Cameron.Griffin@teck.com		X	X	X			
City Sparwood		Province BC		City Burnaby		Province BC		Email 5:			
Postal Code VIC 4C3		Country Canada		Postal Code VSA 4N7		Country Canada		PO number 432106			
Phone Number 1-250-865-5289				Phone Number							

SAMPLE DETAILS								ANALYSIS REQUESTED									
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	C-Grab C-Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage P/F CARBOYS	39 d rainbow trout early life stage NO3/SO4 - CARBOYS	39 d rainbow trout early life stage NO3/SO4 - BARRELS						
EV_ER4_WS_2016-11-15_N	EV_ER4	WS	N	11/15/2016	9:55	G	3				3						
Total							3										

wo# 161183

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS				RELINQUISHED BY/AFFILIATION				DATE/TIME				ACCEPTED BY/AFFILIATION				DATE/TIME			
39 d Rainbow Trout early life stage NO3/SO4												Nautilus - Burnaby				Nov 16/16 @ 10:00			
												NY - Nam Yamamoto							
												3x 200L - Temp 3.6°C				= refresh sample			
NB OF BOTTLES RETURNED/DESCRIPTION				Sampler's Name				Sampler's Signature				Mobile #				Date/Time			
Regular (default) X				Cam Griffin												15 Nov 2016			
Priority (2-3 business days) - 50% surcharge																			
Emergency (1 Business Day) - 100% surcharge																			
For Emergency <1 Day, ASAP or Weekend - Contact ALS																			

① heavy, colorless, odorless, some particulates

Teck

COC ID: 20161122N		TURNAROUND TIME:				RUSH:					
PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job# Elkview Operations		Lab Name Nautilus Environmental		Report Format / Distribution				Excel	PDF	EDD	
Job Description SA Chronic Toxicity Sampling		Lab Contact Krysta Peracy		Email 1: Michael.Moore@teck.com		X		X	X		
Project Manager Michael Moore		Email krysta@nautilusenvironmental.ca		Email 2: teckcoal@equisonline.com		X		X	X		
Email Michael.Moore@teck.com		Address 8664 Commerce Court		Email 3: James.Boldt@teck.com		X		X	X		
Address RR#1 HWY# 3		Imperial Square, Lake City		Email 4: Cameron.Griffin@teck.com		X		X	X		
City Sparwood Province BC		City Burnaby Province BC		Email 5:							
Postal Code VIC 4C3 Country Canada		Postal Code V5A 4N7 Country Canada		PO number 432106							
Phone Number 1-250-865-5289		Phone Number									

SAMPLE DETAILS								ANALYSIS REQUESTED									
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage P/F CARBOYS	39 d rainbow trout early life stage NO3/SO4 - CARBOYS	39 d rainbow trout early life stage NO3/SO4 - BARRELS						Temp.
① EV_ER4_WS_2016-11-22_N ⁶	EV_ER4	WS	N	11/22/2016	16:35	G	3				3						40
Total							3										

WO # 161183

3x200L

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS 39 d Rainbow Trout early life stage NO3/SO4				RELINQUISHED BY/AFFILIATION				DATE/TIME		ACCEPTED BY/AFFILIATION				DATE/TIME	
										Eric Cheung				Nov 23/16 @ 0730h	
										Nautilus - Burnaby				refresh sample	
NB OF BOTTLES RETURNED/DESCRIPTION				Sampler's Name				Mobile #		Sampler's Signature				Date/Time	
Regular (default) X				Com Griffin										22 Nov - 16	
Priority (2-3 business days) - 50% surcharge															
Emergency (1 Business Day) - 100% surcharge															
For Emergency <1 Day, ASAP or Weekend - Contact ALS															

① Clear, colourless, odourless, some particulates
 - Sample only used for ongoing NO3 test

Teck

COC ID:	20161129N			TURNAROUND TIME:		RUSH:	
PROJECT/CLIENT INFO				LABORATORY		OTHER INFO	
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental		Report Format / Distribution
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Percy		Excel
Project Manager	Jeff Williams			Email	krysta@nautilusenvironmental.ca		PDF
Email	Jeff.Williams@teck.com			Address	8664 Commerce Court		EDD
Address	RR#1 HWY#3				Imperial Square, Lake City		
City	Sparwood	Province	BC	City	Burnaby	Province	BC
Postal Code	V1C 4C3	Country	Canada	Postal Code	V5A 4N7	Country	Canada
Phone Number	1-250-865-5289			Phone Number			

SAMPLE DETAILS								ANALYSIS REQUESTED									
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G-Grab C=Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage P/F CARBOYS	30 d rainbow trout early life stage NO3/SO4 - CARBOYS	30 d rainbow trout early life stage NO3/SO4 - BARRELS						
EV_ER4_WS_2016-11-29_N_A	EV_ER4	WS	N	11/29/2016	7:50	G	1										
Total							17										

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS 39 d Rainbow Trout early life stage NO3/SO4	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			Nautilus - Burnaby	Nov 30/16 @ 09:30
			NY - Nain Yamamoto	1X200L
NB OF BOTTLES RETURNED/DESCRIPTION			refresh sample	Temp - 2.0°C
Regular (default) <input checked="" type="checkbox"/>	Priority (2-3 business days) - 50% surcharge	Emergency (1 Business Day) - 100% surcharge	For Emergency <1 Day, ASAP or Weekend - Contact ALS	
Sampler's Name	Sampler's Signature	Mobile #	Date/Time	
	<i>Cameron Griffin</i>		29 Nov '16	

① Clear, accurate, accurate, some particulates
 * sample only used for ongoing NO3 test

Cameron Griffin

COC ID:		Q4 Tox Refresh Dec 6		TURNAROUND TIME:			regular		RUSH:		
PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name		Greenhills Operations		Lab Name		Nautilus Environmental		EDD delivery:			
Project Manager		Leigh Stickney		Lab Contact		Krysta Pearcy		Site:		leigh.stickney@teck.com EQUIS: GHO	
Email		leigh.stickney@teck.com		Email				Report Format / Distribution			
Address		PO Box 5000		Address		8664 Commence Court		Yes		PDF Yes Excel	
City		Elkford		Province		BC		City		Imperial Square Lake City	
Postal Code		V0B 1H0		Country		Canada		City		Burnaby	
Phone Number		250 865 3274		Postal Code		V5A 4N7		Country		Can	
				Phone Number				PO number		359182	

SAMPLE DETAILS								ANALYSIS REQUESTED										
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Please indicate below Filtered, Preserved or both (F, P, F/P)										
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
								96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7d C.dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyalella P/F	Temp °C	
GH_FR1_WS_2016-12-06_N-*	GH_FR1	WS	N	6-Dec-16	08:45	G	3					X					0.3	
GH_ER2_WS_2016-12-06_N-*	GH_ER2	WS	N	6-Dec-16	13:30	G	12					X					0.5	

wo# 161183
= refresh sample =
samples arrived partially frozen

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
All tubes/canisters are from GH-ER2	Kevin Wolchuk	Dec 6/16	13:30	Nautilus - Burnaby NY - Nain Yamamoto	Dec 07/16	10:20

SERVICE REQUEST (rush - subject to availability)			
Regular (default) <input checked="" type="checkbox"/>	Priority (2-3 business days) - 50% surcharge	Emergency (1 Business Day) - 100% surcharge	For Emergency <1 Day, ASAP or Weekend - Contact ALS
Sampler's Name	Kevin Wolchuk	Mobile #	250.425.5310
Sampler's Signature		Date/Time	Dec. 6/16 13:30

① clear, colourless, odourless, some particulates
* Samples were not used as test ended on Dec 9/16 for NO3 test.

Teck

COC ID:	20161206N			TURNAROUND TIME:		RUSH:		
PROJECT/CLIENT INFO				LABORATORY		OTHER INFO		
Facility Name / Job#	Elkview Operations			Lab Name	Nautilus Environmental			
Job Description	SA Chronic Toxicity Sampling			Lab Contact	Krysta Peracy			
Project Manager	Jeff Williams			Email	krysta@nautilusenvironmental.ca			
Email	Jeff.Williams@teck.com			Address	8664 Commerce Court			
Address	RR#1 HWY# 3				Imperial Square, Lake City			
City	Sparwood		Province	BC	City	Burnaby	Province	BC
Postal Code	VIC 4C3		Country	Canada	Postal Code	V5A 4N7	Country	Canada
Phone Number	1-250-865-5289			Phone Number				
					Report Format / Distribution	Excel	PDF	EDD
					Email 1:	Jeff.Williams@teck.com	X	X
					Email 2:	teckcost@equisonline.com		X
					Email 3:	James.Boldt@teck.com	X	X
					Email 4:	Cameron.Griffin@Teck.com	X	X
					Email 5:			X
					PO number	432106		

SAMPLE DETAILS ANALYSIS REQUESTED

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30-day rainbow trout early life stage P/F CARBOYS	39 d rainbow trout early life stage NO3/SO4 - CARBOYS	39 d rainbow trout early life stage NO3/SO4 - BARRELS	Temp. °C
EV_ER4_WS_2016-12-06_N ¹	EV_ER4	WS	N	12/6/2016	10:00	G	1				1	0.0
					Total		1					

wo# 161183
 = refresh sample =
 sample arrived partially frozen

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
39 d Rainbow Trout early life stage NO3/SO4			Nautilus - Burnaby NY - Aki Yamamoto	Dec 07/16 @ 10:20

NB OF BOTTLES RETURNED/DESCRIPTION	Regular (default) X	Priority (2-3 business days) - 50% surcharge	Emergency (1 Business Day) - 100% surcharge	For Emergency <1 Day, ASAP or Weekend - Contact ALS	Sampler's Name	Sampler's Signature	Mobile #	Date/Time
					Cam Griffin			6 DEC '16

① Clear, colourless, odourless, some particulates
 A sample was not use as test ended on Dec 9/16 for NO3 test

COC ID: Oct 25 Q4 Tox Week 1		TURNAROUND TIME: regular		RUSH:						
PROJECT/CLIENT INFO			LABORATORY		OTHER INFO					
Facility Name	Greenhills Operations		Lab Name	Hydroqual Laboratories Ltd		EDD delivery:				
Project Manager	Leigh Stickney		Lab Contact	Jacklyn Pool		Site: leigh.stickney@teck.com EQUIS: GHO				
Email	leigh.stickney@teck.com		Email			Report Format / Distribution				
Address	PO Box 5000		Address	#4, 6125 - 12th Street S.E.		Yes PDF Yes Excel				
City	Elkford	Province	BC	City	Calgary	Province	AB	Email 1:	leigh.stickney@teck.com	
Postal Code	V0B 1H0	Country	Canada	Postal Code	T2H 2K1	Country	Can	Email 2:	sean.beswick@teck.com	
Phone Number	250 865 3274		Phone Number	403.253.7121				Email 3:	jevin.wolchuk@teck.com	
						PO number				

SAMPLE DETAILS								ANALYSIS REQUESTED															
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Please indicate below Filtered, Preserved or both (F, P, F/P)															
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A				
								96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7d C. dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyalella P/F	30 d early life stage, fathead minnow Pass/Fail						
GH_FR1_WS_2016-10-25_N	GH_FR1	WS	N	25-Oct-16		G	4																
GH_ER2_WS_2016-10-25_N	GH_ER2	WS	N	25-Oct-16	12:00	G	4																
1017-0247	Week 2																						
1017-0317	2016/10/26 1145																						
	6x 20 L Carboys																						
	2x 50 Gal drums																						
	No SKI ibc																						
	Beats paw																						
	mc																						

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Jein Wolchuk	Oct. 25/16	12:30			

SERVICE REQUEST (rush - subject to availability)			
Regular (default) X	Priority (2-3 business days) - 50% surcharge	Emergency (1 Business Day) - 100% surcharge	For Emergency <1 Day, ASAP or Weekend - Contact ALS
Sampler's Name	Jein Wolchuk	Mobile #	250.415.5310
Sampler's Signature	<i>Jein Wolchuk</i>	Date/Time	Oct. 25/16 12:30

Teck

COC ID: 20161025H TURNAROUND TIME: RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Elkview Operations			Lab Name	HydroQual Calgary			Report Format / Distribution				
Job Description	SA Chronic Toxicity Sampling			Lab Contact				Email 1	Michael.Moore@teck.com	Excel	PDF	EDD
Project Manager	Michael Moore			Email				Email 2	teckcoal@equisonline.com	X	X	X
Email	Michael.Moore@teck.com			Address	6125 12 St SE			Email 3	James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3							Email 4	Cameron.Griffin@teck.com	X	X	X
								Email 5				
City	Sparwood	Province	BC	City	Calgary	Province	AB	PO number	432106			
Postal Code	V1C 4C3	Country	Canada	Postal Code	T2H 2K1	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS								ANALYSIS REQUESTED															
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage fathead minnow SO4 - CARBOYS	30 d early life stage fathead minnow SO4 - BARRELS													
EV_ER4_WS_2016-10-25_N	EV_ER4	WS	N	10/25/2016	8 35	G	2			2													
							Total																

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Nitrate/Sulphate Testing Program				

NB OF BOTTLES RETURNED/DESCRIPTION	Regular (default)	Priority (2-3 business days) - 50% surcharge	Emergency (1 Business Day) - 100% surcharge	For Emergency <1 Day, ASAP or Weekend - Contact ALS	Sampler's Name	Mobile #	Sampler's Signature	Date/Time
	X				Cameron Griffin			25 Oct 2016

2016/10/26 Bears paw
 1145
 2x 50 GAL barrel
 no S/S
 Good condition
 18°C MC

COC ID: Nov 1 Q4 Tox Week 3		TURNAROUND TIME: regular		RUSH:				
PROJECT/CLIENT INFO			LABORATORY		OTHER INFO			
Facility Name	Greenhills Operations		Lab Name	Hydroqual Laboratories Ltd		EDD delivery:		
Project Manager	Leigh Stickney		Lab Contact	Jacklyn Pool		Site: leigh.stickney@teck.com EQuIS: GHO		
Email	leigh.stickney@teck.com		Email			Report Format / Distribution		
Address	PO Box 5000		Address	#4, 6125 - 12th Street S.E.		Yes PDF Yes Excel		
City	Elkford	Province	BC	City	Calgary	Province	AB	Email 1: leigh.stickney@teck.com
Postal Code	V0B 1H0	Country	Canada	Postal Code	T2H 2K1	Country	Can	Email 2: sean.beswick@teck.com
Phone Number	250 865 3274		Phone Number	403.253.7121				Email 3: jevin.wolchuk@teck.com
					PO number			

SAMPLE DETAILS								ANALYSIS REQUESTED											
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Please indicate below Filtered, Preserved or both (F, P, F/P)											
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
								96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7d C.dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyalella P/F	30 d early life stage, fathead minnow Pass/Fail	30 d early life stage, fathead minnow SO4	
GH_FR1_WS_2016-11-01_N	GH_FR1	WS	N	1-Nov-16	10:00	G	2										X	X	
GH_ER2_WS_2016-11-01_N	GH_ER2	WS	N	1-Nov-16	11:45	G	3										X	X	
1617-0317																			
week 3 1617-0247 / 1617-0319 week 2																			
1617-0317 week 2 2016/11/02 1130 Good Condition 3x 20 L Carboys 2x 55 Gal barrels BeuB per w 11°C NO S/F MC																			
ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS			RELINQUISHED BY/AFFILIATION			Date	Time	Accepted By/Affiliation				Date	Time						
			Jevin Wolchuk			Nov 1/16	12:30												

SERVICE REQUEST (rush - subject to availability)			
Regular (default) X	Sampler's Name	Mobile #	
Priority (2-3 business days) - 50% surcharge	Sampler's Signature	Date/Time	
Emergency (1 Business Day) - 100% surcharge			
For Emergency <1 Day, ASAP or Weekend - Contact ALS			

Teck

COC ID: **2016110111** TURNAROUND TIME: RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO						
Facility Name / Job#	Elkview Operations			Lab Name	HydroQual Calgary			Report Format / Distribution			Excel	PDF	EDD	
Job Description	SA Chronic Toxicity Sampling			Lab Contact				Email 1:	Michael.Moore@teck.com			X	X	X
Project Manager	Michael Moore			Email				Email 2:	teckcoal@equisonline.com			X	X	X
Email	Michael.Moore@teck.com			Address	6125 12 St SE			Email 3:	James.Bolt@teck.com			X	X	X
Address	RR#1 HWY# 3							Email 4:	Cameron.Griffin@teck.com			X	X	X
								Email 5:						
City	Sparwood	Province	BC	City	Calgary	Province	AB	PO number	432106					
Postal Code	V1C 4C3	Country	Canada	Postal Code	T2H 2K1	Country	Canada							
Phone Number	1-250-865-5289			Phone Number										

SAMPLE DETAILS								ANALYSIS REQUESTED									
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont	Analysis	30 d early life stage fathead minnow S04 - CARBOYS	30 d early life stage fathead minnow S04 - BARRELS							
EV_ER4_WS_2016-11-01_N	EV_ER4	WS	N	11/1/2016		G	1			1							
							Total	1									

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
30 d early life stage fathead minnow S04				

NB OF BOTTLES RETURNED/DESCRIPTION		Sampler's Name	Mobile #
Regular (default)	X	<i>Cameron Griffin</i>	
Priority (2-3 business days) - 50% surcharge			
Emergency (1 Business Day) - 100% surcharge			
For Emergency <1 Day, ASAP or Weekend - Contact ALS			
		Sampler's Signature	Date/Time
			1 Nov 2016

1617-0318 Week 2

2016/11/02
 1130 Good Condition
 1 x 55 gal barrel
 2 x 20 L Carboys
 no S/H Bears Paw
 12°C
 MC

COC ID: **Q4 Tox Refresh Nov 8** TURNAROUND TIME: regular RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name: Greenhills Operations				Lab Name: Hydroqual Laboratories Ltd				EDD delivery:			
Project Manager: Leigh Stickney				Lab Contact: Jacklyn Pool				Site: leigh.stickney@teck.com		EQuIS: GHO	
Email: leigh.stickney@teck.com				Email:				Report Format / Distribution			
Address: PO Box 5000				Address: #4, 6125 - 12th Street S.E.				Yes PDF		Yes Excel	
City: Elkford Province: BC				City: Calgary Province: AB				Email 1: leigh.stickney@teck.com			
Postal Code: V0B 1H0 Country: Canada				Postal Code: T2H 2K1 Country: Can				Email 2: sean.beswick@teck.com			
Phone Number: 250 865 3274				Phone Number: 403.253.7121				Email 3: jevin.wolchuk@teck.com			
								PO number			

SAMPLE DETAILS								ANALYSIS REQUESTED											
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Please indicate below Filtered, Preserved or both (F, P, F/P)											
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
GH_FR1_WS_2016-11-08_N	GH_FR1	WS	N	8-Nov-16	09:45	G	2	96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7 d C. dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyalella P/F	30 d early life stage, fathead minnow Pass/Fail	30 d early life stage, fathead minnow SO4	
GH_ER2_WS_2016-11-08_N	GH_ER2	WS	N	8-Nov-16	10:15	G	3												
1617-0317	2016/11/09	M45																	
Week 3	Good Condition																		
	nos/E																		
	3-55 G 46 drums																		
	2-206 Carboys																		

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	Justin Wolchuk	Nov 8/16	10:30			

SERVICE REQUEST (rush - subject to availability)			
Regular (default) X	Sampler's Name	Jevin Wolchuk	Mobile #
Priority (2-3 business days) - 50% surcharge	Sampler's Signature		250.910.5470
Emergency (1 Business Day) - 100% surcharge			Date/Time
For Emergency <1 Day, ASAP or Weekend - Contact ALS			

Teck

COC ID: **20161108H** TURNAROUND TIME: RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Elkview Operations			Lab Name	HydroQual Calgary			Report Format / Distribution		Excel	PDF	EDD
Job Description	SA Chronic Toxicity Sampling			Lab Contact				Email 1:	Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore			Email				Email 2:	teckcoal@equasonline.com			X
Email	Michael.Moore@teck.com			Address	6125 12 St SE			Email 3:	James.Bohrt@teck.com	X	X	X
Address	RR#1 HWY# 3							Email 4:	Cameron.Griffin@teck.com	X	X	X
								Email 5:				
City	Sparwood	Province	BC	City	Calgary	Province	AB	PO number	432106			
Postal Code	V1C 4C3	Country	Canada	Postal Code	T2H 2K1	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS								ANALYSIS REQUESTED													
Sample ID	Sample Location	Field Matrix	Hazardous Maternal (Yes/No)	Date	Time (2-4hr)	G=Grab C=C=Comp	# Of Cont.	Analysis	30 d early life stage fathead minnow S04 - CARBOYS	30 d early life stage fathead minnow S04 - BARRELS											
EV_ER4_WS_2016-11-08_N	EV_ER4	WS	N	11/8/2016	9:00	G	1			1											
							Total	1													

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
30 d early life stage fathead minnow S04				

NB OF BOTTLES RETURNED/DESCRIPTION	Sampler's Name	Mobile #	Sampler's Signature	Date/Time
Regular (default) X Priority (2-3 business days) - 50% surcharge Emergency (1 Business Day) - 100% surcharge For Emergency <1 Day, ASAP or Weekend - Contact ALS			<i>Cameron Griffin</i>	8 NOV 2016

*1617-0318
week 3*

*2016/11/09 Good
1145 Condition
NO S/L
Boys pan
1x 55 Gal barrel
2x 20 L Carboys
139
ML*

COC ID: **Q4 Tox Refresh Nov 15** TURNAROUND TIME: regular RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name	Greenhills Operations			Lab Name	Hydroqual Laboratories Ltd			EDD delivery:			
Project Manager	Leigh Stickney			Lab Contact	Jacklyn Pool			Site:	leigh.stickney@teck.com	EQUIS:	GHO
Email	leigh.stickney@teck.com			Email				Report Format / Distribution			
Address	PO Box 5000			Address	#4, 6125 - 12th Street S.E.			Yes	PDF	Yes	Excel
City	Elkford	Province	BC	City	Calgary	Province	AB	Email 1: leigh.stickney@teck.com			
Postal Code	V0B 1H0	Country	Canada	Postal Code	T2H 2K1	Country	Can	Email 2: sean.beswick@teck.com			
Phone Number	250 865 3274			Phone Number	403.253.7121			Email 3: jevin.wolchuk@teck.com			
								PO number			

SAMPLE DETAILS								ANALYSIS REQUESTED											
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Please indicate below Filtered, Preserved or both (F, P, F/P)											
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
								96 hr Rainbow trout (pass/fail)	48 hr daphnia (pass/fail)	48 hr daphnia @ 10 deg C (pass/fail)	7d C. dubia NO3/SO4	39 d rainbow trout early life stage NO3/SO4	72 hr P Subcapitata	30 day rainbow trout early life stage P/F	28 day H azteca	28 Day Hyallella P/F	30 d early life stage, fathead minnow Pass/Fail	30 d early life stage, fathead minnow SO4	
GH_FR1_WS_2016-11-15_N	GH_FR1	WS	N	15-Nov-16	1130	G	2										X	X	
GH_ER2_WS_2016-11-15_N	GH_ER2	WS	N	15-Nov-16	1200	G	3											X	
1617-0317	2016/11/16				1130														

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	Date	Time	Accepted By/Affiliation	Date	Time
	J. Enns (Hyqua)	15-NOV-16	19:00			

SERVICE REQUEST (rush - subject to availability)			
Regular (default) X	Sampler's Name	Jevin Wolchuk	Mobile # 250.910.5470
Priority (2-3 business days) - 50% surcharge	Sampler's Signature		Date/Time
Emergency (1 Business Day) - 100% surcharge			
For Emergency <1 Day, ASAP or Weekend - Contact ALS			

Teck

COC ID: **20161115H** TURNAROUND TIME: RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Elkview Operations			Lab Name	HydroQual Calgary			Report Format / Distribution	Excel	PDF	EDD	
Job Description	SA Chronic Toxicity Sampling			Lab Contact				Email 1:	Michael.Moore@teck.com	X	X	X
Project Manager	Michael Moore			Email				Email 2:	teckcoal@equisonline.com			
Email	Michael.Moore@teck.com			Address	6125 12 St SE			Email 3:	James.Bold@teck.com	X	X	X
Address	RR#1 HWY# 3							Email 4:	Cameron.Griffin@teck.com	X	X	X
								Email 5:				
City	Sparwood	Province	BC	City	Calgary	Province	AB	PO number	432106			
Postal Code	V1C 4C3	Country	Canada	Postal Code	T2H 2K1	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS **ANALYSIS REQUESTED** Filtered - F, Field, L, Lab, PL, Field & Lab, N, Near

Sample ID	Sample Location	Field Matrix	Hazardous Maternal (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Analysis	30 d early life stage fathead minnow S04 - CARBOYS	30 d early life stage fathead minnow S04 - BARRELS							
<i>1617-0318</i> <i>Week 4</i> EV_ER4_WS_2016-11-15_N	EV_ER4	WS	N	11/15/2016	9:55	G	2		2								
							Total										

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
30 d early life stage fathead minnow S04				

NB OF BOTTLES RETURNED/DESCRIPTION	Sampler's Name	Mobile #
Regular (default) X	<i>Cam Griffin</i>	
Priority (2-3 business days) - 50% surcharge	<i>[Signature]</i>	
Emergency (1 Business Day) - 100% surcharge		
For Emergency <1 Day, ASAP or Weekend - Contact ALS		15 000 16

2016/11/16
1130 NOS/K
2x 20 L Carboys
1x 55 Gal drum
NOS/K bevspaw carrier
MC

COC ID:

Q4 Tox Refresh Nov 22

TURNAROUND TIME:

regular

RUSH:

PROJECT/CLIENT INFO

LABORATORY

OTHER INFO

Facility Name: Greenhills Operations
 Project Manager: Leigh Stickney
 Email: leigh.stickney@teck.com
 Address: PO Box 5000

Lab Name: Hydroqual Laboratories Ltd
 Lab Contact: Jacklyn Pool
 Email:
 Address: #4, 6125 - 12th Street S.E.

EDD delivery:
 Site: leigh.stickney@teck.com EQuIS: GH0
 Report Format / Distribution
 Yes PDF Yes Excel
 Email 1: leigh.stickney@teck.com
 Email 2: sean.beswick@teck.com
 Email 3: jevin.wolchuk@teck.com
 PO number

City: Elkford Province: BC
 Postal Code: V0B 1H0 Country: Canada
 Phone Number: 250 865 3274

City: Calgary Province: AB
 Postal Code: T2H 2K1 Country: Can
 Phone Number: 403.253.7121

SAMPLE DETAILS

ANALYSIS REQUESTED

Please indicate below Filtered, Perserved or both (F, P, F/P)

Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS															
								#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A				
								96 hr Rainbow trout (pass/fail)															
								48 hr daphnia (pass/fail)															
								48 hr daphnia @ 10 deg C (pass/fail)															
								7d C.dubia NO3/SO4															
								39 d rainbow trout early life stage NO3/SO4															
								72 hr P Subcapitata															
								30 day rainbow trout early life stage P/F															
								28 day H azteca															
								28 Day Hyalella P/F															
								30 d early life stage, fathead minnow Pass/Fail															
								30 d early life stage, fathead minnow SO4															

*Week 5
1617-0319*

1617-0317

*2016/11/23 no SLR
1110 12°C
Good Condition me
4 x 20 L Carboys
1 x 55 Gall barrel
Bears PCW*

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION

Date Time Accepted By/Affiliation Date Time

J. Ennis (Nupga) 12-Nov-16 14:00

SERVICE REQUEST (rush - subject to availability)

Regular (default) <input checked="" type="checkbox"/>	Sampler's Name	Jevin Wolchuk	Mobile #	250.910.5470
Priority (2-3 business days) - 50% surcharge	Sampler's Signature		Date/Time	
Emergency (1 Business Day) - 100% surcharge				
For Emergency <1 Day, ASAP or Weekend - Contact ALS				

Teck

COC ID: **20161122H** TURNAROUND TIME: RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Elkview Operations			Lab Name	HydroQual Calgary			Report Format / Distribution	Excel	PDF	EDD	
Job Description	SA Chronic Toxicity Sampling			Lab Contact				Email 1:	Michael Moore@teck.com	X	X	X
Project Manager	Michael Moore			Email				Email 2:	teckcoal@equisonline.com			
Email	Michael.Moore@teck.com			Address	6125 12 St SE			Email 3:	James.Boldt@teck.com	X	X	X
Address	RR#1 HWY# 3							Email 4:	Cameron.Griffin@teck.com	X	X	X
								Email 5:				
City	Sparwood	Province	BC	City	Calgary	Province	AB	PO number	432106			
Postal Code	V1C 4C3	Country	Canada	Postal Code	T2H 2K1	Country	Canada					
Phone Number	1-250-865-5289			Phone Number								

SAMPLE DETAILS								ANALYSIS REQUESTED													
Sample ID	Sample Location	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ANALYSIS	30 d early life stage fathead minnow SO4 - CARBOYS	30 d early life stage fathead minnow SO4 - BARRELS											
EV_ER4_WS_2016-11-22_N	EV_ER4	WS	N	11/22/2016	8:35	G	2		2												
							Total	2													

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
30 d early life stage fathead minnow SO4				

NB OF BOTTLES RETURNED/DESCRIPTION		Sampler's Name	Mobile #
Regular (default) X		<i>Cameron Griffin</i>	
Priority (2-3 business days) - 50% surcharge			
Emergency (1 Business Day) - 100% surcharge			
For Emergency <1 Day, ASAP or Weekend - Contact ALS			
	Sampler's Signature	Date/Time	22 NOV 2016

*2016-11-22 we
1617-0318 weeks*

*2016/11/23
1110
Good Condition
Beats plan
NO S/I
2x 20 L Carboys
1x 55 GAL barrel
Doc
MC*

END OF REPORT

APPENDIX B

Summaries of Test Conditions for Laboratory Toxicity Tests

Table B-1: Summary of Test Conditions: Northern Leopard Frog Tadpole Development Test

Attribute	Test Details
Test organism	<i>Lithobates pipiens</i> (formerly <i>Rana pipiens</i>)
Test organism source	Field collected gravid females collected in Ontario by University of Ottawa (Vance Trudeau) and spawned in laboratory water prior to transport ^(b)
Test organism age at initiation	Gosner stage 27
Test type	Static-renewal
Test termination criteria	≥70% of control organisms reach onset of metamorphosis; ≥80% survival
Test vessel	18-L glass aquaria ^(b)
Test volume	8-L
Test replicates	4 test replicates per treatment
No. of organisms	10 per replicate
Control water	Dechlorinated municipal tap water and synthetic hard water controls ^(a)
Test solution renewal	Three times per week (75% renewal)
Test temperature	23 ± 1°C
Feeding	Daily, approximately 3% body weight. The administered food will be Sera Micron®. This is a commercially available tadpole food that has been demonstrated in validation studies to support proper growth and development of amphibian larvae ^(b) .
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	Continuous
Statistical software	JMP, CETIS
Test endpoints	Survival, weight, length, snout to vent length, developmental stage, incidence of deformities. Test endpoints measured at end of test (Gosner stage 42) and intermediate stage (approximately Gosner stage 34-35 depending on observed rate of development) ^(b) .
Reference toxicant	96-h test using sodium chloride ^(b)

^(a) Applies to laboratory control waters. Upstream water from the Elk River (GH_ER2) will also be tested as a reference water treatment.

^(b) Denotes refinement from the previous study design (Golder and Nautilus 2016).

Table B-2: Summary of Test Conditions: Water Flea Survival and Reproduction Test

Attribute	Test Details
Test organism	<i>Ceriodaphnia dubia</i>
Test organism source	In-house culture
Test organism age	<24 h old neonates produced within 12 h
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20 mL test tube
Test volume	15 mL
Test solution depth	10 cm
Test replicates	10–30 test replicates per treatment ¹
Number of organisms	1 per replicate
Control/dilution water	20% Perrier water and 80% deionized water + 5 µg/L Se and 2 µg/L vitamin B12
Test solution renewal	Daily (100% renewal)
Test temperature	25 ± 1°C
Feeding	<i>Pseudokirchneriella subcapitata</i> and YCT
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen, pH, and conductivity measured daily; hardness and alkalinity of undiluted sample measured at test initiation; survival and reproduction checked daily
Test protocol	Environment Canada (2007a) EPS 1/RM/21
Statistical software	CETIS
Test endpoint	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods ²
Reference toxicant	Sodium chloride (NaCl)

¹ Test replication of 30 refers to the increased replication for the survival endpoint only; based on EMC advice, increased organism replicates (30 first-generation females per treatment) were incorporated for the survival endpoint only. For reproduction the standard replication required by Environment Canada (2007a) (10 first-generation females per treatment) was applied.

² Test was deemed complete when field reference and lab control samples met requirement for production of three broods (rather than just the lab control).

Table B-3: Summary of Test Conditions: Rainbow Trout Early Life Stage (Embryo-Alevin) Test

Attribute	Test Details
Test organism	<i>Oncorhynchus mykiss</i>
Test organism source	Vancouver Island Trout Hatchery, Duncan, BC
Test organism age	<30 min post fertilization, <24 h old gametes
Test type	Static renewal
Test duration	28 days for sulphate tests; 39 days for extended testing to full yolk sac absorption for nitrate tests
Test vessel	2-L plastic containers
Test volume	2 L
Test solution depth	17 cm
Test replicates	4 test replicates per treatment (increased to 8 for sulphate testing to improve statistical power)
Number of organisms	30 eggs per container
Control water	Dechlorinated Metro Vancouver municipal tapwater (hardness 12 mg/L CaCO ₃)
Test solution renewal	Daily (80% renewal)
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24-h dark; low intensity light used during solution renewals
Aeration	Continuous gentle aeration (6.5 ± 1 mL/min/L)
Test measurements	Temperature, dissolved oxygen, pH, and conductivity measured daily; hardness and alkalinity on undiluted sample measured at test initiation; survival checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/28; Canaria et al. (1999)
Test endpoint	Survival, viability (which assesses incidence of deformities in addition to mortalities), proportion with fully absorbed yolk sac (swim-up; nitrate tests only), length, wet weight
Statistical software	CETIS Version 1.8.7
Test acceptability criteria for controls	≥65% normal hatched fish
Reference toxicant	Sodium dodecyl sulphate (SDS)

Table B-4: Summary of Test Conditions: Fathead Minnow Survival and Growth Test

Attribute	Test Details
Test organism	<i>Pimephales promelas</i>
Test organism source	Aquatox, Hot Springs, AR
Test organism age	<24 hours
Test type	Static renewal
Test duration	~32 days (until 28 days post hatch)
Test vessel	1-L plastic container
Test volume	1 L
Test replicates	4 per treatment
Number of organisms	10 per replicate
Control water	Dechlorinated City of Calgary municipal tapwater
Test solution renewal	Daily (80% renewal)
Test temperature	25 ± 1°C
Feeding	Twice a day, after hatch, with newly hatched brine shrimp (<i>Artemia nauplii</i>)
Light intensity	100 – 500 lux
Photoperiod	16 hours light / 8 hours dark
Test measurements	Temperature, dissolved oxygen, pH, and conductivity measured daily; hardness and alkalinity measured upon arrival; survival checked daily
Aeration	Provided post hatch (<100 bubbles/min)
Test protocol	USEPA (1996) and ASTM (2013)
Test endpoints	Hatch, survival, length, biomass, normal development (which includes incidence of deformities)
Statistical software	CETIS Version 1.8.7
Test acceptability criteria for controls	>66% hatch; ≥70% post-hatch survival
Reference toxicant	Sodium chloride (NaCl)

APPENDIX C

Final Approved Study Design for Nitrate and Sulphate Toxicity



October 3, 2016

File: 107517

Teck Coal Ltd.
PO Box 1777
609 Douglas Fir Road
Sparwood, BC V0B 2G0

Dear Carla Fraser:

Re: Approval of “Final Study Design – Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements”

The Ministry of Environment (MOE) is in receipt of *Final Study Design – Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements (August 5, 2016)* prepared by Golder Associates and submitted by Teck Coal Ltd. on August 5th, 2016. This Study Design was submitted as required by Permit 107517 Condition 9.8.1 and the nitrate toxicity section of the November 14, 2014 RAEMP Approval Letter. I understand that the Study Design considered results from previous chronic toxicity testing and includes testing on amphibian, invertebrate and fish species, as required by Permit 107517 and the RAEMP Approval Letter. I also understand that the Environmental Monitoring Committee (EMC) has reviewed several drafts of this Study Design and discussed it on multiple occasions over the last year.

The *Final Study Design – Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements* dated August 5, 2016 is hereby approved. It is expected that Teck Coal will continue to engage the EMC in the data analyses and reporting for this project.

Should you have any questions concerning this acceptance letter, please contact Lana Miller at Lana.Miller@gov.bc.ca.

Sincerely,

Douglas Hill, P.Eng.
for Director, *Environmental Management Act*
Mining Operations

copy: Environment Canada, Vancouver BC
Alison Burton, KNC, Cranbrook BC



5 August 2016

FINAL STUDY DESIGN

Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements

Submitted to:

Nick Manklow
Lead Adaptive Water Management
Teck Coal Limited – Sparwood Environmental Office
124B Aspen Drive, Sparwood, BC V0B 2G0

REPORT



Report Number: 1523293-3100

Distribution:

1 copy - Teck Coal Limited
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Seasonal Water Quality Summaries for Proposed Sampling Locations

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Amphibian Study Design

APPENDIX C

Summaries of Test Conditions for Laboratory Toxicity Tests



List of Abbreviations

Abbreviation	Definition
ASTM	American Society for Testing and Materials
BC MOE	BC Ministry of Environment
BC WQG	BC water quality guideline
CaCO ₃	Calcium carbonate equivalent
CETIS	Comprehensive Environmental Toxicity Information System™
CM_MC2	Michel Creek upstream of Andy Goode Creek
EMC	Environmental Monitoring Committee
EMS	Environmental Management System
EPS	Environmental Protection Series
ER2	Order Station at Elk River upstream of Grave Creek (Teck ID EV_ER4)
EV_ER4	Elk River upstream of Grave Creek (see ER2)
EV_HC1	Harmer Spillway at Elk Valley Operations
EV_MC2	Michel Creek at Highway 3 Bridge
EVWQP	Elk Valley Water Quality Plan
FR_FRCP1	Fording River downstream of Cataract Creek
FR-B	Fording River at Fording Bridge
FR4	Order Station at Upper Fording River upstream of Josephine Falls (Teck ID GH_FR1)
FR4-HH	FR4 hardness-supplemented water (to 700 mg/L as CaCO ₃)
FR_UFR1	Fording River upstream reference location
GH_ER2	Elk River upstream reference location
GH_ERC	Elk River downstream of Thompson Creek
GH_FR1	Upper Fording River upstream of Josephine Falls (see FR4)
ICx	Inhibition concentration causing x percent reduction in sublethal endpoint
ID	Site identifier
JMP	John's Macintosh Program (statistical software developed by the SAS Institute)
LC_LCDSSLCC	Line Creek downstream of South Line Creek confluence
LOEC	Lowest observed effect concentration
NO ₃ -N	Nitrate nitrogen
NOEC	No-observed effect concentration
Q	Quarter of sampling (Q1, Q2, Q3, Q4)
RAEMP	Regional Aquatics Effects Monitoring Program
SO ₄	Sulphate ion
SPO	Site Performance Objective
TDS	Total dissolved solids
USEPA	United States Environmental Protection Agency
WCT	Westslope cutthroat trout
YCT	Yeast-Cerophyll®-trout chow food



1.0 INTRODUCTION

This document describes study designs for a Nitrate Chronic Toxicity Study and a Sulphate Chronic Toxicity Study at high hardness concentrations. The Nitrate Chronic Toxicity Study is being completed by Teck Coal Ltd. (Teck) in response to a condition included in a letter approving the Regional Aquatics Effects Monitoring Program (RAEMP) issued by the BC Ministry of Environment (BC MOE) on 14 November 2014 (hereafter referred to as the RAEMP Approval Condition). The Sulphate Chronic Toxicity Study is being completed in accordance with Section 9.8.1 of Environmental Management Act Permit 107517.

Both studies will assess the sensitivity of amphibians, invertebrates and fish to nitrate and sulphate in a laboratory using waters from the Elk Valley at hardness concentrations relevant to conditions in the Elk Valley. Both studies include activities scheduled for completion in 2016 and 2017; these represent a continuation of work to better understand toxicity to aquatic species of the Elk Valley. The study design builds from:

- Pilot testing in 2015 with amphibians for the purposes of method development;
- Testing completed in 2013 in support of the Elk Valley Water Quality Plan (EVWQP) (Teck 2014); and
- Testing completed in 2015 in support of Permit 107517, including chronic toxicity testing under Sections 9.8 (i) and (ii) and Section 9.8.2 (Golder 2016a).

The primary purpose of the Nitrate Chronic Toxicity Study and the Sulphate Chronic Toxicity Study is to address residual uncertainties, and they are but two components of a larger set of chronic toxicity testing requirements being executed by Teck.

An overview of all chronic toxicity testing requirements is presented below, along with a summary of the earlier testing and the residual uncertainties that were identified during and since the development of the EVWQP. The objectives of the nitrate and sulphate chronic toxicity studies are then identified, along with proposed approaches to meet these objectives and a review of the scope of this document. The proposed designs for the studies are outlined in Section 2 for nitrate and Section 3 for sulphate.

1.1 Background

A primary objective of the nitrate and sulphate toxicity study designs is to address uncertainties that have been identified from previous rounds of testing. This section summarizes the key findings and residual uncertainties from previous testing, organized based on whether testing was completed before or after the approval of the EVWQP under Permit 107517 in November 2014. Study design elements to address these uncertainties are discussed further in Sections 2 and 3 for nitrate and sulphate, respectively.



1.1.1 Pre-Permit Nitrate and Sulphate Toxicity Testing

In 2013, water from five locations in the Elk Valley, including one reference site, was collected and submitted for toxicity testing. Some of the water from each location was tested directly, with the remaining water being spiked with different levels of nitrate or sulphate to create a range of exposure concentrations (Teck 2014). For both sulphate and nitrate, test organisms consisted of two species of fish (rainbow trout and fathead minnows) and two species of invertebrates (*Hyalella azteca* and *Ceriodaphnia dubia*). Testing was completed following standard methods, with test durations being 7 days for both fish species, 14 days for *H. azteca* and 7 to 8 days for *C. dubia*.

The resulting body of information was combined with that generated in 2012 from mixture testing completed using laboratory water and water from the Fording River near Line Creek Operations (Golder and Nautilus 2013). Test organisms in the 2012 mixture study included both aforementioned species of invertebrates and rainbow trout. It also included sulphate toxicity testing with mayflies (*Centroptilum triangulifer*). Test durations for *H. azteca* and *C. dubia* were the same as those used in 2013, whereas longer duration rainbow trout tests were used in the 2012 mixture study (i.e., 28 to 39 day tests). The duration of the mayfly test was 28 days.

The combined dataset was used, in combination with available scientific literature, to develop toxicity benchmarks for amphibians (based on literature only), invertebrates and fish, all of which were incorporated into the EVWQP (see Teck 2014 for details). Residual uncertainties associated with the benchmarks were identified during the preparation and review of the EVWQP. For nitrate, the residual uncertainties related to:

- a lack of site-specific information about the sensitivity of amphibians and how it may compare to that of other species;
- whether longer-term tests with *H. azteca* would indicate a greater level of sensitivity to nitrate than previously defined by the 14 day tests; and
- the sensitivity of rainbow trout to nitrate over a range of hardness conditions, given that the number of tests completed using longer-term exposures were limited to those completed in the 2012 mixture study.

These uncertainties are reflected in the wording of the RAEMP Approval Condition:

“Additional toxicity testing to study the effects of nitrate, including:

- *amphibian toxicity testing to assess the sensitivity of representative species to nitrate using long-term metamorphosis tests;*
- *chronic toxicity testing to assess the sensitivity of invertebrates to nitrate using long-term tests; and*
- *early life stage rainbow trout toxicity testing to assess the relationship between water hardness and nitrate toxicity across a range of hardness representative of the Elk and Fording rivers.”*

The residual uncertainties for sulphate related to a lack of site-specific information for amphibians, the sensitivity of fish to sulphate, and a desire to have additional longer-term testing completed with rainbow trout and fathead minnows at high hardness concentrations (greater than 250 mg/L as CaCO₃). For sulphate, these uncertainties are reflected in the wording of Section 9.8.1 of Permit 107517:



“The Permittee must develop with input from the EMC, and implement a toxicity testing program specifically to assess sulphate toxicity at high hardness concentrations. Results will be used to support finalization of long term sulphate site performance objectives. The following toxicity test shall be conducted as a component of the sulphate toxicity testing program:

- 30-day early life-stage test with the fathead minnow, *Pimephales promelas* (USEPA 1996) using <24-hour post-fertilization eggs; endpoints: survival, hatching, growth, deformity.
- other sensitive species (amphibian, trout, water flea, etc.) shall be included.”

1.1.2 Outline of Permit-Based Chronic Toxicity Testing Program

As previously noted, the nitrate and sulphate chronic toxicity studies described below are not occurring in isolation. They are components of a larger set of chronic toxicity testing requirements that are being completed by Teck. Since the issuance of Permit 107517, a number of chronic aquatic toxicity tests have been conducted using Elk Valley waters or using exposure conditions and species of relevance to the Elk Valley. Many of these tests were conducted to satisfy other Permit-based requirements, and most of the testing in 2015 was not conducted specifically for evaluation of nitrate and/or sulphate. However, because concentrations of nitrate and/or sulphate were elevated above reference conditions in these tests, the findings were considered in the design of the Nitrate Chronic Toxicity Study and the Sulphate Chronic Toxicity Study. Results were of interest in terms of identifying sensitive test species and endpoints, documenting test variability and quality control issues, and evaluating the linkage of observed toxicity to nitrate or sulphate concentrations (i.e., concentration-response analysis).

The other toxicity testing components consist of the following (Figure 1):

- Ongoing toxicity testing as required by Section 9.8 of Permit 107517 consisting of the following:
 - semi-annual testing of ambient waters from the Elk Valley with rainbow trout in 30 day test exposures in 2015 and beyond;
 - quarterly testing of ambient waters from the Elk Valley with algae (72 hour), two species of invertebrate (*C. dubia* [7 day] and *H. azteca* [28 day]) and fathead minnows (30 day) in 2015 and beyond;
 - a once-every-three year examination of westslope cutthroat trout embryo development under a range of selenium exposures, starting in 2015; and
- a 2015 sublethal toxicity (mixture) study to confirm that surface waters meeting the Site Performance Objectives (SPOs) defined for order stations are not toxic to sensitive aquatic receptors (Section 9.8.2 of Permit 107517).

Elements of these other components either overlap with or can be used to inform the design of the nitrate and sulphate studies. It is for this reason that the bulk of the work associated with the nitrate and sulphate studies was scheduled for 2016, following the review and analysis of the 2015 results from the mixture study and the quarterly and semi-annual testing (Section 1.1.3). The linkages between all chronic toxicity testing requirements are illustrated in Figure 1.



Figure 1 also identifies 2015 pilot testing with amphibians as part of the nitrate and sulphate study designs. This work was completed in 2015, as it was required in order to finalize the nitrate and sulphate study designs in 2016.

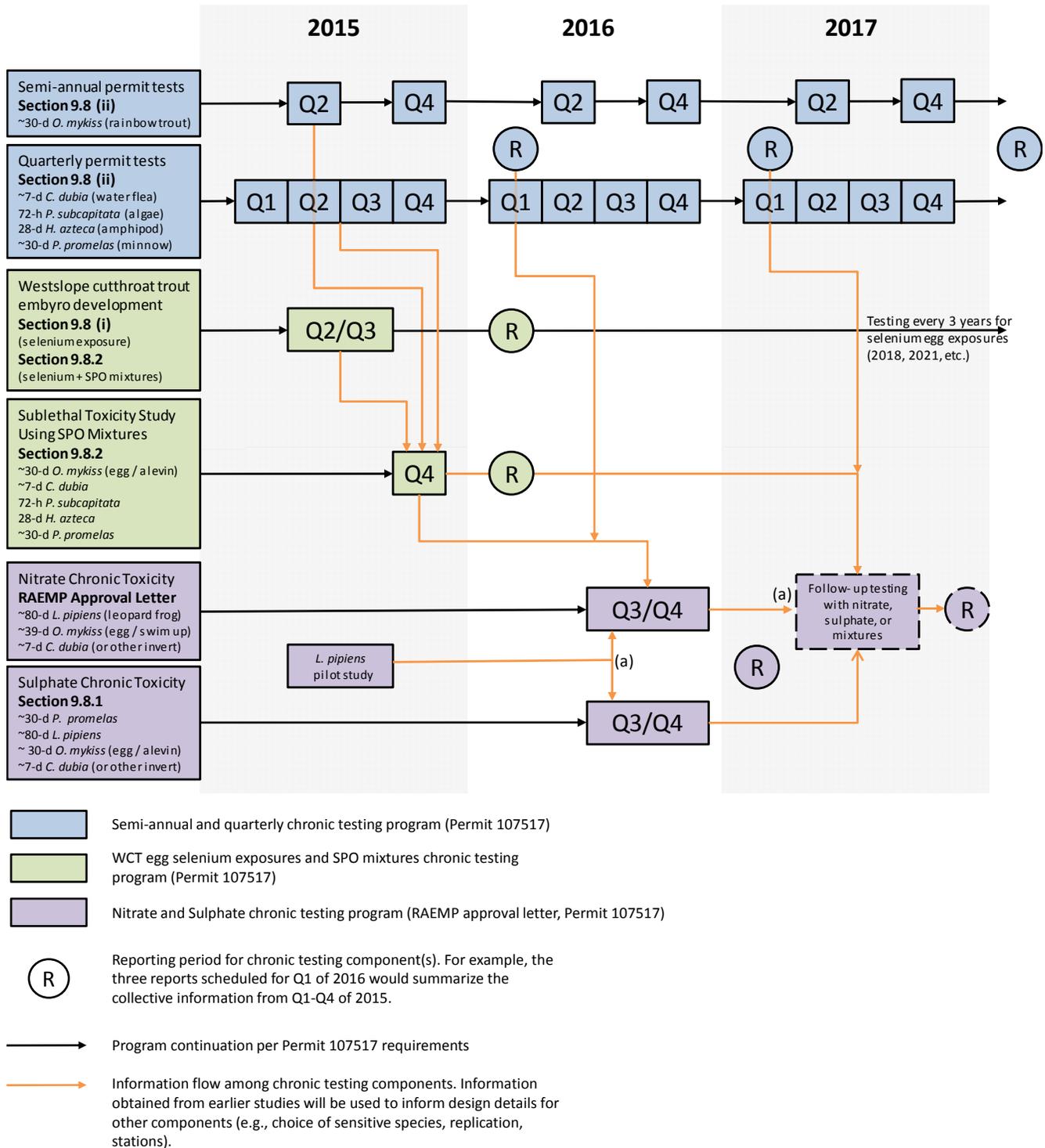
1.1.3 Summary of Permit-Based Chronic Toxicity in 2015

The details of the 2015 Chronic Toxicity Testing Program, including methods, results, interpretation, and recommendations, are provided in Golder (2016a). A brief summary of each component is provided below, focussing on findings of relevance to the design of the Nitrate Chronic Toxicity Study and the Sulphate Chronic Toxicity Study.



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Figure 1: Overview of Elk Valley Chronic Toxicity Testing Requirements



(a) The amphibian testing originally planned for Q3 of 2016 was terminated due to a negative control failure, and has therefore been reassigned to start in late Q2 (carrying into Q3) of 2017. The initiation date will depend on the developmental status of leopard frog cultures.



1.1.3.1 Quarterly and Semi-annual Toxicity Tests

The quarterly and annual toxicity testing program that commenced in 2015 addresses Permit requirements in Section 9.8(ii) of Permit 107517, and included chronic tests with the water flea (*Ceriodaphnia dubia*), algae (*Pseudokirchneriella subcapitata*), rainbow trout (*Oncorhynchus mykiss*), amphipod (*Hyalella azteca*), and fathead minnow (*Pimephales promelas*). In 2015, testing was conducted at seven compliance points (i.e., test site waters) plus two upstream reference locations, and waters were tested over four quarters in 2015 (Q1-Q4). There was no evidence of adverse effects in the majority of quarterly and semi-annual toxicity tests conducted in test site waters with *C. dubia* (23 of 28 tests), *P. subcapitata* (16 of 28 tests), *H. azteca* (10 of 12 tests), and *O. mykiss* (8 of 14 tests). Of the tests for which a statistically significant response was identified in the laboratory reports, most were consistent with normal variability in the performance of test organisms and water chemistry did not indicate any parameters with potential to cause adverse effects.

Findings from 2015 testing that are of relevance to the design of the nitrate and sulphate study, particularly for the identification of test species sensitive to nitrate or sulphate, included:

- *C. dubia* was identified to be the most sensitive invertebrate species tested in 2015, with mean responses for the reproduction endpoint observed to be significantly lower than one or both references for at least one sampling location in each of Q1, Q2, and Q4. The high laboratory replication in this protocol (8 replicates per treatment) aided in the distinguishing of toxicity responses, such as those at FR_FRCP1 (upper Fording River influenced by mine discharge water from Cataract Creek) and CM_MC2 (Michel Creek upstream of Andy Goode Creek), from other samples that yielded endpoint responses similar to reference waters.
- *C. dubia* exhibited toxicity in water sample FR_FRCP1 during Q1 of 2015; this sample reflected water quality from Cataract Creek during base flow rather than typical Fording River water quality. A concentration-response analysis in Golder (2016a) identified several parameters that may have contributed to the observed response in this test, including nitrate, sulphate, selenium, and TDS (Golder 2016a). The evidence for potential selenium toxicity in this sample is weaker than for nitrate and sulphate because selenium was screened in based on comparison to a no-effects concentration (unbounded), whereas nitrate and sulphate site-specific effects concentrations were bounded. Concentrations of nitrate (30 mg/L NO₃-N¹) and sulphate (1,430 mg/L) in this test were greater than the IC₂₀ values for nitrate in Fording River water (25.1 mg/L NO₃-N) and sulphate in alkalinity-supplemented Fording River water (840 mg/L) (Golder 2013). Therefore, although no individual constituent could be conclusively linked to the observed toxicity at FR_FRCP1, the result provides additional evidence that *C. dubia* is sensitive to the mixture of mine-related constituents that includes nitrate and sulphate.
- *H. azteca*, in addition to exhibiting lower sensitivity relative to *C. dubia*, also exhibited higher replicate response variability. For the few cases where decreases in survival or growth were observed, it was uncertain whether the results represented an adverse response or normal variability in test organism performance. Both of these considerations make *H. azteca* an inferior test species choice to *C. dubia* for evaluating aquatic toxicity to mine-related constituents. Furthermore, no water quality parameter was identified as a potential

¹ mg/L NO₃-N (or mg/L N) refers to concentration units of milligrams per litre of nitrate-nitrogen equivalent, as opposed to the nitrate ion equivalent (mg/L NO₃⁻). The former is consistent with the provincial water quality guideline for nitrate (Meays 2009) and is used throughout this report.



cause of the statistically significant results in the few tests for which toxicity to *H. azteca* was observed (Golder 2016a).

- *O. mykiss* testing did not identify unusual behaviour or increased rate of deformities. The most sensitive endpoints in the 2015 testing were survival and growth, whereas all test results for survival, viability, length, and weight fell within the normal range of responses for pooled reference tests. Some stations exhibited statistically significant reductions in survival or growth relative to at least one matched reference, but the interpretation of the biological significance for these cases was obscured by high among-replicate variability.
- *P. subcapitata* exhibited multiple individual results with significant toxicity compared to at least one reference water. However, for most of those statistically significant responses, evidence for adverse effects was equivocal because cell yield was significantly reduced relative to one but not both reference waters and/or was within the normal range of responses for pooled reference tests. The concentration-response evaluation (Golder 2016a) indicated that none of the evaluated parameters exhibited a consistent concentration-response relationship. Concentrations of most parameters in tests with a significant result were equal to or lower than concentrations in reference waters and/or test site waters with non-significant results and/or were lower than the chronic BC WQG.
- *P. subcapitata* exhibited significantly reduced cell yield in three tests (Q1 EV_HC1 and FR_FRCP1; Q2 LC_LCDSSLCC) for which cell yield was significantly lower than reference and all replicates were lower than the normal variability observed in reference waters. However, nitrate is not expected to have contributed to toxicity in these tests because the maximum test site concentration (30 mg/L NO₃-N) was lower than the highest concentration tested in the Golder (2013) mixture toxicity study that reported no adverse effects for this species (41 mg/L NO₃-N). The contributions of TDS (2,580 mg/L), sulphate (1,430 mg/L) and selenium (497 µg/L) in the Q1 FR_FRCP1 test were higher than the range tested in the mixture toxicity study and therefore these substances could not be excluded as potential toxicants.
- *P. promelas* testing did not provide evidence of adverse effects on hatch, length, or normal development in any test. Variable responses for *P. promelas* survival and biomass were observed, but were investigated by Nautilus in the memo *Update of Toxicity Identification Evaluation Efforts for Fathead Minnow Tests*, and found to be caused by microbiological components of the samples (e.g., fungi or other microbes present in the field samples). These responses were unrelated to chemical toxicants, as evidenced by the incidence of mortality in some reference water samples (Golder 2016a). The effect of fungi or other microbes are an artefact of laboratory-based testing and are not reflective of potential impairment of wild fish populations. The *P. promelas* test has been shown to be susceptible to confounding microbiological factors under laboratory conditions, and the toxicity identification evaluation conducted by Nautilus provided supporting information for the interpretation of test results. The implications for the 2016 chronic toxicity testing are that this protocol (without modification) is a poor discriminator of chemical-specific toxicity; results can be made more reliable by modifying the test procedure to avoid confounding microbiological effects.
- The uncertainty assessment identified natural variability in reference water response. Test organism responses in Elk River and Fording River references were usually, but not always, comparable within a given season. Because test organism responses showed similar seasonal trends in laboratory control water (which is consistent across quarters) and reference waters, the variability in reference response appears to be related to the natural variability in the test organisms themselves, rather than seasonal changes in water quality. The implication for the 2016 chronic toxicity testing are that reference water toxicity testing is



necessary in each round of sampling to help control for seasonal variations in organism sensitivity and to provide important context for the interpretation of test site results.

1.1.3.2 SPO Mixture Testing

The site performance objectives (SPO) mixture study addressed Permit Section 9.8.2 requirements to confirm that when nitrate, selenium, sulphate, and cadmium are present together in surface waters at the long-term SPO concentrations, the waters are not toxic to sensitive aquatic species relevant to the Elk Valley. To address this permit requirement, mixture toxicity tests were undertaken with *C. dubia*, *P. subcapitata*, *H. azteca*, *P. promelas*, and *O. mykiss*. A study design for the mixture toxicity tests was submitted to BC MOE on 30 April 2015 (Golder 2015a,b) and results are summarized in Golder (2016a).

Findings of relevance to the design of the nitrate and sulphate study included:

- There was no evidence of adverse effects of SPO mixtures on *C. dubia*, *P. subcapitata*, *P. promelas* or *O. mykiss* at any dilution. These results confirm that Elk and Fording River waters meeting the SPOs specified in Permit 107517 are not toxic to sensitive aquatic receptors. Therefore, to identify the thresholds for toxicity of nitrate and sulphate to aquatic organisms in the 2016 work, testing at concentrations above the SPOs is required.
- Survival and growth in the *H. azteca* test showed no statistically significant differences between laboratory control water and reference waters. However, there were unexplained mortalities in four of ten replicates in the *H. azteca* test in the 100% vol/vol Elk River SPO mixture. These mortalities, which were not observed in other SPO treatments, may have reflected a confounding factor that affected some but not all replicates in that test. This finding is consistent with the results of the quarterly testing of *H. azteca*, for which high inter-replicate variability was observed. These findings provide evidence that *H. azteca* testing may be prone to artefacts and/or high test endpoint variation relative to other sensitive test species.

1.1.3.3 Westslope Cutthroat Trout Gamete Study

The Fording River westslope cutthroat trout (WCT) gamete study addressed Permit Section 9.8(i) requirements to evaluate survival and development of WCT gametes obtained from fish utilizing habitats in the Fording River, tributaries, and associated lentic habitats once every three years. This study also addressed requirements of Section 9.8.2 to confirm that surface waters meeting the SPOs are not toxic to sensitive aquatic receptors. The latter component of the study is of relevance to the evaluation of nitrate and sulphate toxicity because both of these constituents (along with cadmium and selenium) were introduced in test waters at SPO concentrations.

There was no effect of SPO-amended test waters on frequency of deformity, length, or weight of WCT fry. A statistically significant difference was found in fry survival between eggs reared in laboratory control water and those reared in Fording River water amended to SPO concentrations; however, the overall pattern of responses did not support attributing these differences to the SPO mixture. The more likely explanation is that there was a confounding factor that affected one or more replicates from some but not all females. The nature of this confounding factor could not be determined, but the results were generally consistent with the sporadic mortality



phenomenon observed in quarterly *P. promelas* testing (and possibly *H. azteca* testing), suggesting that microbial factors may have affected site water test results.

Given the residual uncertainty as to the cause of variable survival of WCT fry in some replicates, it was determined that an early life stage salmonid toxicity endpoint (specifically rainbow trout) should be retained in the 2016 sulphate and nitrate toxicity designs. For sulphate testing under Permit Section 9.8.1, salmonids were identified by BC MOE as candidate test organisms but were not strictly required. The WCT gamete study indicates that salmonids could be a sensitive receptor group for evaluating toxicity of mine-influenced waters.

1.1.3.4 Amphibian Pilot Study

Amphibian testing is required as part of the nitrate and sulphate chronic testing program. Section 9.8.1 of the Permit lists amphibians as candidate sensitive species for sulphate testing at high hardness, and the RAEMP approval letter requires additional nitrate toxicity testing, including "amphibian toxicity testing to assess the sensitivity of representative species to nitrate using long-term metamorphosis tests." The first stage of amphibian testing entailed completion of a chronic survival, growth and development pilot study with *L. pipiens* exposed to nitrate and sulphate. The purpose of this study was to ensure that this species could be cultured and tested successfully in the laboratory, and to provide preliminary indications of effects ranges for testing in 2016.

Findings of relevance to the design of the nitrate and sulphate study included:

- The results of the pilot study indicated that the testing conditions used in this study were suitable for testing with *L. pipiens*.
- The test was able to detect effects of nitrate to larval survival and provided preliminary estimates of LC₂₀ and LC₅₀ values (19.2 mg/L NO₃-N and 28.8 mg/L NO₃-N, respectively); testing above and below these concentrations was recommended for future testing of nitrate in 2016. No effects were observed for any growth endpoint at any exposure concentration.
- No effects were detected that could be attributed to sulphate at concentrations up to 1,000 mg/L. Testing above this sulphate concentration was therefore recommended for future testing, recognizing that there are solubility constraints to introduction of very high sulphate concentrations.
- There was a statistically significant difference in survival and days to metamorphosis between a soft laboratory water control and reconstituted hard water. This effect was identified as an important consideration for the 2016 amphibian testing of the hard waters of the Elk Valley.

1.2 Study Objectives and Approach

The Nitrate and Sulphate Chronic Toxicity studies are designed to meet the Permit 107517 and RAEMP Approval Condition requirements. In so doing, they will generate site-relevant information to achieve the following objectives:

- Evaluate the sensitivity of amphibians to nitrate and sulphate relative to other aquatic species—This objective will be satisfied using amphibian toxicity testing of amended (spiked) site waters to assess the sensitivity of a representative species (leopard frog) to nitrate and sulphate using long-term metamorphosis tests. These



tests, conducted in parallel for nitrate and sulphate, will address the Section 9.8.1 requirement for testing of “other sensitive species” and the specific RAEMP Approval Condition related to amphibian testing of nitrate. The tests will be conducted over ranges of nitrate and sulphate exposures that overlap the effect benchmarks for sensitive species used in the development of SPOs. The program will evaluate the potential for hardness-dependence of toxicity to leopard frogs, and will derive benchmarks for chronic sublethal endpoints that can be compared to those derived for other species.

- Evaluate the sensitivity of invertebrates and fish using longer-term tests relative to those conducted prior to Permit 107517—This objective will be satisfied by incorporating site-specific embryo-alevin rainbow trout toxicity testing across a wider range of hardness and water quality conditions than has been assessed previously for this test type. In addition, incorporation of the 30-day early life-stage test of fathead minnow development test in the sulphate toxicity program will strengthen the assessment of chronic toxicity to fish. Both the rainbow trout and fathead minnow test protocols will apply test durations equal to or greater than those required for Permit-based testing under Section 9.8 (ii). For invertebrates, additional chronic testing with the three-brood *Ceriodaphnia dubia* test will be used to reduce uncertainty in the concentration-response profile for this species. Results of other Permit-based chronic testing, including the 28-d *Hyalella azteca* survival, growth, and biomass test (per Section 9.8 [ii]), will be incorporated in the evaluation of the protectiveness of the nitrate and sulphate SPOs.
- Confirm the benchmarks established in the EVWQP for high hardness conditions—Additional longer-term testing will be completed with sensitive fish and invertebrate species focussing on the high hardness concentrations (greater than 250 mg/L as CaCO₃). For nitrate, this objective will be satisfied through additional testing of Fording River site waters (high hardness), plus testing of waters amended to even higher hardness levels (i.e., approximately 700 mg/L as CaCO₃). The latter treatments are intended to represent conditions in other mine-influenced waters in the Elk Valley, conditions observed in other seasons, and/or conditions representative of long-term estimates of water quality in mine-influenced water bodies. For sulphate, a similar approach will be used, but will incorporate an even wider range of hardness conditions resulting from the addition of calcium sulphate and magnesium sulphate salts. These results will be used to confirm previous test findings, reduce uncertainty in site-specific effect benchmark derivations, and support finalization of long term sulphate site performance objectives per Section 9.8.1 of Permit 107517.

1.3 Scope of this Document

The intent of this document is to describe the overall design of the Nitrate and Sulphate Chronic Toxicity studies, in terms of anticipated sample locations, test species, test durations, and test conditions (e.g., exposure concentrations, test endpoints, and other details of the testing regime). This document provides details of the measurements that will be made for both the water samples and for the test organisms during the toxicity tests. Finer details concerning sampling logistics, individual sample preservation, shipping arrangements, health and safety, and other details of sample collection are not discussed herein.

This document also incorporates modifications to previous drafts of the study design, including the draft study design for chronic toxicity testing of nitrate and sulphate to support Permit requirements (Golder 2015c) and the final draft study design (Golder 2016b). As such it contains additional details, rationale, and clarifications requested



by the Environmental Monitoring Committee (EMC). Feedback on the proposed study design has been provided by the EMC in the following formats:

- EMC review of Golder (2015c), as compiled in the spreadsheet titled *Permit 107517 Environmental Monitoring Committee Advice—Section 9.8 Integrated Toxicity Study Design*, dated November 2015.
- Conference call with EMC (19 April 2016) to discuss the proposed study design for 2016 testing of amphibians, plus discussion of the 2015 pilot study results.
- EMC Meeting #8 in Cranbrook BC (26 April 2016)—Agenda topic “Section 9.8 Chronic Toxicity Testing”: review and discussion of 2015 chronic test results and the sulphate/nitrate chronic toxicity study design.
- EMC review of the Golder and Nautilus (2016) study design for amphibians (Appendix B), as compiled in the April 2016 spreadsheet titled *Permit 107517 Environmental Monitoring Committee Advice—Amphibian Toxicity Testing (EVP Section 9-8-1 and 9-4 RAEMP Approval Letter)*.
- EMC review of the 2015 chronic toxicity interpretative report (Golder 2016a), as compiled in the April 2016 spreadsheet titled *Permit 107517 Environmental Monitoring Committee Advice—2015 Chronic Toxicity Interpretive Report*.
- EMC Meeting #9 in Fernie BC (22 June 2016)—Agenda topic “Section 9.8 Integrated Nitrate/Sulphate Toxicity Study”: review and discussion of Final Draft Nitrate/Sulphate Study Design (Golder 2016b), including a summary of how previous EMC advice was addressed. Additional written feedback was compiled in the July 2016 spreadsheet titled *Permit 107517 Environmental Monitoring Committee Advice—Integrated NO₃-SO₄ Toxicity Testing Study Design Final Draft (EVP Section 9.8 and 9.4)*.

1.4 Sampling Station Nomenclature

Table 1 summarizes the sampling station IDs used in this document to reference proposed water collection locations. The Order Station ID is used preferentially as the naming convention for sampling locations; when a station is not an Order Station, the Teck sampling location code is used. Water quality characteristics for these water collection locations proposed for the 2016 testing program are summarized in Appendix A.

Table 1: Sampling Locations for 2016 Chronic Toxicity Testing

Watercourse	Sampling Location	Order Station ID	Teck WQ Station ID	EMS Location ID
Fording River	Fording River upstream reference ⁽¹⁾	—	FR_UFR1	E216777
	Fording River Mine-Influenced (Upper Fording River upstream of Josephine Falls)	FR4	GH_FR1	0200378
Elk River	Elk River upstream reference	—	GH_ER2	0200389
	Elk River Mine-Influenced— Elk River upstream of Grave Creek	ER2	EV_ER4	0200027

(1) The FR_UFR1 station is a contingency collection location for use in the event of logistical challenges for sampling of GH_ER2 water.
 (2) Additional stations referenced in this report in discussion of previous toxicity testing data include: Fording River downstream of Cataract Creek (FR_FRCP1, EMS E300071), Elk River downstream of Thompson Creek (GH_ERC, EMS E300090), Michel Creek upstream of Andy Goode Creek (CM_MC2, EMS E258937), Michel Creek at Highway 3 Bridge (EV_MC2, EMS E300091), Harmer Spillway at Elk Valley Operations (EV_HC1, EMS E102682), Line Creek downstream of South Line Creek confluence (LC_LCDSSLCC, EMS E297110), and Fording River at Fording Bridge (FR-B, no EMS number).



2.0 NITRATE CHRONIC TOXICITY STUDY

The Nitrate Chronic Toxicity Study consists of the following three components, reflective of the test species being considered: an amphibian testing component, an invertebrate test component and a fish test component. Each of these components is discussed in more detail below.

2.1 Amphibian Testing

The amphibian testing will entail assessing the sensitivity of amphibians to nitrate² using a representative species (leopard frog, *Lithobates pipiens*) in a laboratory setting using waters collected from the Elk Valley and tested at hardness concentrations relevant to the Elk Valley. These studies represent a continuation of work to better understand toxicity to aquatic species of the Elk Valley, and they build upon laboratory testing completed in 2015 as part of the pilot stage investigation of amphibian toxicity testing. Their primary purpose is to address permit and approval requirements pertaining to amphibian chronic toxicity testing.

The preparation of the detailed study design for amphibian testing was prioritized by Teck due to the limited seasonal window of testing for field-collected amphibians. In order to conduct tests of leopard frog larval development, collection of eggs must be conducted in May, with exposures in the laboratory extending into June and July. As such, the detailed study design was prepared earlier than the remaining study components, with a study design document submitted by Golder and Nautilus (2016) on 15 April 2016, and subsequently reviewed by EMC. Following review of the amphibian study design by EMC, the *L. pipiens* tests were initiated as planned by Nautilus in their Burnaby BC laboratory, with testing commencing in June 2016. However, a high rate of mortality was observed early in the exposure period, including the negative controls, ultimately causing a control failure and termination of the test. As described in Teck (2016), a second round of testing in July 2016, including copper amendment to control for potential microbial effects, also failed to meet laboratory control performance criteria. Consequently, the 2016 amphibian testing program was terminated. The laboratory theorizes that poor test performance was related to specimen batch health, and may be related to a viral or bacterial infection within the supplied egg masses. This theory of a viral or bacterial infection is supported by similar poor survival observations in other testing utilizing the same batch of specimens for another client at the laboratory. To further investigate the health of the specimens, select specimens have been preserved and will be sent to the University of Prince Edward Island where specimen health will be evaluated and assessed for potential viral presence or bacterial infection.

The consequence of the control failures described above is that all amphibian tests must be reinitiated in 2017 using new organism cultures. Leopard frogs have a single annual development testing window, requiring that testing will be postponed until late Spring of 2017. At this time, no other changes to the implementation of the amphibian testing program are anticipated.

The amphibian study design, recently updated to reflect the outcome of 2016 testing (i.e., control failure and implications for future testing) is attached as Appendix B. Rather than duplicate the contents of Appendix B, the remainder of this section emphasizes a tabular summary of the experimental design (as requested by EMC) and provides a summary of revisions (all minor) to the previous version of the study design for amphibian testing. The

² Testing of amphibians with nitrate exposures is being conducted in parallel with related tests for sulphate. As these tests may share negative controls and reference waters, the sulphate and nitrate testing components have been combined in Table 2.



detailed study design is provided in Appendix B, and the summary of test conditions for *L. pipiens* testing is provided in Appendix C (Table C-1).

2.1.1 2017 Experimental Design

Amphibian testing will be conducted concurrently for the nitrate and sulphate toxicity testing programs (Table 2). The exposure series for these two constituents are separate, and it is possible that the tests for nitrate and sulphate may not be set up on the same day. Should test initiation be split, separate negative controls (4 replicates each) would be established for the two constituents; following the test, these controls would be assessed statistically to determine whether they are sufficiently similar to warrant combining as a pooled reference³. If tests for nitrate and sulphate are set up on the same day, the replication for the laboratory negative control will be double that of most treatments (i.e., 8 replicates instead of 4).

The range of nitrate concentrations shown in Table 2 refers to the total nitrate concentrations (nominal concentrations in the exposure chambers, including the base concentrations from the site waters, plus the additional nitrate added at the laboratory). As discussed with EMC on April 19, April 26, and June 22, the rationale for the range of concentrations (Figure 2) is to satisfy the desired conditions of:

- testing of nitrate concentrations both above and below the IC₂₀ determined in the pilot study;
- testing of concentrations that bracket the BC WQG and the effects thresholds for no-effect (NOEC) and low-effect (LOEC) based thresholds derived from the literature; and
- inclusion of a maximum concentration >100 mg/L NO₃-N to assist in concentration-response analysis.

The unamended site water treatments for the Fording River (Order Station FR4) and upstream Elk River (reference station GH_ER2) will incorporate additional replication (Table 2). Similar to the negative laboratory control, the additional replication may be required due to nitrate and sulphate series being set up on different days. Should results for each set of four replicates be statistically indistinguishable, results will be pooled.

2.1.2 Refinements to April 2016 Study Design

The following clarifications have been made to the amphibian study design located in Appendix B (Golder and Nautilus 2016), either in response to queries from the EMC or to resolve remaining technical details:

- **Reference Toxicant Test**—The amphibian toxicity testing will include reference toxicant testing. However, as discussed at EMC Meeting #8, a complete laboratory control chart will not be available for this test due to limited use of this test organism in previous investigations. The 2017 tests will incorporate a 96-h reference toxicant test using sodium chloride as the reference toxicant for *L. pipiens* (following Environment Canada draft procedures). The previous reference toxicant results at Nautilus have tested Gosner Stage 25 at test

³ Decisions regarding pooling or splitting of sample toxicity results, including batches of negative control replicates, will apply analysis of variance (ANOVA) with consideration given to use of linear orthogonal contrasts per Hoke et al. 1990.



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

initiation, which will be continued in this program to facilitate comparison to previous results. The results from this test will also be compared to a reference toxicant control chart produced by Environment Canada during their work to develop test methodology with this species.

Table 2: Experimental Design Summary for 2016 Amphibian Testing

Treatment		Number of Test Replicates			
		Laboratory Negative Control	Site Water Exposures		
			Elk Reference GH_ER2	Order Station FR4	Order Station ER2
Dechlorinated	—	8 ^(a)	—	—	—
Unamended Site Water	—	—	8 ^(a,b)	8 ^(b)	4
Synthetic hardness adjustment ^(c) (mg/L as CaCO ₃)	150	8 ^(a)	—	—	—
	200	—	4	—	—
	325	—	4	—	—
Nitrate supplemented (mg/L NO ₃ -N)	10	—	—	4	4
	16	—	—	4	4
	26	—	—	4	4
	41	—	—	4	4
	66	—	—	4	4
	105	—	—	4	4
Sulphate amended (mg/L SO ₄)	429	—	4	4	—
	800	—	4	4	—
	1200	—	4	4	—
Total Replicates	—	16	28	44	28

Notes:

^(a) Separate negative laboratory controls (dechlorinated municipal tap water) will be run for sulphate and nitrate testing (4 replicates each) to account for potentially different set up days in the laboratory and to provide greater samples size for control performance evaluation.

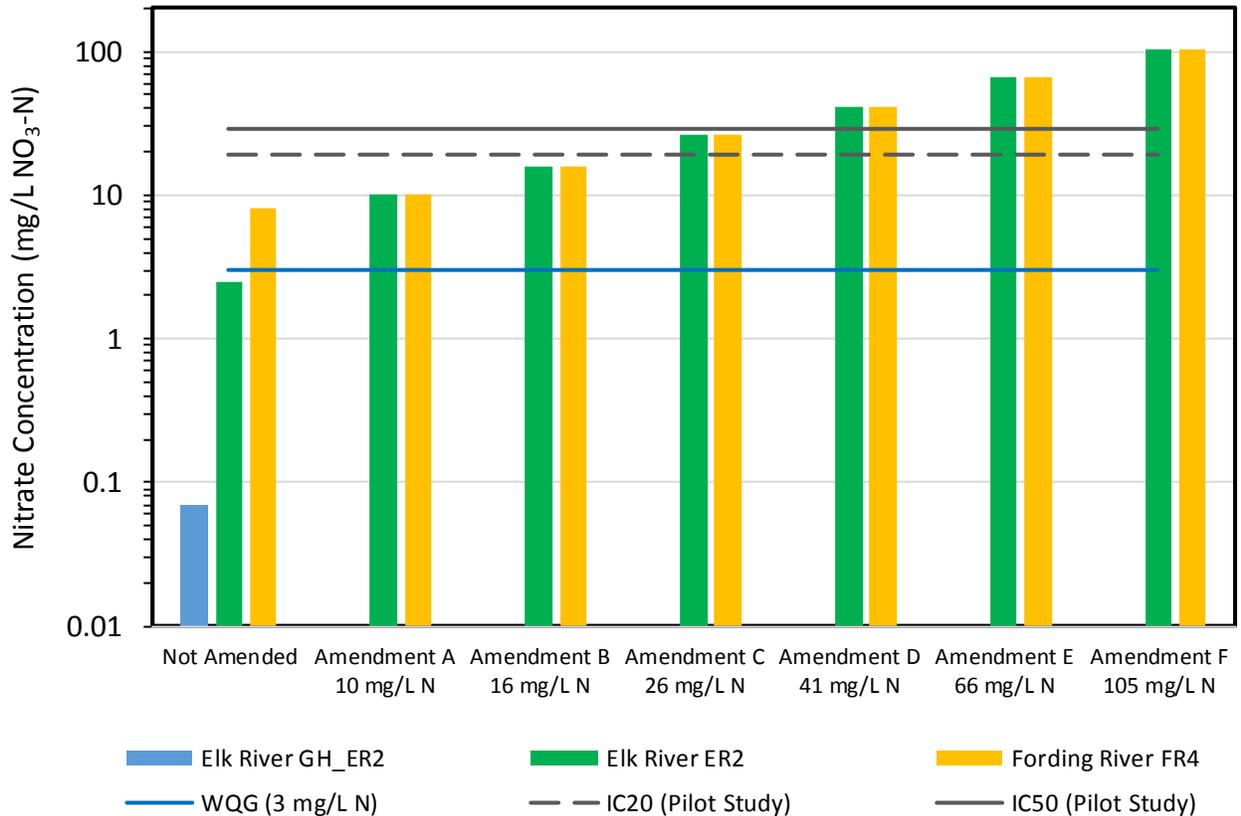
^(b) Unamended upstream reference (GH_ER2) and FR4 samples will be used as base waters for both nitrate and sulphate concentration series. Unamended upstream reference water and FR4 water will be tested separately (4 replicates each) for both the nitrate and sulphate concentration series (increased sample size for evaluating reference response in site waters).

^(c) Hardness levels of 150, 200, and 325 mg/L as CaCO₃ approximate the mean hardness levels anticipated for upstream reference, Elk River (Order Station ER2) and Fording River (Order Station FR4) waters during breeding season.



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Figure 2: Summary of the 2016 Amphibian Toxicity Study Design for Nitrate.



Notes:

Concentrations for unamended waters depicted in the figure are estimates from previous sampling of these stations.

Reference water (GH_ER2) will be tested at three hardness levels (~150, ~200, ~325 mg/L CaCO₃) to approximate the mean hardness levels anticipated for upstream reference, Elk River (Order Station ER2) and Fording River (Order Station FR4) waters during breeding season.

Negative laboratory control water (not depicted in figure) will be tested in dechlorinated soft water and synthetic hard water.



- **Egg Source**—The leopard frog egg masses used in 2016 were obtained from Dr. Vance Trudeau at the University of Ottawa. These eggs were sourced from a local experimental pond, then transported to the laboratory where gravid females were induced to spawn in clean laboratory water using the hormone mixture Amphiplex, which is a combination of a gonadotropin-releasing hormone agonist and a dopamine antagonist. Eggs were then shipped in a cooler overnight to the Nautilus Environmental laboratory in Burnaby, where they were held, allowed to develop, and reared in a controlled environment room where temperature was slowly raised from shipping to testing temperature (23°C). The hatch rate and fertilization rates in the laboratory spawned eggs were confirmed to be sufficiently high for use in the 2016 study. Given the negative control failures in the 2016 study, consideration will be given to alternate suppliers in 2017. This decision will be made once results of the ongoing investigation of specimen batch health (and viral assessment) are available for the organisms tested in 2016.
- **Analytical Measurements in Water**—The water used in testing consists of three broad types, including clean laboratory water (dechlorinated municipal tap water and synthetic hard water), base waters supplied from the Elk Valley (a total of 2600 L per week), and modified experimental waters (i.e., base waters amended through addition of sulphate or nitrate salts). The laboratory water quality is monitored as part of routine laboratory quality assurance/quality control. Subsamples of unamended base waters from each Elk Valley sampling location will be submitted for a full chemical analysis, with rapid turnaround time to facilitate calculation of the required chemical amendments each week. The full chemical analysis will include major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, and alkalinity), a high resolution metals scan for both total and dissolved metals, total dissolved solids, and nutrients (nitrate, nitrite, ammonia, phosphorus). Sulphate or nitrate (as applicable) will be measured in all test concentrations of the modified experimental waters weekly throughout exposure. These measurements will provide confirmation that the amended test concentrations are consistent with the target test concentrations. Routine, water quality (pH, dissolved oxygen and temperature) will also be measured in the toxicity laboratory before and after water exchanges throughout the exposure (three times per week).
- **Interim Biological Measurements**—During the April 26 meeting with EMC, there was discussion regarding the frequency and type of interim measurements, defined as measurements or observations made at an intermediate test stage prior to test termination. The Environment Canada draft procedure (under development) does not currently specify interim measurements. Although frequent measurement of test organisms is discouraged, due to the potential for handling stress on the developing organisms, one round of interim measurements has been incorporated in the study design. The time duration (i.e., number of days) will not be specified in advance because the developmental rate is difficult to predict. Instead, visual observations will be made during the test to identify when the organisms are approximately halfway through the development span of the test (i.e., Gosner Stage 34-35). If necessary, one replicate of the negative control and reference water will be handled to confirm the developmental status prior to conducting detailed measurements such as weight, snout to vent length, developmental stage, and incidence of deformities.
- **Study Timing**—The timing of testing in 2017 is not known with precision in advance, because the initiation date depends on the rate of organism development, which varies as a function of organism source and seasonal weather conditions. Based on previous experience, test initiation is likely to begin in early June 2017.



- **Selection of Reference Location**—The upstream Elk River reference site (GH_ER2) has been selected for the amphibian toxicity testing program.
- **Water Quality Characteristics of Sampling Locations**—During review of the draft sampling design, EMC requested tabulation of the water quality characteristics of the three sampling locations that were selected to evaluate the toxicity of nitrate (i.e., including summary statistics for each water quality variable, including mean, standard deviation, range, and percentiles of the data distribution. Appendix A provides these tabulated values, with summaries of data collected over the period of 2010-2016. The water quality data have been grouped by season, with four seasons each of three months duration (February to April, May to July, August to October, and November to January). The seasons were defined on basis of the annual hydrograph, with the May to July season reflecting both the period of freshet that coincides with the period of amphibian larval development.

These minor revisions to the amphibian study design (Golder and Nautilus 2016) have been incorporated in the updated design for the amphibian study, which is included as Appendix B.

As noted above, the EMC requested additional information related to water quality characteristics of the proposed sampling stations, with the objective of confirming that these stations provide a sufficiently broad and representative range of water quality conditions. To this end, Appendix A includes graphical presentation of the water quality trends observed from 2010-2016 at each sampling location, including presentation of seasonal trends. The three stations selected for amphibian testing span a broad range of water quality conditions. For example, the mean hardness values observed in recent years during the freshet season range from approximately 150 mg/L as CaCO₃ in reference waters to more than 300 mg/L as CaCO₃ in the Fording River mine-influenced waters (Order Station FR4). Although higher hardness conditions are observed in the Elk Valley at some locations and times of year, such conditions are not considered to be representative of amphibian breeding habitat, for two reasons. First, the hardness levels observed during freshet months, which are applicable to the amphibian developmental period, are lower than those observed in other seasons. Second, the hardness levels in lentic areas where amphibians would be developing (i.e., stream edges, wetlands, and slow-moving streams) are lower than in adjacent main channel areas. Specifically, in sampling of lotic and lentic areas along the Fording and Elk River mainstems in fall 2013, there was a tendency for lentic concentrations of mine-related constituents to be lower than in adjacent mainstem sampling locations (Teck 2014 Annex E; Appendix B).

2.2 Invertebrate Testing

2.2.1 Background and Objectives

The objective of this component is to further assess the sensitivity of invertebrates to nitrate using long-term tests, thereby adding to the existing site-specific knowledge base that includes data from prior testing:

- the Phase 1 Mixture Toxicity Study performed on water samples collected from the Fording River between December 2012 and March 2013 (Golder and Nautilus 2013);
- the 2013 testing completed in support of the EVWQP, using water samples collected at stations in the Fording and Elk rivers (Teck 2014); and



- testing completed in 2015 in support of Permit 107517, including chronic toxicity testing under Sections 9.8 (i) and (ii) and Section 9.8.2 (Golder 2016a).

One of the objectives of the invertebrate testing is to confirm previous test results using the *C. dubia* survival and reproduction test, which has yielded more sensitive toxicological responses for nitrate exposure relative to other species (trout, minnows, amphipods, and algae). Although the Phase 1 Fording River tests with *C. dubia* (Golder and Nautilus 2013) were in general agreement with the Fall 2013 Fording River tests (Teck 2014) for larger effect sizes (e.g., IC₅₀ estimates), the shape of the concentration-response curves varied between testing programs. Specifically, the FR-B⁴ waters tested in the Phase 1 study were less toxic at nitrate concentrations below 20 mg/L NO₃-N. To further evaluate the nitrate benchmarks based on the *C. dubia* reproduction endpoint, it is necessary to conduct additional testing, particularly for the nitrate range between the WQG (3 mg/L NO₃-N) and 20 mg/L NO₃-N.

2.2.2 Study Design

Chronic toxicity testing using sensitive invertebrate species is proposed to provide a validation of previous test results and improve our understanding of the linkage between nitrate toxicity and water characteristics (i.e., modifying factors related to hardness, ionic composition, or other constituents). Implementation of toxicity testing of site waters (supplemented with nitrate salts) as part of the Nitrate Chronic Toxicity Study is scheduled for October of 2016.

2.2.2.1 Consideration of 2015 Results

Chronic invertebrate testing has been conducted for other Permit 107517 conditions (see Figure 1 and Section 1.1.2). The data collected in 2015 have been reviewed (Golder 2016a) and provide important information for planning the 2016 sampling and analysis. Key findings from the 2015 testing of invertebrates include:

- Testing under Section 9.8 (ii) of Permit 107517 provided information on the sensitivity of *H. azteca* in long-term chronic exposures (28-d survival and growth endpoints) relative to shorter duration tests from previous testing of this species. Despite the longer test duration, the chronic *H. azteca* tests did not exhibit greater sensitivity relative to the 7-d *C. dubia* test.
- The 2015 testing of *H. azteca* exhibited higher replicate variability relative to *C. dubia*, and also exhibited a weaker statistical association between concentrations of mine-related constituents and observed effects. For the few cases where decreases in survival or growth of *H. azteca* were observed, it was uncertain whether the results represented an adverse response or normal variability in test organism performance.
- The results of the 2015 testing of *H. azteca* are consistent with 14-d tests of survival and growth with this species conducted in 2013 as part of the development of the EVWQP (Teck 2014). The 2013 testing indicated that elevated nitrate concentrations can reduce survival and inhibit the biomass of freshwater amphipods.

⁴ FR-B is the Fording River at Fording Bridge sampling location where water was collected for the Phase 1 mixture toxicity study (Golder and Nautilus 2013).



However, the comparison of IC₂₀ estimates among test species and endpoints results indicated that *H. azteca* is less sensitive to nitrate than *C. dubia*. Furthermore, the confidence intervals for the *H. azteca* IC₂₀ values were relatively wide in both studies, due to high data variability.

- Testing under Section 9.8(ii) of Permit 107517 provided information on the toxicity of nitrate and other mine-related constituents when all constituents were simultaneously introduced at SPO concentrations. Despite the longer test duration, the chronic *H. azteca* tests did not yield evidence of adverse effects (i.e., no statistically significant differences between laboratory control water and reference waters. There were unexplained mortalities in four of ten replicates in the *H. azteca* test in the 100% vol/vol Elk River SPO mixture, but these were insufficient to cause a statistically significant mortality response.

Following completion of the 2015 chronic testing programs under Section 9.8 (ii) and Section 9.8.2, of Permit 107517, the recommended test species for representation of invertebrates is *C. dubia*, using the protocol for three brood survival and reproduction. Over multiple programs of testing, the *C. dubia* endpoint has consistently yielded greater sensitivity, lower test variance, and clearer linkage to mine-related constituents, relative to the *H. azteca* test. All of these are desirable characteristics for evaluating nitrate toxicity.

2.2.2.2 2016 Experimental Design

The timing of the invertebrate testing component of the Nitrate Chronic Toxicity Study is tentatively scheduled for October of 2016 (Figure 1). This provides alignment with the fish components of the study, and can be coordinated with other Permit-based testing in the Elk Valley. The test species used to represent the invertebrate community will be *C. dubia*, using the Environment Canada three-brood survival and reproduction protocol. The summary of test conditions for this protocol is provided in Appendix C (Table C-2).

The 2016 nitrate testing program for *C. dubia* will include:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location upstream of Teck operations⁵;
 - Elk River downstream of Fording River – Order Station ER2 (EMS Number E0200027); and
 - Fording River downstream of Greenhills Creek – Order Station FR4 (EMS Number 0200378)
- Amendment (spiking) of the water collected at Order Station FR4 to create modified base water⁶ with higher hardness (700 mg/L as CaCO₃). The amendment would introduce magnesium sulphate and calcium sulphate, using a ratio of calcium:magnesium that is representative of mine-influenced conditions (i.e., 2.6:1). The purpose of this amendment is to represent higher hardness conditions that are observed in some portions of the Fording River watershed upstream of FR4, and that are observed during periods of elevated hardness

⁵ Reference location selection will depend on results of ongoing water quality monitoring. Candidate references include Elk River upstream of Greenhills Operation (GH_ER2, EMS Number 0200389) and Fording River upstream of Henretta Creek (FR_UFR1, EMS Number E216777). The GH_ER2 water sample will be the default reference location and FR_UFR1 serving as a contingency collection location.

⁶ Base water is defined as site water (with or without hardness adjustment) prior to the introduction of the supplemental nitrate.



during winter base flow. The name convention assigned to this high-hardness modified base water is FR4-HH. This addition to the study design has been made based on EMC review of the draft study design, in which a broader range of hardness was recommended to strengthen the assessment of hardness-dependence for nitrate toxicity.

- For all base waters (GH_ER2, ER2, FR4, FR4-HH), amendment of samples with nitrate additions (using sodium nitrate salts) will be conducted to create a series of six additional nitrate concentrations per sample site, similar to the approach used in the 2013 work completed in support of the EVWQP (Teck 2014).
- The range of the concentration series will emphasize the 3 to 60 mg/L NO₃-N range to overlap the effect benchmark levels developed for aquatic invertebrates in the EVWQP. For example, the range of IC₁₀, IC₂₀ and IC₅₀ values for *C. dubia* and *H. azteca* in Elk valley waters ranged from 3 to 59 mg/L NO₃-N (Teck 2014). One treatment in the Fording River waters has been proposed for 75 mg/L NO₃-N to assist in fitting of the concentration-response curves. The concentration ranges have been specified separately for each base water due to the anticipated hardness-dependence of nitrate toxicity, as was observed in previous toxicity testing. For each base water, the nitrate concentrations have been developed to span from expected no-effect concentrations to concentrations expected to yield significant toxicity (i.e., approximately 50% inhibition of reproduction).
- A modification to the Environment Canada three-brood survival and reproduction protocol will be incorporated to provide additional replication for the survival endpoint. This modification has been incorporated in response to a recommendation from the EMC based on review of the final draft study design. For each standard test replicate (i.e., each of the 10 test replicates per treatment required by the Environment Canada protocol), two additional replicates will be prepared, such that each treatment contains an A, B, and C replicate. The A replicate will be evaluated following the standard test protocol, with quantification of both the survival of the first-generation females and three broods of reproduction (neonates). The B and C replicates will be evaluated for mortalities at end of test only. Accordingly, the reproduction endpoint will include data from a maximum of 30 neonate broods (from 10 first-generation females, each contributing up to three broods), but the survival endpoint will now include data from a total of 30 first-generation females.

The total concentrations of nitrate in the nitrate treatments are summarized below, and depicted in Figure 3. These concentrations reflect the sum of both the nitrate in the base waters plus nitrate added through the addition of sodium nitrate. The concentrations in the unamended samples are estimates based on an assumption of October sampling and review of the recent trends in water chemistry (Appendix A):

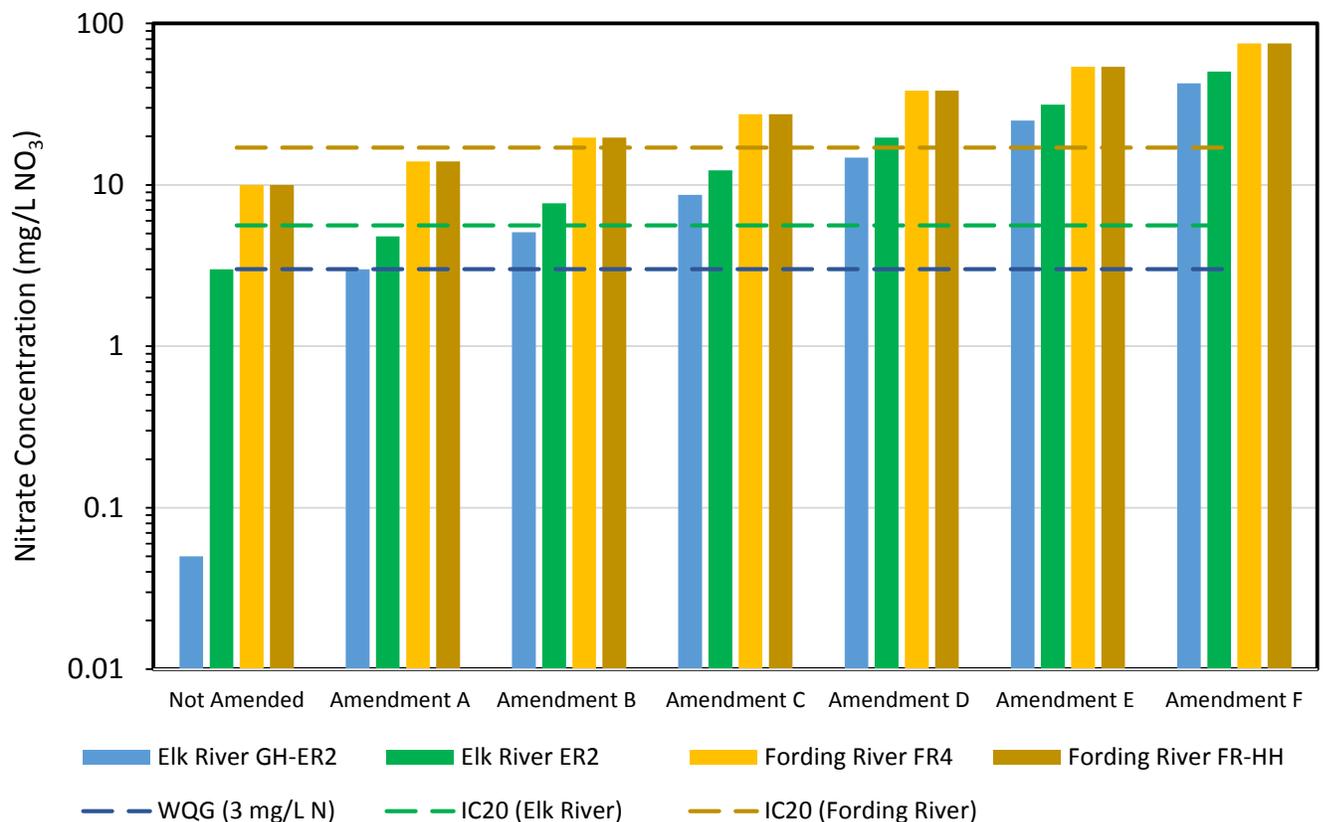
- Station GH_ER2 (EMS Number E02000389)—0.05 (unamended), 3, 5, 9, 15, 25, and 43 mg/L NO₃-N (concentration factor of 1.7× between amended treatments);
- Order Station ER2 (EMS Number E0200027)—3 (unamended), 5, 8, 12, 20, 31, and 50 mg/L NO₃-N (concentration factor of 1.6× between amended treatments);
- Order Station FR4 (EMS Number 0200378)—10 (unamended), 14, 20, 27, 38, 54, and 75 mg/L NO₃-N (concentration factor of 1.4× between amended treatments); and
- Treatment FR4-HH (Order Station FR4 water with supplemented hardness)—10 (no nitrate amendment), 14, 20, 27, 38, 54, and 75 mg/L NO₃-N (concentration factor of 1.4× between amended treatments).



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Testing of all base waters and corresponding nitrate levels will be conducted using the three-brood *C. dubia* toxicity test (Appendix C, Table C-2). Prior to test initiation, subsamples of base waters from each of the three Elk Valley sampling locations will be collected at the toxicity testing laboratory and submitted for a full chemical analysis, with rapid turnaround time to facilitate calculation of the required chemical amendments. The full chemical analysis will include major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, and alkalinity), a high resolution metals scan for both total and dissolved metals, total dissolved solids, and nutrients (nitrate, nitrite, ammonia, phosphorus). Following the addition of magnesium sulphate (FR4-HH water), calcium sulphate (FR4-HH water), and sodium nitrate (all base waters) to achieve the desired exposure series, subsamples will be collected and submitted for confirmation of hardness, nutrients (nitrate, nitrite, ammonia, phosphorus), and ionic composition in the test waters. At the termination of the test, hardness, nutrients, and ionic composition will be measured again to provide an indication of any changes of water quality parameters over the course of the test. Routine water quality (pH, dissolved oxygen and temperature) will also be measured in the toxicity laboratory on a daily basis.

Figure 3: Summary of the 2016 Invertebrate Toxicity Study Design for Nitrate.



Note: IC₂₀ values shown on the figure are the site-specific Level 2 thresholds for nitrate toxicity developed based on *C. dubia* derived from the Fall 2013 testing in support of the EVWQP (Teck 2014).

Fording River FR4-HH consists of FR4 water hardness-supplemented to 700 mg/L as CaCO₃ prior to addition of nitrate.



2.3 Fish Testing

2.3.1 Background and Objectives

The objective of this component is to further assess the sensitivity of rainbow trout to nitrate and assess the relationship between water hardness and nitrate toxicity across a range of hardness representative of the Elk and Fording rivers. Previous testing completed in support of the EVWQP (Teck 2014) identified salmonids (and specifically rainbow trout) as the most sensitive species to nitrate exposure. This finding is consistent with other published tests of chronic nitrate toxicity to salmonids to nitrate (McGurk et al. 2006). Specific uncertainties that will be addressed include:

- Duration and life stage—During the development of the EVWQP, questions were raised about the duration of some test protocols (i.e., 7-day swim-up fry development test using rainbow trout *O. mykiss*). Shorter term test durations may not be as sensitive as longer term tests, such as the embryo-alevin development of rainbow trout, which spans approximately one month and covers more life stages. Both test protocols are specified in Environment Canada (1998).
- Response variability in site waters—Site-specific results are available for longer-term chronic tests (e.g., 39-day embryo-alevin development of rainbow trout, and 68-day embryo-alevin development of the lake trout *Salvelinus namaycush*); however, these results were limited to samples from a single location on the Fording River (Fording River at Fording Bridge) (Golder and Nautilus 2013).
- Hardness-Dependence—Improved understanding of the hardness relationship that is applicable to the range of water chemistry in the Elk Valley, specifically in terms of whether results generated using waters from one location (e.g., the Fording River) can be reliably extrapolated to other locations. In their review of the draft study design, EMC also requested an expansion of the hardness range to include very high hardness (i.e., greater than the hardness levels currently observed at Order Station FR4).

2.3.2 Study Design

To address the uncertainties discussed above, additional chronic toxicity testing using rainbow trout is proposed, with implementation of additional tests of site waters (supplemented with nitrate) tentatively scheduled for October of 2016. The timing of testing is conditional upon the availability of rainbow trout embryos, which are seasonally constrained and dependent upon availability from local suppliers. The 2016 testing will provide a validation of previous test results and improved understanding of the linkage between nitrate toxicity and water characteristics.

2.3.2.1 Consideration of 2015 Results

Chronic salmonid testing has been conducted for other Permit 107517 conditions (see Figure 1 and Section 1.1.2). The test protocol applied for semi-annual testing evaluated 28-d survival, viability, length, and weight of embryo-alevin rainbow trout following Environment Canada (1998). Key findings from the 2015 testing (Golder 2016a) of rainbow trout of relevance to the nitrate study design include:

- The only adverse effect on *O. mykiss* endpoints in any Q2 test was a reduction in weight in one test (EV_HC1) and this result appears to be unrelated to nitrate. However, replicate variability was high in Q2 at both reference locations and in test waters; interpretation of the biological significance for these cases was



obscured by high among-replicate variability. High replicate variability has been observed with previous testing of *O. mykiss* (Meays and Nordin 2013; Teck 2014).

- In Q4, survival and viability were significantly reduced in five tests (FR_FRCP1, GH_FR1, GH_ERC, EV_HC1, CM_MC2), length was significantly reduced in three tests (FR_FRCP1, GH_FR1, GH_ERC), and weight was significantly reduced in one test (GH_ERC) relative to one or both reference waters. The response sizes were small, mean responses in test waters were similar to the mean reference response in 2015, and all replicates were within the normal range of responses for pooled reference tests. One survival response (the lowest survival in Q4 associated with sample FR_FRCP1) was observed for a test water with 16 mg/L NO₃-N; however, no consistent concentration-response was observed for nitrate and any biological endpoint.
- The semi-annual tests with *O. mykiss* did not identify unusual behaviour or increased rate of deformities. The most sensitive endpoints in the 2015 testing were survival and growth.

There was no statistically significant adverse effect of any SPO mixture on *O. mykiss* survival, viability, length, or weight at any dilution. This indicates that identification of a nitrate threshold for rainbow trout development must consider concentrations higher than the SPOs.

2.3.2.2 2016 Experimental Design

Emphasis on rainbow trout in the 2016 testing program remains appropriate due both to the demonstrated sensitivity of early life stage trout to nitrate, as reported in literature studies and in previously completed site-specific tests. Rainbow trout are also specifically referenced for consideration in the REAMP Approval Condition.

Although the semi-annual Permit-based testing for rainbow trout under Section 9.8(ii) entails use of the Environment Canada (1998) ~30-day embryo-alevin test protocol, a modification to longer duration is recommended for evaluation of nitrate. The 39-day early life stage rainbow trout test (with full adsorption of the yolk sac) is proposed, as it would target the most sensitive species and life stage identified in previous site-specific testing. The 39-day duration is slightly longer than in the semi-annual testing program under Permit 107517 Section 9.8(ii); the rationale for this modification is to provide consistency with previous site-specific testing of Fording Bridge waters (Golder and Nautilus 2013) and with other published tests of chronic nitrate toxicity to salmonids to nitrate (McGurk et al. 2006). The summary of test conditions for this protocol is provided in Appendix C (Table C-3).

The timing of the rainbow trout testing component of the Nitrate Chronic Toxicity Study is tentatively scheduled for October of 2016 (Figure 1). However, in the event of challenges obtaining eggs of sufficient quality for testing, testing could be deferred to November, as the spawning window for rainbow trout in the fall season is wider than in the spring.

The 2016 nitrate testing program for rainbow trout will include:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location upstream of Teck operations—Station GH_ER2 (EMS Number E02000389);
 - Elk River downstream of Fording River—Order Station ER2 (EMS Number E0200027); and

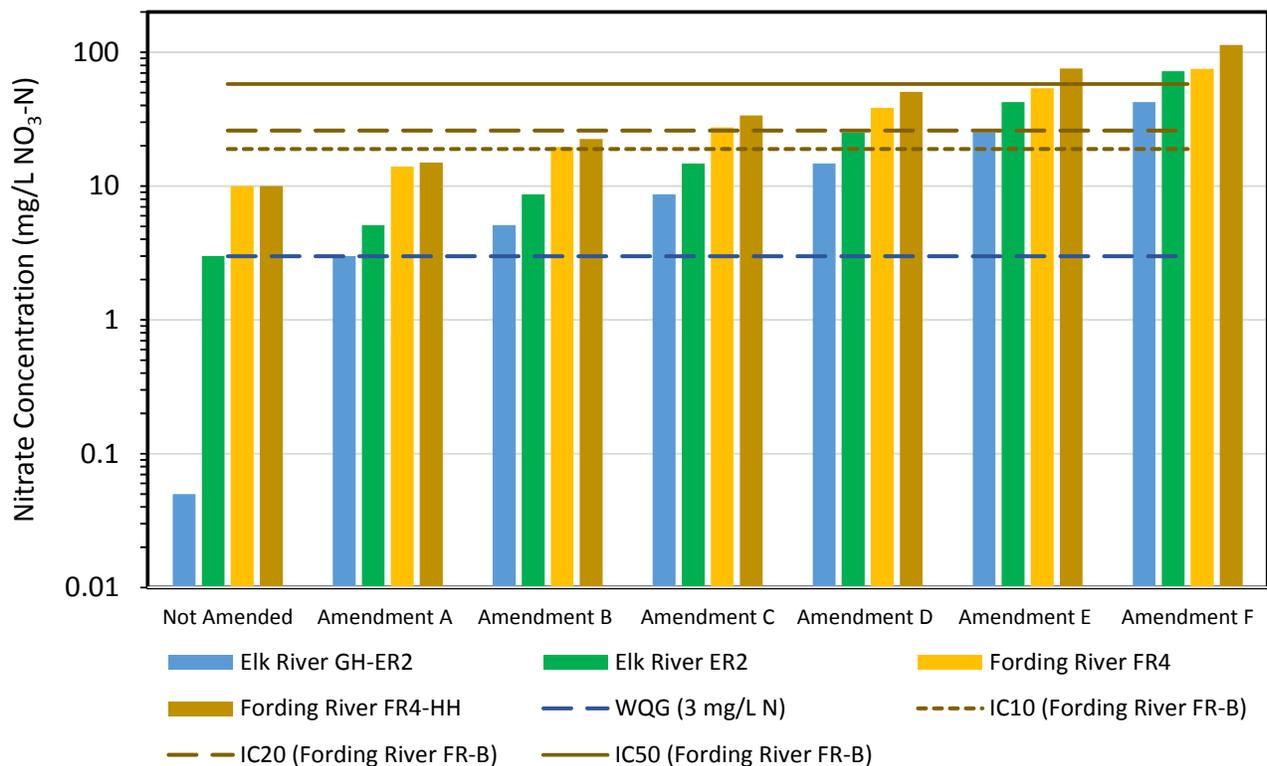


FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

- Fording River downstream of Greenhills Creek–Order Station FR4 (EMS Number 0200378)
- Amendment (spiking) of the water collected at Order Station FR4 to create an additional base water with higher hardness (700 mg/L as CaCO₃), exactly as described in Section 2.2.2.2 for invertebrate testing.
- For all base waters (GH_ER2, ER2, FR4, FR4-HH), amendment of samples with nitrate additions (using sodium nitrate salts) to create a series of six additional nitrate concentrations per sample site.
- The range of the concentration series will be slightly different than for *C. dubia*, to reflect the differences in the effect concentrations from past site specific testing (Figure 4). The concentration ranges have been specified separately for each base water due to the anticipated hardness-dependence of nitrate toxicity, as documented in the literature for several freshwater aquatic species.

The total concentrations of nitrate in the base waters are summarized below, and depicted in Figure 4. These concentrations reflect the sum of both the nitrate in the collected waters plus nitrate added through the addition of sodium nitrate.

Figure 4: Summary of the 2016 Rainbow Trout Embryo-alevin Toxicity Study Design for Nitrate.



Note: IC_x values shown on the figure are the site-specific thresholds for nitrate toxicity developed based on the Phase 1 mixture toxicity testing (Golder and Nautilus 2013). FR-B refers to the Fording River sampling location at Fording Bridge (test hardness 435 mg/L as CaCO₃).

Fording River FR4-HH consists of FR4 water hardness-supplemented to 700 mg/L as CaCO₃ prior to addition of nitrate.



The concentrations in the unamended samples are estimates based on an assumption of October sampling and review of the recent trends in water chemistry (Appendix A):

- Station GH_ER2 (EMS Number E02000389)—0.05 (unamended), 3, 5, 9, 15, 25, and 43 mg/L NO₃-N (concentration factor of 1.7× between amended treatments);
- Order Station ER2 (EMS Number E0200027)—3 (unamended), 5, 9, 15, 25, 43, and 72 mg/L NO₃-N (concentration factor of 1.7× between amended treatments);
- Order Station FR4 (EMS Number 0200378)—10 (unamended), 14, 20, 27, 38, 54, and 75 mg/L NO₃-N (concentration factor of 1.4× between amended treatments); and
- Treatment FR4-HH (Order Station FR4 with supplemented hardness)—10 (no nitrate amendment), 15, 23, 34, 51, 76, and 114 mg/L NO₃-N (concentration factor of 1.5× between amended treatments).

Chemical testing of waters will be conducted as described above for the three-brood *C. dubia* toxicity test, with the same analytes and detection limits. However, the duration of the rainbow trout test necessitates additional analyses, as multiple water samples will be used through the test (i.e., replacement water delivered to the laboratory once per week over the course of the test). Each water delivery will require subsampling from each station for analysis of major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, and alkalinity), a high resolution metals scan for both total and dissolved metals, total dissolved solids, and nutrients (nitrate, nitrite, ammonia, phosphorus).



3.0 SULPHATE CHRONIC TOXICITY STUDY

The Sulphate Chronic Toxicity Study consists of three components, reflective of the test species being considered: an amphibian testing component, an invertebrate test component and a fish test component. Each of these components is discussed in more detail below. Some of the study design components for sulphate are very similar to those discussed in Section 2.0 for nitrate (e.g., same species and protocol identified for both substances). Where this occurs, reference is made to protocol details in Section 2.0; however, differences between programs (e.g., concentration series, sampling locations, sulphate-specific considerations) are described in this section.

3.1 Amphibian Testing

The methods and results of 2015 amphibian pilot testing are provided as an attachment to Appendix B. Findings of specific relevance to the design of the sulphate study included:

- No effects were detected that could be attributed to sulphate at concentrations up to 1,047 mg/L. Testing above this sulphate concentration was therefore recommended for future testing, recognizing that there are solubility constraints to introduction of very high sulphate concentrations.
- There was a statistically significant difference in survival and days to metamorphosis between a soft laboratory water control and reconstituted hard water. The potential for hardness-dependence has implication for the sulphate study design because amendment of water samples with sulphate salts will result in related changes to water hardness.

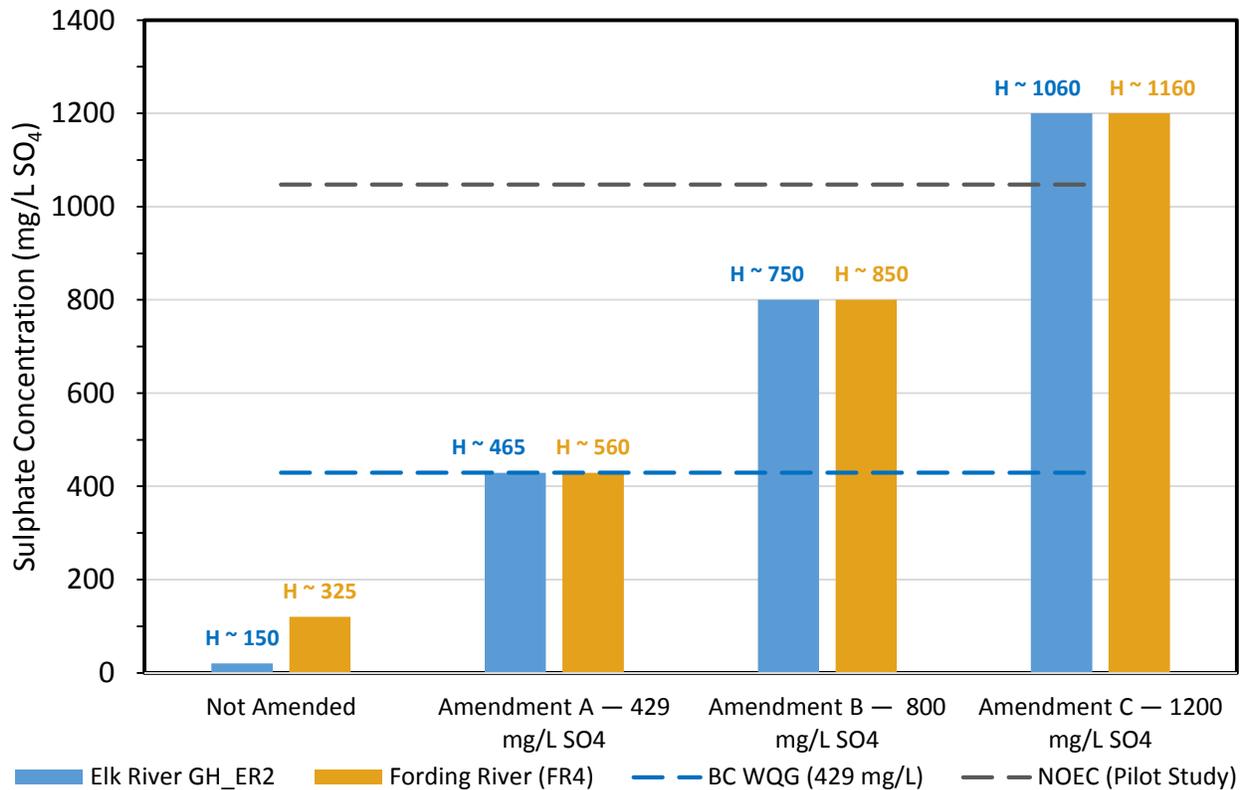
For the 2017 amphibian testing, exposures will be conducted concurrently for the nitrate and sulphate toxicity testing programs (Table 2). Section 2.1 provides an overview of test methodologies that affect both the nitrate and sulphate study designs. The experimental design for sulphate is conveyed in Figure 5. For other details of the rationale and methods for the 2017 sulphate toxicity study of amphibians, please consult Appendix B.

The range of sulphate concentrations shown in Table 2 refer to the total sulphate concentrations (nominal concentrations in the exposure chambers, including the base concentrations from the site waters, plus the additional sulphate added at the laboratory).



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Figure 5: Summary of the 2016 Amphibian Toxicity Study Design for Sulphate.



Note: NOEC = Unbounded no-effect concentration from 2015 pilot study.

H = calculated water hardness (mg/L as CaCO₃) resulting from amendment of GH_ER2 and FR4 with calcium sulphate and magnesium sulphate.

The rationale for the range of sulphate concentrations (Figure 5) is to satisfy the following desired conditions:

- Testing of sulphate concentrations below the unbounded NOEC of 1,047 mg/L determined in the pilot study—this is to account for potential sensitivity differences in site-specific water relative to laboratory water;
- Testing of sulphate concentrations above the previously tested range (i.e., above 1,047 mg/L)—if effects are observed at the highest exposure concentration, this would assist with concentration-response analysis; conversely, if effects are not observed, this would provide increased confidence that amphibians are not a sensitive organism relative to other test species.



- Testing of concentrations within the solubility constraints of the sulphate salts used for sample amendment; for this reason the upper bound of the series was set to 1,200 mg/L SO₄⁷.

3.2 Invertebrate Testing

3.2.1 Background and Objectives

The objective of this component is to further assess the sensitivity of invertebrates to sulphate under high hardness conditions. Specific uncertainties that will be addressed through this work include:

- Within-test variability in water flea reproduction endpoint—In previous work, *C. dubia* (a water flea) were, on average, found to be less sensitive than rainbow trout to sulphate; however, the differences among species were small in relation to the wide confidence bands around the species-specific endpoint estimates (i.e., 95% confidence limits for the IC_x estimates were overlapping for the two species).
- Variation in *C. dubia* reproduction across studies—Golder and Nautilus (2013) reported greater levels of sensitivity to sulphate relative to testing conducted in 2013 (Teck 2014). It is unknown whether this difference relates to location- or season-specific differences in toxicity, or reflects variation in test organism cultures. Additional testing should help to clarify this area of uncertainty.

3.2.2 Study Design

Chronic toxicity testing using a sensitive invertebrate species is proposed to provide a validation of previous test results and improve our understanding of the linkage between sulphate toxicity and water characteristics. Implementation of toxicity testing of site waters (supplemented with sulphate salts) as part of the Nitrate Chronic Toxicity Study is scheduled for October of 2016.

3.2.2.1 Consideration of 2015 Results

Chronic invertebrate testing has been conducted for other Permit 107517 conditions (see Figure 1 and Section 1.1.2). The data collected in 2015 have been reviewed (Golder 2016a) and provide important information for scoping the 2016 sampling and analysis. Key findings from the 2015 testing of invertebrates were summarized in Section 2.2.2.1 for nitrate, and many of those considerations also apply for sulphate. Over multiple programs of testing, the *C. dubia* endpoint has consistently yielded greater sensitivity, lower test variance, and clearer linkage to mine-related constituents, relative to the *H. azteca* test. All of these are desirable characteristics for evaluating sulphate toxicity.

The lack of clear association between sulphate concentrations and *H. azteca* toxicity in the 2015 quarterly testing program is consistent with previous observations of site-specific testing of this species. Fall 2013 testing at four stations in the Elk Valley using the 14-d Environment Canada protocol did not elicit significant toxicity up to the maximum concentration tested (approximately 1,100 to 1,200 mg/L SO₄). In contrast, *C. dubia* was the second

⁷ The sulphate concentration at which solubility constraints would take effect is not known precisely. Introduction of 2,000 mg/L was not feasible during the pilot study (precipitation was observed).



most sensitive species to sulphate in previous site specific chronic toxicity testing (Teck 2014), with the lowest IC₂₀ for reproduction of 595 mg/L SO₄ observed for the FR-B station in the Phase 1 Mixture Toxicity Study Golder and Nautilus 2013).

3.2.2.2 2016 Experimental Design

To address the uncertainties discussed in Section 3.2.2.1, additional chronic toxicity testing using *C. dubia* is proposed, using the Environment Canada (2007) protocol for three-brood survival and reproduction. This incorporates a sensitive invertebrate endpoint, as has been identified in previous site-specific testing (Golder and Nautilus 2013) and provincial testing (Meays and Nordin 2013) of sulphate in hard water. This test would also satisfy the "water flea" test requirement specified in Permit Section 9.8.1, and uses a chronic test protocol that has been recommended by BC MOE for other Permit-based testing (e.g., Section 9.8 (ii) quarterly testing). The summary of test conditions for this protocol is provided in Appendix C (Table C-1).

The 2016 testing program for invertebrates with sulphate will include:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location upstream of Teck operations—Station GH_ER2 (EMS Number E02000389);
 - Fording River downstream of Greenhills Creek—Order Station FR4 (EMS Number 0200378) – an area of high hardness under current mine-influenced conditions; and
 - Elk River downstream of Fording River—Order Station ER2 (EMS Number E0200027) – an area of lower hardness relative to FR4, but higher than reference water hardness.
- Amendment (spiking) of samples with sulphate additions, covering a range that extends from below the SPO of 429 mg/L SO₄ to 1300 mg/L SO₄.
- Sulphate will be introduced using calcium and magnesium salts, and in proportion to observed calcium and magnesium ratios in the Fording River. This will result in further increases to sample hardness, but in a manner representative of mining influences (Figure 6). Testing of sulphate up to 1300 mg/L SO₄ is not expected to cause difficulty with the introduction of calcium sulphate (CaSO₄) within the solubility constraints of the laboratory water (i.e., precipitation is not expected to occur).

Other aspects of the study design for invertebrates and sulphate (e.g., subsampling for water chemistry, water quality analytes, test schedule) are expected to mirror those described for nitrate in Section 2.2.2.2, as appropriate.

The total concentrations of sulphate in the base waters are summarized below, and depicted in Figure 6. These concentrations reflect the sum of both the sulphate in the collected waters plus sulphate added through the addition of sulphate salts. The concentrations in the unamended samples are estimates based on an assumption of October sampling and review of the recent trends in water chemistry (Appendix A):

- Station GH_ER2 (EMS Number E02000389)—20 mg/L SO₄ (unamended);



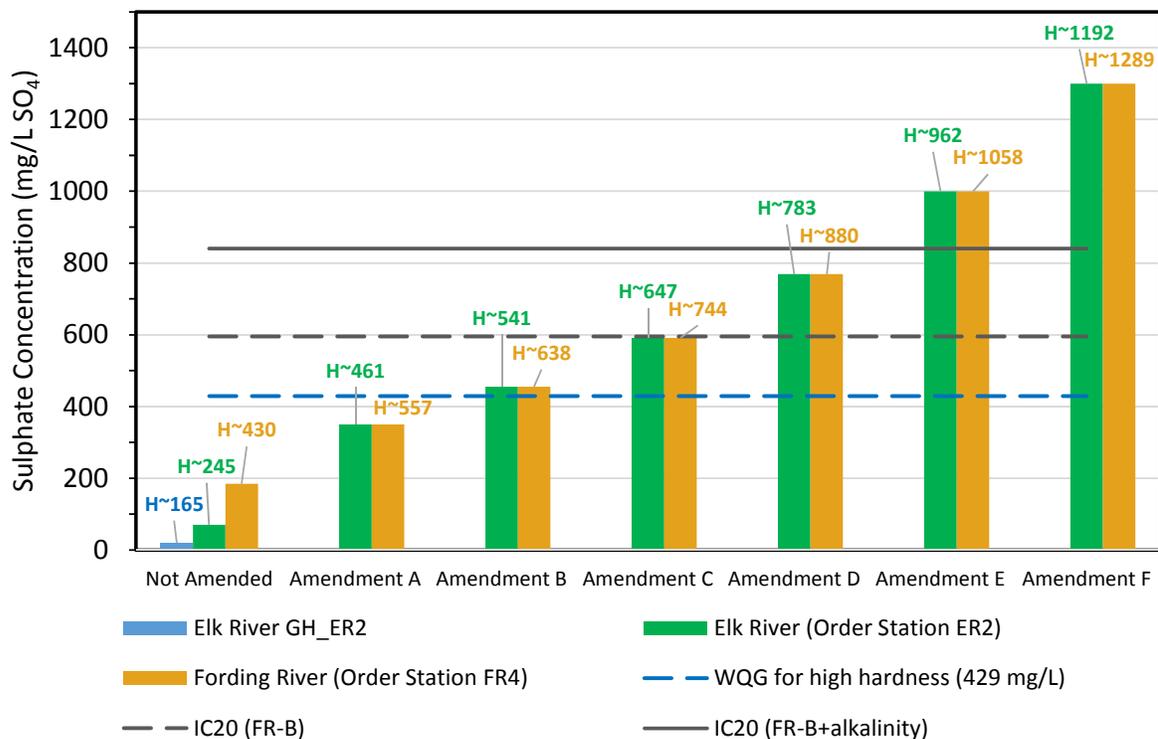
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- Order Station ER2 (EMS Number E0200027)—70 (unamended), 350, 455, 592, 769, 1000, and 1300 mg/L SO₄ (concentration factor of 1.3× between amended treatments); and

Order Station FR4 (EMS Number 0200378)—185 (unamended), 350, 455, 592, 769, 1000, and 1300 mg/L SO₄ (concentration factor of 1.3× between amended treatments).

The supplementation with sulphate will result in corresponding elevations of water hardness, due to the use of calcium and magnesium salts. The data labels in Figure 6 depict these increases.

Figure 6: Summary of the 2016 Invertebrate Toxicity Study Design for Sulphate.



Note: IC₂₀ values shown on the figure are the site-specific Level 2 benchmarks for sulphate toxicity developed based on *C. dubia* testing from the Phase 1 Mixture Toxicity Study, using Fording River water collected at Fording Bridge (Golder and Nautilus 2013).

Data labels on top of bars represent calculated water hardness (mg/L as CaCO₃) resulting from amendment of water samples with calcium sulphate and magnesium sulphate at a 2.6:1 calcium to magnesium ratio.



3.3 Fish Testing

3.3.1 Background and Objectives

The objective of this component is to further assess the sensitivity of fish to sulphate under high hardness conditions. Previous testing completed in support of the EVWQP (Teck 2014) identified salmonids (specifically rainbow trout embryo-alevin development) as the most sensitive species to sulphate exposure. The site-specific test results from 28-d embryo-alevin development tests in very high hardness water from the Fording River were similar to those documented by BC MOE (Meays and Nordin 2013) in the development of the water quality guideline for sulphate in high hardness water (429 mg/L SO_4 for water hardness of 181-250 mg/L as CaCO_3).

Testing will include both rainbow trout and fathead minnows. Rainbow trout are being considered because of the aforementioned sensitivity to sulphate; fathead minnows are included as per the requirements of Section 9.8.1 of Permit 107517.

Specific uncertainties that will be addressed through this work include:

- Interspecies sensitivity—Generate information for a non-salmonid species to evaluate differences among species and test protocols, while recognizing that non-salmonid species are not present in the upper Fording River where the highest sulphate and hardness levels in the Elk Valley occur.
- Within-test variability for rainbow trout development endpoint—Generate data to narrow confidence bands around the endpoint estimates from site-specific embryo-alevin tests (i.e., 95% confidence limits for the IC_x estimates); confidence bands from previous testing were wide.

Potential hardness-dependence—There is limited information on the hardness-dependence of sulphate toxicity to fish at water hardness levels above 250 mg/L as CaCO_3 . The testing completed in support of the EVWQP indicated that sensitivity of trout to sulphate in Fording River water was similar to that observed in other testing of high hardness waters (Meays and Nordin 2013), but the results of the former were limited to a single station and sampling event.

3.3.2 Study Design

Additional chronic toxicity testing using both rainbow trout and fathead minnows is proposed. The 2016 testing will provide a validation of previous test results and improved understanding of the linkage between sulphate toxicity and water characteristics.

3.3.2.1 Consideration of 2015 Results

Chronic fish testing has been conducted for other Permit 107517 conditions (see Figure 1 and Section 1.1.2). The data collected in 2015 have been reviewed (Golder 2016a) and provide important information for scoping the 2016 sampling and analysis. Key findings from the 2015 testing of salmonids were summarized in Section 2.3.2.1 for nitrate, and many of those considerations also apply for sulphate. In particular, the high replicate variability that was observed in 2015 testing, and that has been observed with previous testing of *O. mykiss* (Meays and Nordin 2013; Teck 2014) is of importance for the design of the sulphate toxicity study.



The 2015 testing also included testing of survival, growth, and development of fathead minnows (*P. promelas*). Survival and biomass were reduced relative to the Fording River reference water in three tests, but a toxicity identification evaluation (TIE) showed that these effects were likely caused by microbiological components of the river water under laboratory test conditions, rather than by chemical toxicants. This conclusion is supported by the results summarized in the memo *Update of Toxicity Identification Evaluation Efforts for Fathead Minnow Tests* (Appendix C of Golder 2016a). In the TIE, site water was treated using filtration, chlorine, ultraviolet sterilization, or copper. Each of these treatments would be expected to curtail growth of microbes in the sample. Because toxicity was reduced using all four treatment methods, Nautilus concluded that is highly likely that adverse effects observed in the *P. promelas* quarterly tests have been caused by microbiological components of the samples, rather than by chemical toxicants. The implications of this finding are that fathead minnow test results, which are required under Section 9.8.1 of Permit 107517, have a high probability of yielding false positives and/or high variability for the survival (and biomass) endpoints, unless additional measures are taken to account for the microbial responses.

3.3.2.2 2016 Experimental Design

Additional chronic toxicity testing using both rainbow trout and fathead minnows is proposed; both tests are approximately one month in duration and include survival, growth, and developmental endpoints. Implementation of additional tests of site waters (supplemented with sulphate) is tentatively scheduled for October of 2016. The timing of testing is conditional upon the availability of rainbow trout embryos, which are seasonally constrained and dependent upon availability from local suppliers. The summary of test conditions for the rainbow trout embryo-alevin test is provided in Appendix C (Table C-3). The summary of test conditions for the fathead minnow larval development test is provided in Appendix C (Table C-4).

The rainbow trout testing for sulphate will incorporate additional replicates (relative to the standard level of replication specified in Environment Canada 1998) to yield narrower confidence limits around the test endpoints. It is proposed that the number of replicates be doubled relative to the standard test conditions for this protocol (i.e., 8 test replicates per treatment instead of 4). This would help to address wide confidence bands around IC₁₀ and IC₂₀ point estimates observed in previous testing. The additional precision is warranted given that the rainbow trout embryo-alevin test results were used in the development of the sulphate site-specific SPO (Teck 2014) and also used in the derivation of the WQG for hard water (Meays and Nordin 2013).

The fathead minnow testing for sulphate will incorporate modification of test procedures to account for the potential interference by microbiological components of the samples. Adverse effects have been observed in samples collected upstream and downstream of mine operations (Nautilus 2016), and that this type of effect on *P. promelas* has been documented elsewhere. To avoid confounding of the sulphate testing with a non-chemical factor, the usefulness of this test for the chronic toxicity testing program would be improved by modifying the test procedure to avoid confounding microbiological effects. Teck has discussed with EMC the best approach to modifying the fathead minnow test (e.g., selection of antimicrobial agent and associated concentration). Based on the findings to date, a copper amendment using 10 µg/L has been established as a suitable compromise between the effectiveness of the treatment (ability to eliminate microbial interference) and the specificity of the treatment (ability to target microbes without causing toxicity from excess copper). The testing of site waters (without sulphate additions) will include experiments with and without copper additions, whereas the site waters amended with additional sulphate will also incorporate copper amendments.



The 2016 testing program for both fish species with sulphate will include:

- Collection of waters from three locations representing a range of hardness conditions:
 - Reference location upstream of Teck operations—Station GH_ER2 (EMS Number E02000389);
 - Fording River downstream of Greenhills Creek—Order Station FR4 (EMS Number 0200378) – an area of high hardness under current mine-influenced conditions; and
 - Elk River downstream of Fording River—Order Station ER2 (EMS Number E0200027) – an area of lower hardness relative to FR4, but higher than reference water hardness.
- Amendment (spiking) of samples with sulphate additions, covering a range that extends from below the SPO of 429 mg/L SO₄ to approximately 1000 mg/L SO₄.
- Sulphate will be introduced using calcium and magnesium salts, and in proportion to observed calcium and magnesium ratios in the Fording River. This will result in further increases to sample hardness, but in a manner representative of mining influences (Figure 7). Testing of sulphate up to 1000 mg/L SO₄ is not expected to cause difficulty with the introduction of calcium sulphate (CaSO₄) within the solubility constraints of the laboratory water.

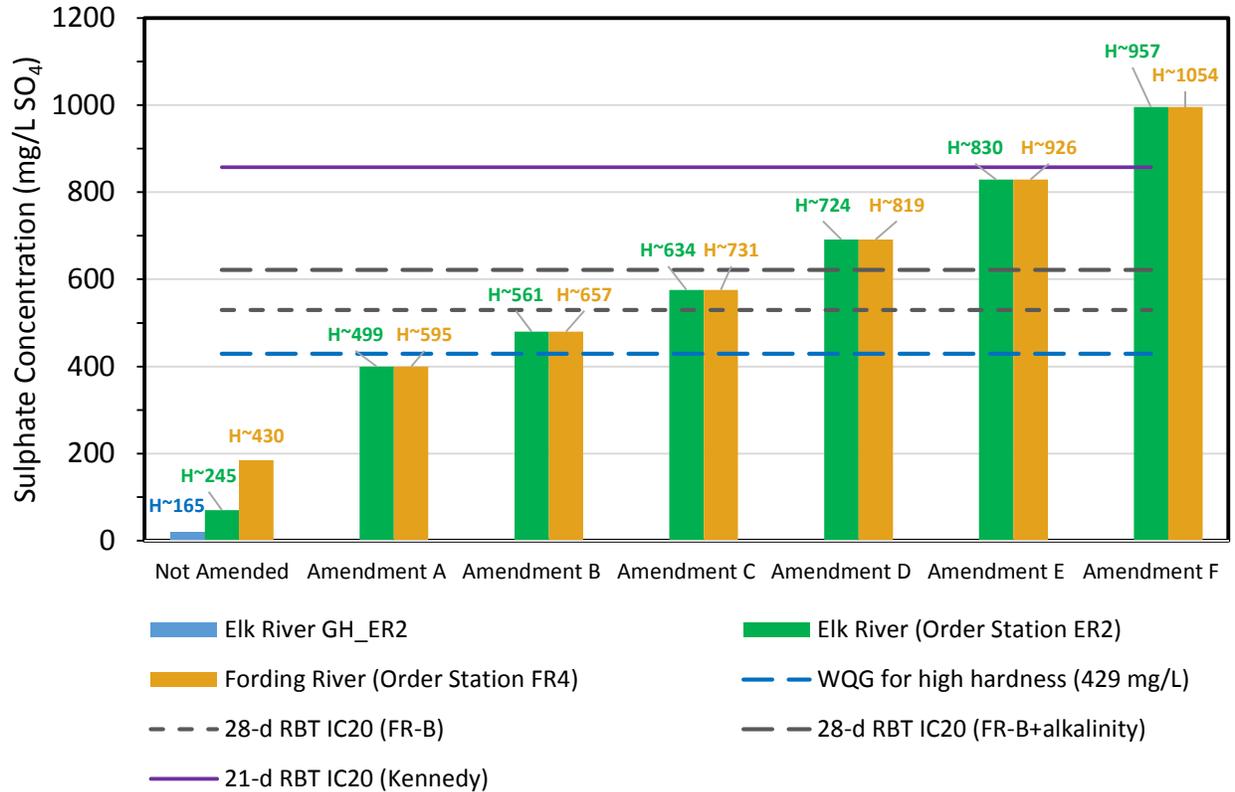
Other aspects of the study design for invertebrates and sulphate (e.g., subsampling for water chemistry, water quality analytes, test schedule) are expected to mirror those described for nitrate in Section 2.3.2.2, as appropriate. The total concentrations of sulphate in the base waters are summarized below, and depicted in Figure 7. These concentrations reflect the sum of both the sulphate in the collected waters plus sulphate added through the addition of sulphate salts. The concentrations in the unamended samples are estimates based on an assumption of October sampling and review of the recent trends in water chemistry (Appendix A):

- Station GH_ER2 (EMS Number E02000389)—20 mg/L SO₄ (unamended);
- Order Station ER2 (EMS Number E0200027)—70 (unamended), 400, 480, 576, 691, 829, and 995 mg/L SO₄ (concentration factor of 1.2× between amended treatments); and
- Order Station FR4 (EMS Number 0200378)—185 (unamended), 400, 480, 576, 691, 829, and 995 mg/L SO₄ (concentration factor of 1.2× between amended treatments).



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Figure 7: Summary of the 2016 Fish Toxicity Study Design for Sulphate.



Note: IC₂₀ values marked as FR-B are the site-specific Level 2 benchmarks for nitrate toxicity developed based on *C. dubia* testing from the Phase 1 Mixture Toxicity Study, using Fording River water collected at Fording Bridge (Golder and Nautilus 2013). IC₂₀ value marked as "Kennedy" is the result (model averaged estimate of 857 mg/L SO₄) from testing by Dr. Chris Kennedy (Simon Fraser University) using a 21-d rainbow trout early life stage test (Meays and Nordin 2013).

Data labels on top of bars represent calculated water hardness (mg/L as CaCO₃) resulting from amendment of water samples with calcium sulphate and magnesium sulphate at a 2.6:1 calcium to magnesium ratio.



4.0 CLOSURE

We trust that the above provides sufficient information for your present needs. If you have any questions, please contact the undersigned.

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5.0 REFERENCES

- Environment Canada. 1998. *Biological Test Method: Toxicity Tests Using Early Life Stages of Salmonid Fish (Rainbow Trout)*. Second Edition. EPS/1/RM/28, July 1998.
- Environment Canada. 2007. *Biological test method: test of reproduction and survival using the cladoceran Ceriodaphnia dubia*. Environmental Protection Series. Report EPS 1/RM/21, Second Edition. Environment Canada, Science and Technology Branch, Ottawa, ON.
- Golder (Golder Associates Ltd.) and Nautilus (Nautilus Environmental Ltd.). 2013. *Phase I Report: Elk Valley Mixture Toxicity Study*. Report Number 13-1349-0006. July 2013.
- Golder. 2015a. *Final Study Design to Address Section 9.8.2 of Permit 107517*. Submitted to Carla Fraser and Mark Digel (Teck Coal Ltd.). 30 April 2015. Project No. 1523293-3000-3002.
- Golder. 2015b. *Section 9.8.2 of Permit 107517 – Response to Ministry Feedback on Study Design*. Submitted to Nick Manklow and Carla Fraser (Teck Coal Ltd.). 30 April 2015. Project No. 1523293-3000-3002.
- Golder. 2015c. *Draft Study Design—Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements*. Submitted to Nick Manklow (Teck Coal Ltd.). 9 October 2015. Project No. 1523293-3020.
- Golder. 2016a. *Interpretive Report—2015 Chronic Toxicity Testing Program*. Submitted to Nick Manklow (Teck Coal Ltd.). March 2016. Project No. 1523293-3030.
- Golder. 2016b. *Final Draft Study Design—Chronic Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements*. Submitted to Nick Manklow (Teck Coal Ltd.). 2 June 2016. Project No. 1523293-3020.
- Golder (Golder Associates Ltd.) and Nautilus (Nautilus Environmental Inc.). 2016. *2016 Study Design—Amphibian Toxicity Testing of Nitrate and Sulphate to Support Permit Requirements*. Submitted to Nick Manklow (Teck Coal Ltd.). Project No. 1523293-3040. 15 April 2016.
- Hoke RA, Geisy JP, Adams JR. 1990. Use of linear orthogonal contrasts in environmental data. *Environmental Toxicology and Chemistry* 9:815-819.
- McGurk MD, Landry F, Tang A, Hanks CC. 2006. *Acute and chronic toxicity of nitrate to early life stages of lake trout (Salvelinus namaycush) and lake whitefish (Coregonus clupeaformis)*. *Environmental Toxicology and Chemistry* 25:2187—2196.
- Meays C and Nordin R. 2013. *Ambient Water Quality Guidelines for Sulphate – Technical Appendix Update*. Water Protection & Sustainability Branch, Environmental Sustainability and Strategic Policy Division, BC Ministry of Environment. April 2013.
- Meays CL. 2009. *Water Quality Guidelines for Nitrogen (Nitrate, Nitrite, Ammonia)*. Addendum to technical appendix. Water Stewardship Division, Ministry of Environment, BC, Canada.
- Nautilus (Nautilus Environmental Inc.). April 22, 2016. *Memo: Toxicity Identification Evaluation efforts for fathead minnow tests (Revision 1)*. Submitted to Cait Good (Teck Coal Ltd.) by James Elphick (Nautilus). April 22, 2016.



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

- Teck (Teck Coal Ltd.). *Area Based Management Plan (ABMP) - the "Elk Valley Water Quality Plan."* Submitted to Ministry of Environment, 22 July 2014 (Approved 18 November 2014).
- Teck (Teck Coal Ltd.). 2016. *Reference: Amphibian Chronic Toxicity Testing - Failed Laboratory Control Performance Criterion #2.* Submitted by Nick Manklow (Lead, Adaptive Water Management, Teck Coal Limited) to Lana Miller (Environmental Impact Assessment Section Head – Mining Operations, Ministry of Environment). August 2016.
- USEPA (United States Environmental Protection Agency). 1996. *Ecological Effects Test Guidelines OPPTS 850.1400 Fish Early-Life Stage Toxicity Test.* Prevention, Pesticides and Toxic Substances (7101). EPA 712-C-96-121. April 1996.



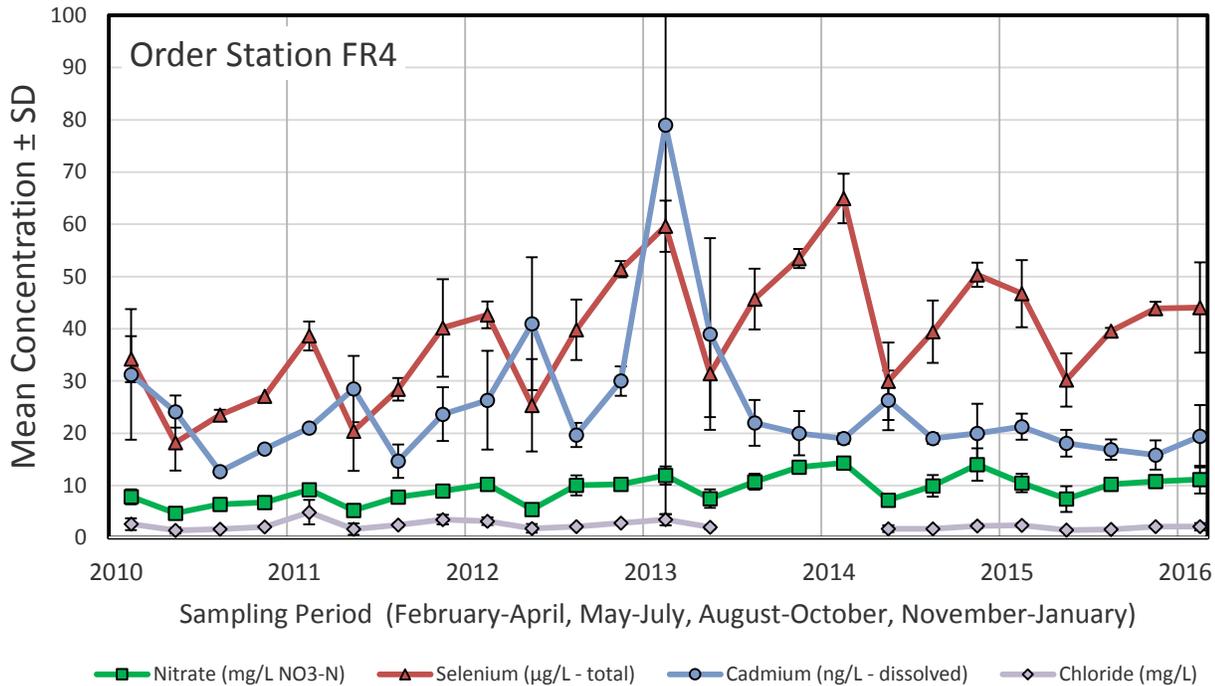
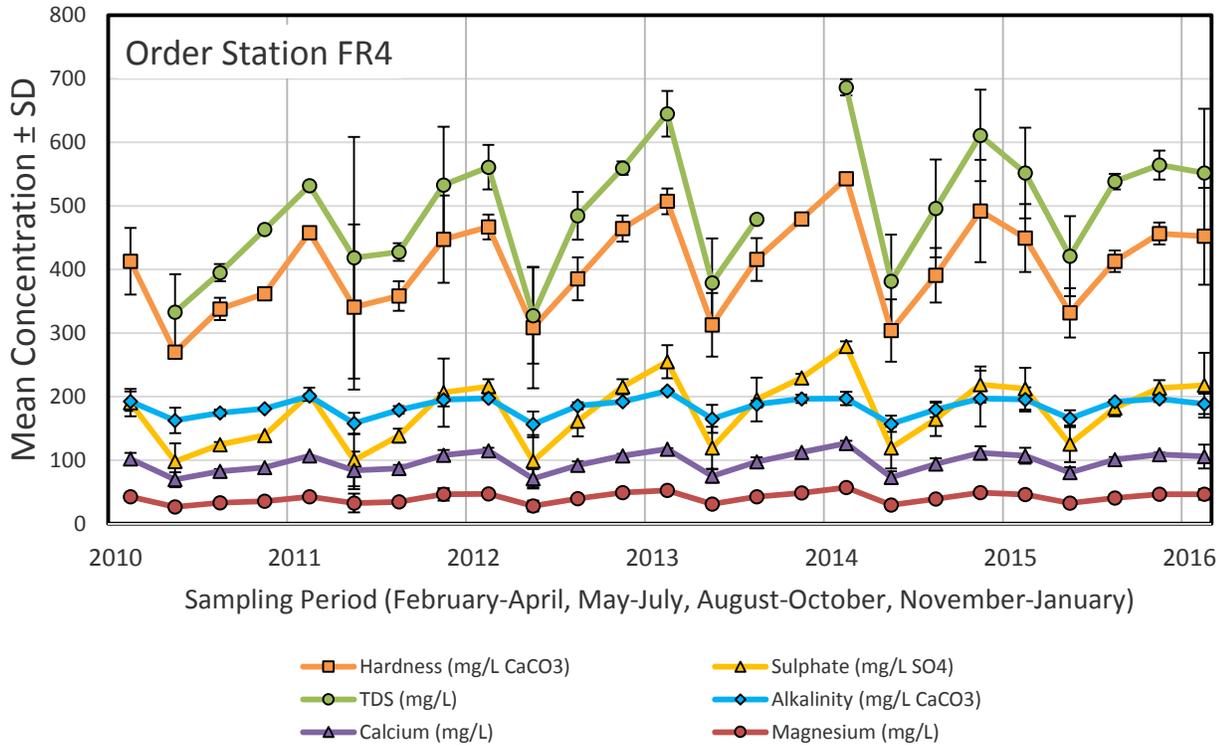
APPENDIX A

Seasonal Water Quality Summaries for Proposed Sampling Locations



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

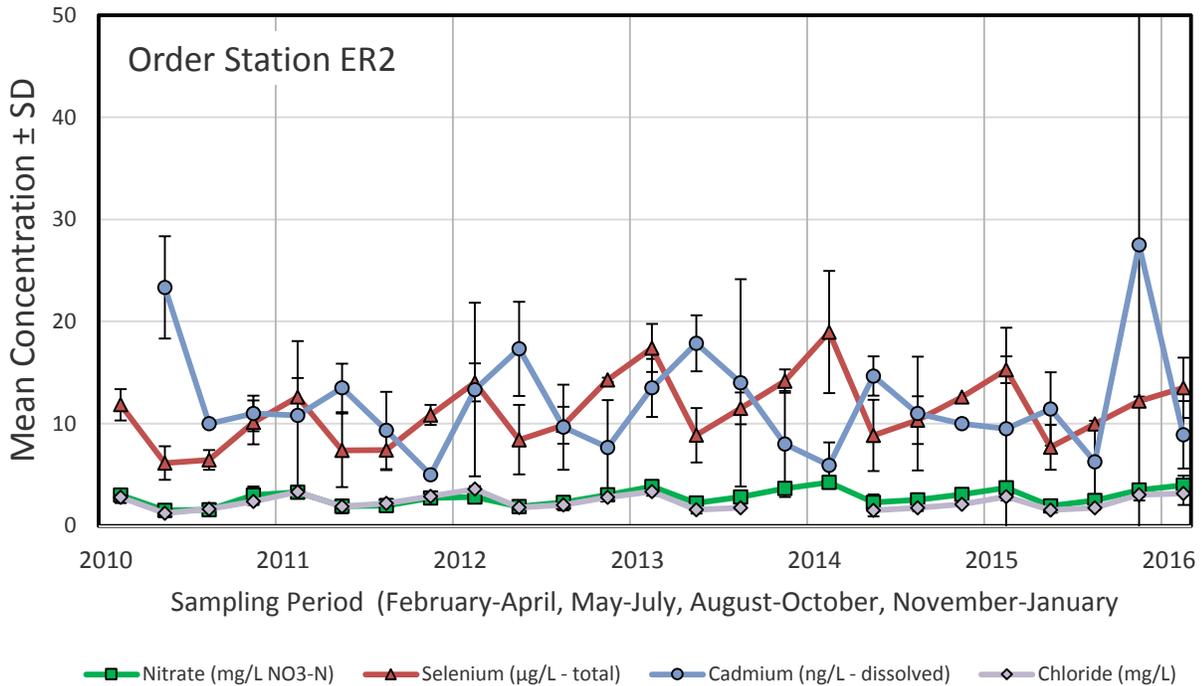
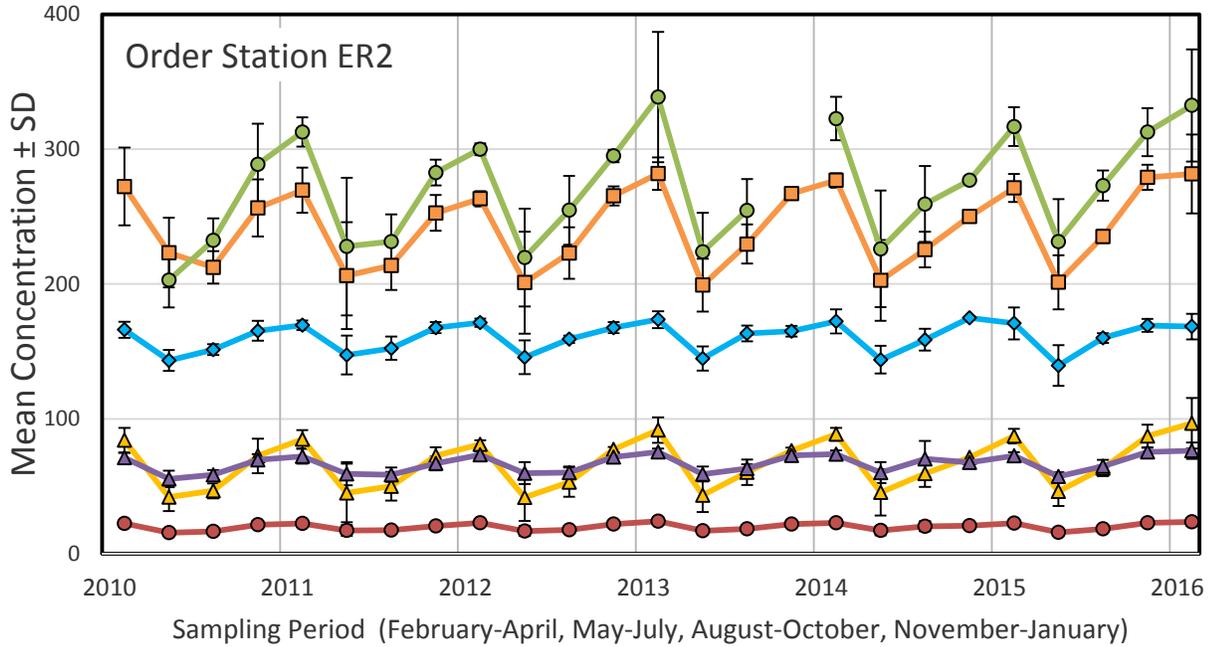
Figure A-1: Water Quality at Upper Fording River upstream of Josephine Falls (Order Station FR4).





FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

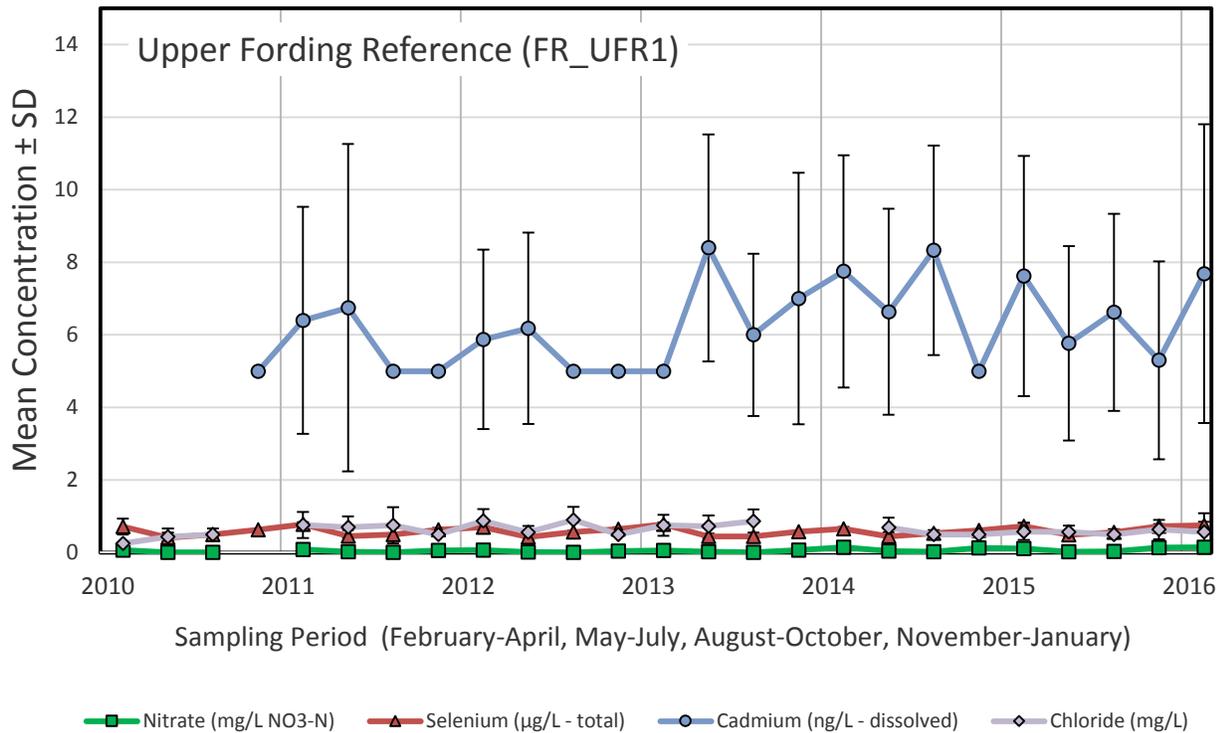
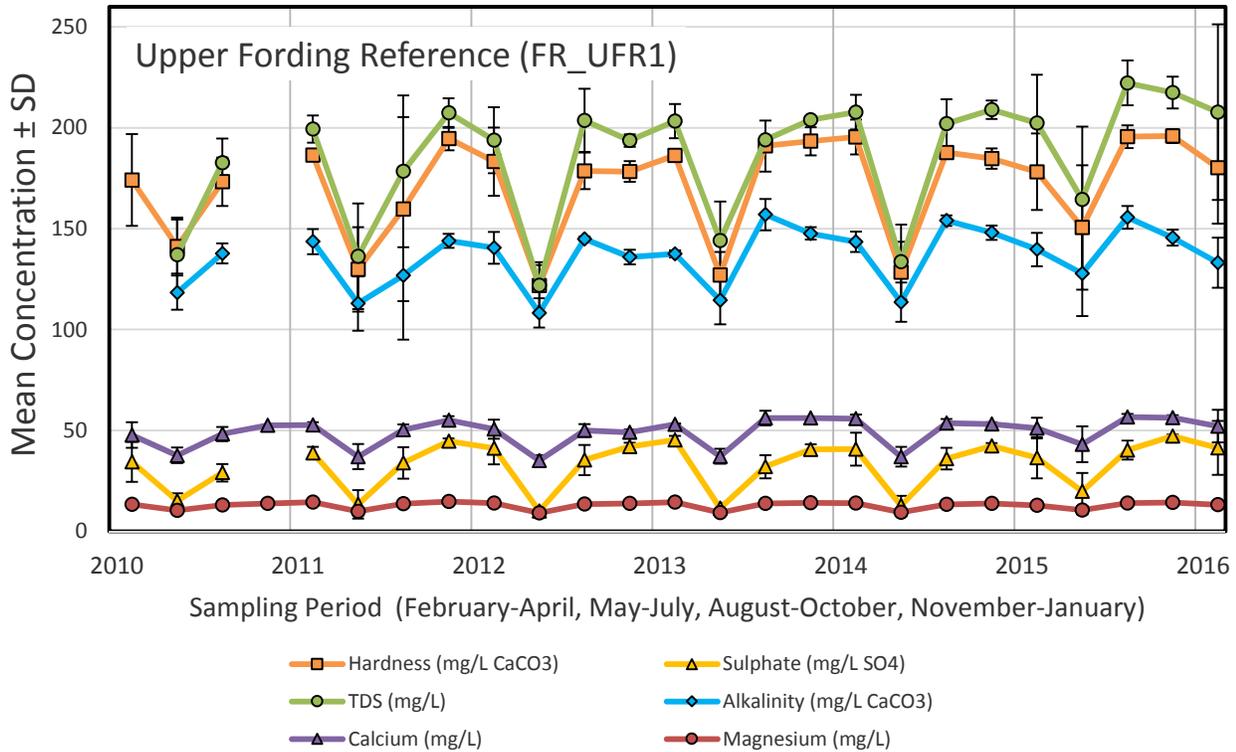
Figure A-2: Water Quality at Elk River upstream of Grave Creek (Order Station ER2).





FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

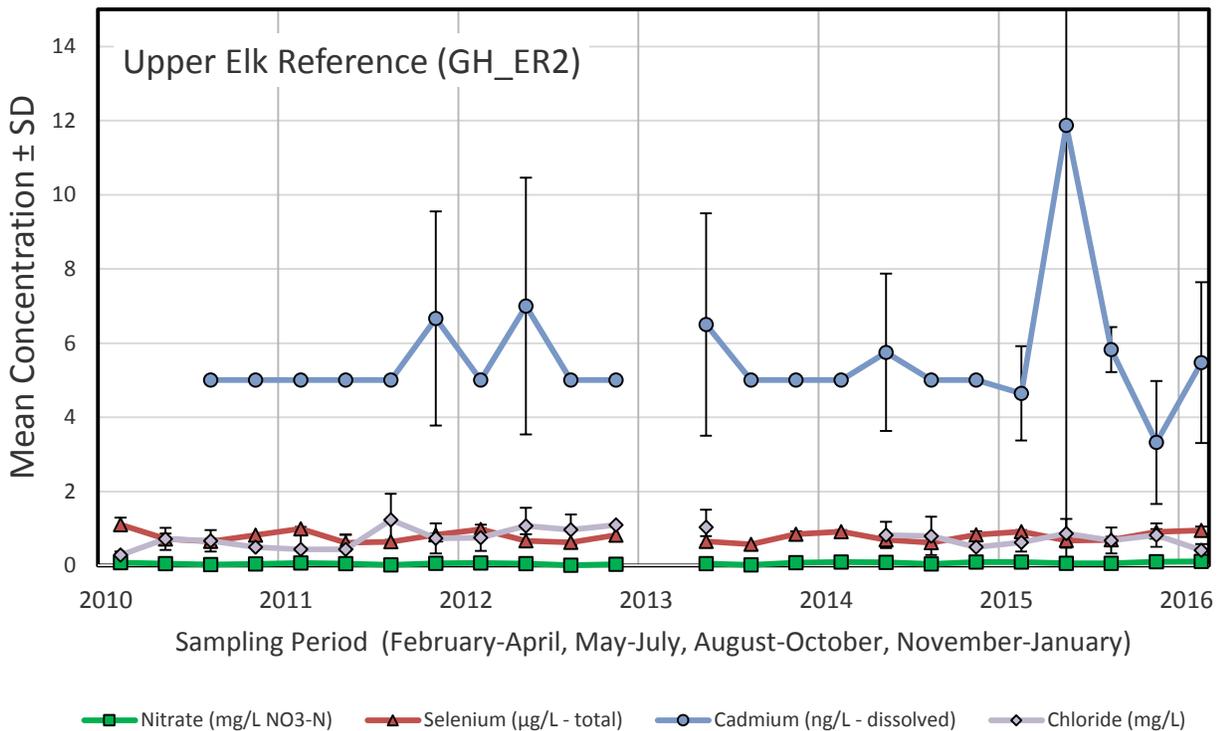
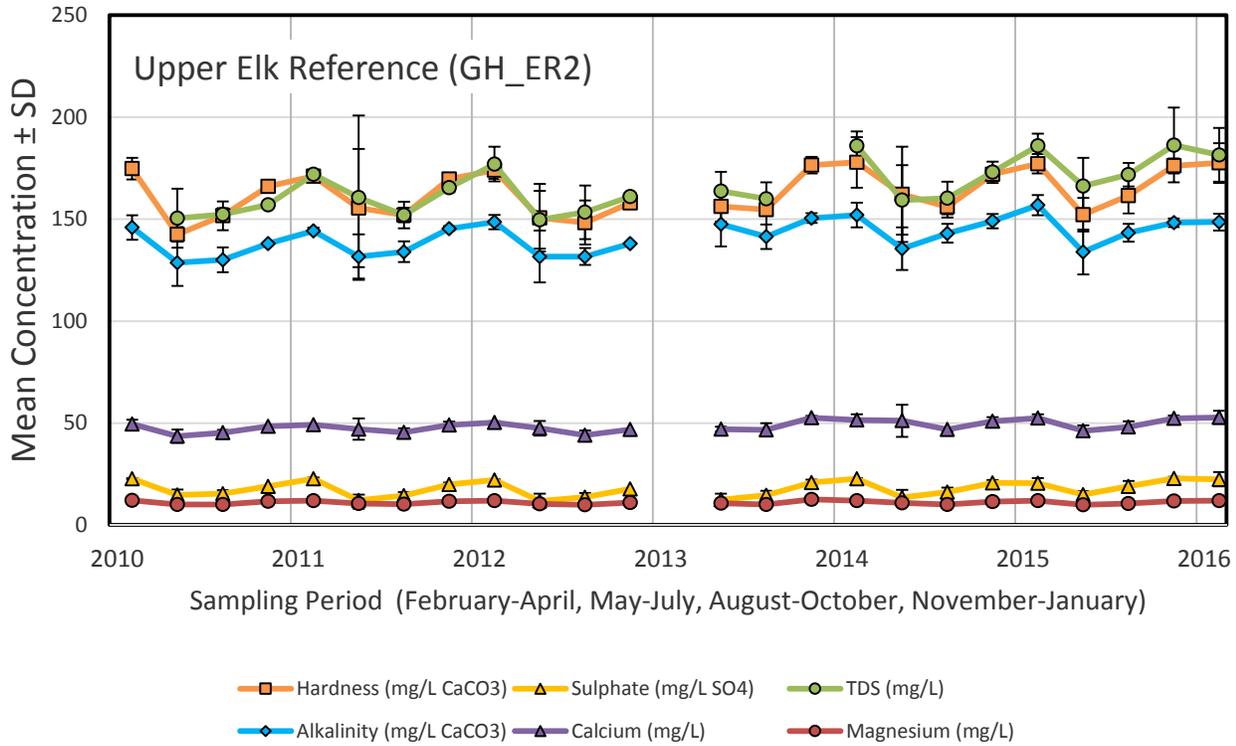
Figure A-3: Water Quality at Upper Fording River reference location upstream of mine-related inputs.





FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Figure A-4: Water Quality at Upper Elk River reference location upstream of mine-related inputs.





FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Table A-1: Seasonal water quality summary for Upper Fording River upstream of Josephine Falls (Order Station FR4) for samples collected between 2010 and 2016

Flow Period	Statistic	Alkalinity (mg/L CaCO ₃)	Dissolved Cd (ng/L)	Ca (mg/L)	Cl (mg/L)	Hardness (mg/L CaCO ₃)	Mg (mg/L)	Nitrate (mg/L NO ₃ -N)	Total Se (µg/L)	Sulphate (mg/L SO ₄)	TDS (mg/L)
Base Flow (Feb-April)	N of Cases	42	34	39	41	34	39	44	42	44	30
	Minimum	147.0	12.2	71.2	1.0	312.0	31.0	4.7	25.7	121.0	366.0
	Maximum	214.0	165.0	131.0	7.5	547.0	58.2	14.4	69.7	287.0	698.0
	Mean	195.3	27.2	108.5	2.8	461.2	46.6	10.3	44.6	216.2	575.0
	Standard Dev.	14.4	25.5	13.8	1.3	61.8	6.8	2.4	10.4	38.1	84.6
	Percentile - 10	171.1	15.6	87.1	1.5	359.4	36.0	7.8	32.4	160.7	447.0
	Percentile - 25	192.0	18.3	102.3	2.4	436.0	42.9	8.5	36.0	195.5	527.0
	Percentile - 50	199.0	21.9	112.0	2.6	472.0	47.6	10.0	44.9	219.0	599.0
	Percentile - 75	203.0	25.0	118.8	3.0	499.0	51.8	12.7	50.5	247.0	625.0
	Percentile - 90	209.3	37.0	124.2	4.5	528.2	54.6	13.6	60.6	264.7	671.5
Percentile - 95	212.4	47.4	125.6	5.7	542.2	57.1	14.3	64.0	278.3	689.0	
Freshet (May-July)	N of Cases	53	42	45	52	32	45	53	55	53	43
	Minimum	134.0	12.6	54.5	0.5	241.0	18.9	0.2	10.9	57.4	244.0
	Maximum	211.0	60.0	105.0	4.4	433.0	43.0	9.5	47.1	195.0	553.0
	Mean	161.1	24.8	74.6	1.6	317.7	29.6	6.1	25.0	110.1	376.7
	Standard Dev.	16.2	8.7	11.7	0.7	51.1	6.1	1.9	8.3	33.9	77.3
	Percentile - 10	140.8	17.1	62.9	1.1	254.8	23.0	3.9	14.8	67.5	283.4
	Percentile - 25	147.8	19.7	64.9	1.3	272.0	24.8	4.8	18.8	86.5	321.5
	Percentile - 50	160.0	25.0	71.0	1.4	315.5	28.4	6.0	23.7	104.0	355.0
	Percentile - 75	175.0	25.0	85.1	1.8	357.5	34.7	7.4	31.3	137.5	434.0
	Percentile - 90	180.4	32.3	90.3	2.6	381.5	37.9	8.7	35.7	155.6	481.8
Percentile - 95	182.8	43.4	94.0	2.9	408.4	39.5	9.2	37.9	171.9	511.6	
Receding Limb (Aug-Oct)	N of Cases	19	19	21	16	21	21	19	21	19	17
	Minimum	166.0	11.0	79.9	1.5	326.0	31.8	5.9	22.5	122.0	384.0
	Maximum	195.0	27.0	106.0	2.8	453.0	46.6	11.8	51.8	220.0	551.0
	Mean	183.6	17.5	93.3	1.9	388.0	38.8	9.2	37.2	162.1	473.0
	Standard Dev.	8.4	3.8	8.2	0.4	38.4	4.5	1.9	8.6	30.2	60.9
	Percentile - 10	170.8	12.4	80.9	1.5	332.4	33.0	6.6	24.1	123.6	394.4
	Percentile - 25	180.0	15.0	86.6	1.6	355.5	34.7	7.7	29.9	135.3	413.0
	Percentile - 50	184.0	17.4	92.1	1.8	394.0	38.1	10.1	39.4	164.0	479.0
	Percentile - 75	190.8	19.8	99.6	2.1	415.8	42.3	10.9	42.6	186.5	532.3
	Percentile - 90	193.2	21.0	103.2	2.5	436.0	44.8	11.5	48.8	202.8	545.8
Percentile - 95	194.6	24.3	105.5	2.7	443.6	45.7	11.7	50.2	215.5	549.3	
Low Flow (Nov-Jan)	N of Cases	19	19	20	17	20	20	19	20	19	17
	Minimum	166.0	12.3	88.3	1.9	362.0	35.5	6.8	27.1	139.0	463.0
	Maximum	228.0	32.0	119.0	4.5	549.0	57.6	16.2	54.9	268.0	662.0
	Mean	195.0	19.5	108.3	2.5	458.3	46.8	10.9	45.3	210.9	557.8
	Standard Dev.	12.1	5.6	6.6	0.6	41.2	4.7	2.1	7.1	28.1	51.8
	Percentile - 10	183.8	13.0	102.5	2.0	408.0	40.8	8.7	34.8	174.2	476.0
	Percentile - 25	190.0	15.8	105.5	2.1	441.5	45.1	10.0	43.1	199.0	546.3
	Percentile - 50	193.0	17.4	108.5	2.4	457.5	46.6	10.6	44.5	211.0	556.0
	Percentile - 75	200.0	23.8	112.0	2.8	480.5	49.2	11.7	51.2	228.3	574.0
	Percentile - 90	205.8	28.0	116.0	3.1	506.0	51.7	13.7	53.3	237.0	632.6
Percentile - 95	218.5	30.2	118.0	4.0	538.0	54.6	15.4	54.5	254.9	653.6	



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Table A-2: Seasonal water quality summary for Elk River mine-influenced location (Order Station ER2) for samples collected between 2010 and 2016

Flow Period	Statistic	Alkalinity (mg/L CaCO ₃)	Dissolved Cd (ng/L)	Ca (mg/L)	Cl (mg/L)	Hardness (mg/L CaCO ₃)	Mg (mg/L)	Nitrate (mg/L NO ₃ -N)	Total Se (µg/L)	Sulphate (mg/L SO ₄)	TDS (mg/L)
Base Flow (Feb-April)	N of Cases	64	56	64	59	59	64	65	67	67	56
	Minimum	145	2.5	63.7	1.23	222	18.3	1.91	8.92	59	244
	Maximum	192	42	82.8	4.4	320	28.7	5.8	31.1	124	463
	Mean	170.1	10.1	73.8	3.1	275.3	23.0	3.6	14.6	88.8	323.3
	Standard Dev.	8.4	6.6	4.4	0.7	18.2	1.8	0.7	3.4	11.2	31.2
	Percentile - 10	159.8	5.0	68.7	2.3	254.0	21.6	3.0	11.1	77.6	297.3
	Percentile - 25	167.0	5.0	71.2	2.9	267.0	22.2	3.2	12.5	83.7	307.0
	Percentile - 50	170.0	8.9	73.8	3.2	275.0	22.8	3.6	14.3	87.9	321.0
	Percentile - 75	175.0	12.4	76.5	3.5	284.0	23.9	4.1	16.4	94.6	332.5
	Percentile - 90	180.0	16.0	79.4	3.9	299.6	25.0	4.4	17.6	102.9	350.9
Percentile - 95	183.0	20.5	81.8	4.0	304.1	26.1	4.7	19.5	110.0	376.1	
Freshet (May-July)	N of Cases	52	49	52	53	44	52	53	56	56	49
	Minimum	105.0	2.5	48.0	0.5	165.0	13.3	1.2	3.9	27.1	172.0
	Maximum	175.0	25.0	75.6	3.4	277.0	24.9	4.2	17.4	88.9	328.0
	Mean	143.7	15.9	58.1	1.5	204.3	16.5	1.9	7.6	44.1	222.7
	Standard Dev.	11.5	5.2	6.4	0.5	28.2	2.7	0.6	2.8	14.4	36.5
	Percentile - 10	133.0	10.6	51.6	1.1	175.0	14.1	1.4	4.9	31.4	188.0
	Percentile - 25	137.0	12.0	53.8	1.2	183.5	14.8	1.5	5.5	34.8	199.5
	Percentile - 50	141.5	15.0	56.8	1.5	196.5	15.8	1.8	7.0	39.2	212.0
	Percentile - 75	150.0	19.0	60.4	1.8	214.0	17.4	2.2	8.8	48.1	235.3
	Percentile - 90	160.0	25.0	67.7	2.1	245.5	20.0	2.8	11.9	65.2	280.4
Percentile - 95	167.3	25.0	72.7	2.4	275.3	23.4	3.1	14.2	78.6	308.0	
Receding Limb (Aug-Oct)	N of Cases	18	18	18	17	18	18	18	18	18	17
	Minimum	143.0	2.5	53.2	1.4	193.0	15.1	1.4	5.6	38.6	208.0
	Maximum	170.0	25.0	84.6	2.6	244.0	23.8	3.3	13.3	70.9	289.0
	Mean	157.4	10.0	62.6	1.9	223.3	18.2	2.3	9.3	55.5	250.6
	Standard Dev.	6.6	5.2	6.9	0.3	14.7	2.1	0.5	2.3	9.8	23.7
	Percentile - 10	148.5	5.0	56.0	1.6	203.3	15.7	1.5	5.9	41.7	221.8
	Percentile - 25	154.0	5.0	58.0	1.6	214.0	16.5	1.9	7.6	48.9	231.8
	Percentile - 50	158.0	10.0	62.9	1.8	225.0	18.2	2.3	9.8	55.9	251.0
	Percentile - 75	161.0	12.0	65.2	2.0	233.0	19.4	2.7	10.5	63.1	268.0
	Percentile - 90	166.8	15.1	67.6	2.5	241.0	20.4	2.9	12.4	69.1	284.6
Percentile - 95	169.2	21.4	78.0	2.6	242.8	22.6	3.2	13.1	70.2	287.9	
Low Flow (Nov-Jan)	N of Cases	19	19	19	16	19	19	19	19	19	16
	Minimum	157.0	5.0	62.2	2.0	237.0	19.4	2.2	8.3	60.1	261.0
	Maximum	175.0	119.0	79.3	3.8	285.0	23.9	3.9	15.1	95.7	337.0
	Mean	167.8	14.2	71.8	2.8	265.7	21.9	3.2	12.3	78.5	297.0
	Standard Dev.	4.9	25.6	4.4	0.5	14.7	1.3	0.5	1.8	9.1	20.6
	Percentile - 10	161.8	5.0	65.6	2.1	244.8	19.9	2.5	9.7	69.0	274.3
	Percentile - 25	163.3	5.0	68.9	2.6	254.5	20.8	2.9	11.7	72.3	282.5
	Percentile - 50	169.0	9.1	72.6	2.7	268.0	22.1	3.2	12.5	77.7	294.5
	Percentile - 75	171.0	11.9	74.8	3.0	279.8	22.9	3.7	13.8	84.2	308.0
	Percentile - 90	174.2	13.6	77.3	3.5	284.6	23.6	3.8	14.5	92.4	330.0
Percentile - 95	175.0	71.7	78.7	3.7	285.0	23.8	3.9	14.8	95.0	335.2	



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Table A-3: Seasonal water quality summary for Upper Fording River reference (Station FR_UFR1) for samples collected between 2010 and 2016.

Flow Period	Statistic	Alkalinity (mg/L CaCO ₃)	Dissolved Cd (ng/L)	Ca (mg/L)	Cl (mg/L)	Hardness (mg/L CaCO ₃)	Mg (mg/L)	Nitrate (mg/L NO ₃ -N)	Total Se (µg/L)	Sulphate (mg/L SO ₄)	TDS (mg/L)
Base Flow (Feb-April)	N of Cases	38	38	47	43	47	47	47	47	47	38
	Minimum	110.0	2.5	36.2	0.05	126.0	9.8	0.03	0.25	12.7	135.0
	Maximum	154.0	15.8	58.0	1.30	205.0	15.5	0.20	0.88	49.9	276.0
	Mean	139.2	6.8	51.3	0.60	181.6	13.7	0.10	0.73	39.1	202.0
	Standard Dev.	8.7	3.1	5.5	0.37	18.8	1.4	0.04	0.12	9.4	24.0
	Percentile - 10	125.4	5.0	40.2	0.23	146.4	11.0	0.05	0.59	23.8	169.4
	Percentile - 25	138.0	5.0	50.0	0.25	178.0	13.4	0.06	0.68	36.6	195.0
	Percentile - 50	140.5	5.0	52.6	0.50	187.0	14.2	0.08	0.73	41.8	203.5
	Percentile - 75	145.0	10.0	54.8	1.00	192.8	14.5	0.13	0.80	46.0	213.0
	Percentile - 90	146.7	11.0	56.8	1.20	197.0	14.9	0.17	0.86	47.1	221.7
Percentile - 95	149.6	12.0	57.2	1.20	202.2	15.0	0.17	0.87	49.7	238.0	
Freshet (May-July)	N of Cases	54	54	58	58	53	58	58	58	58	54
	Minimum	95.1	2.5	30.7	0.25	107.0	7.6	0.00	0.25	6.7	105.0
	Maximum	159.0	53.0	56.3	1.20	198.0	14.0	0.11	0.97	33.9	223.0
	Mean	115.2	9.5	37.6	0.60	132.0	9.8	0.02	0.44	13.6	137.8
	Standard Dev.	13.4	8.9	5.6	0.24	20.1	1.4	0.03	0.15	6.1	25.3
	Percentile - 10	101.9	5.0	31.8	0.50	111.0	8.3	0.00	0.25	7.9	111.8
	Percentile - 25	106.0	5.0	34.0	0.50	118.8	8.8	0.00	0.37	9.5	120.0
	Percentile - 50	111.5	5.0	35.9	0.50	126.0	9.4	0.01	0.42	11.8	132.0
	Percentile - 75	123.0	11.0	40.0	0.50	141.8	10.6	0.03	0.50	15.8	151.0
	Percentile - 90	130.3	25.0	44.8	1.07	155.6	11.7	0.06	0.64	21.4	165.3
Percentile - 95	147.0	25.0	49.6	1.10	174.0	12.8	0.07	0.75	28.0	188.8	
Receding Limb (Aug-Oct)	N of Cases	28	28	28	26	28	28	28	28	28	24
	Minimum	79.2	2.5	44.9	0.50	91.9	12.0	0.00	0.25	22.7	124.0
	Maximum	165.0	50.0	59.5	1.50	204.0	14.9	0.09	0.68	47.5	246.0
	Mean	147.9	8.6	53.4	0.63	183.8	13.7	0.02	0.52	35.3	202.3
	Standard Dev.	16.0	9.2	4.2	0.28	21.2	0.8	0.02	0.09	6.5	24.6
	Percentile - 10	137.3	5.0	47.5	0.50	165.5	12.5	0.00	0.43	25.4	175.5
	Percentile - 25	144.0	5.0	50.0	0.50	181.0	13.1	0.00	0.47	31.4	188.0
	Percentile - 50	150.5	5.0	54.1	0.50	187.5	13.8	0.01	0.52	36.1	205.0
	Percentile - 75	156.5	9.4	57.0	0.50	196.0	14.2	0.02	0.58	40.0	217.0
	Percentile - 90	163.0	11.5	57.9	1.09	199.7	14.7	0.04	0.62	44.1	226.6
Percentile - 95	164.1	27.5	58.8	1.26	202.2	14.9	0.05	0.65	45.6	236.2	
Low Flow (Nov-Jan)	N of Cases	21	22	22	18	21	22	21	22	21	19
	Minimum	133.0	2.5	48.0	0.50	174.0	13.5	0.01	0.55	37.8	191.0
	Maximum	151.0	11.0	57.5	1.10	200.0	15.4	0.21	0.79	48.3	232.0
	Mean	144.6	5.4	54.6	0.57	191.2	14.2	0.10	0.66	44.5	210.1
	Standard Dev.	5.1	2.1	2.8	0.19	7.9	0.4	0.06	0.07	3.0	10.6
	Percentile - 10	138.0	2.5	50.0	0.50	178.8	13.7	0.02	0.59	40.8	194.6
	Percentile - 25	142.0	5.0	52.8	0.50	185.5	13.9	0.06	0.59	41.9	204.0
	Percentile - 50	145.0	5.0	55.8	0.50	194.0	14.2	0.08	0.65	44.3	210.0
	Percentile - 75	148.3	6.7	56.6	0.50	198.0	14.5	0.17	0.70	47.1	214.5
	Percentile - 90	151.0	8.4	57.2	0.92	198.4	14.6	0.18	0.78	47.9	224.4
Percentile - 95	151.0	9.6	57.4	1.10	199.4	14.9	0.20	0.79	48.1	229.3	



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Table A-4: Seasonal water quality summary for Upper Elk River reference (Station GH_ER2) for samples collected between 2010 and 2016

Flow Period	Statistic	Alkalinity (mg/L CaCO ₃)	Dissolved Cd (ng/L)	Ca (mg/L)	Cl (mg/L)	Hardness (mg/L CaCO ₃)	Mg (mg/L)	Nitrate (mg/L NO ₃ -N)	Total Se (µg/L)	Sulphate (mg/L SO ₄)	TDS (mg/L)
Base Flow (Feb-April)	N of Cases	29	51	26	55	25	26	31	29	31	19
	Minimum	137.0	0.0	46.6	0.00	162.0	11.0	0.06	0.83	15.1	167.0
	Maximum	164.0	25.0	55.5	1.10	191.0	13.0	0.17	1.47	24.8	197.0
	Mean	150.2	4.3	51.1	0.24	176.5	12.0	0.09	1.00	22.0	183.4
	Standard Dev.	6.7	7.3	2.5	0.30	7.2	0.5	0.02	0.13	2.0	8.4
	Percentile - 10	143.0	0.0	48.0	0.00	170.0	11.4	0.06	0.88	19.7	171.4
	Percentile - 25	145.0	0.0	49.1	0.00	171.8	11.6	0.07	0.92	22.0	180.0
	Percentile - 50	150.0	0.0	50.9	0.25	175.0	12.0	0.09	0.96	22.5	182.0
	Percentile - 75	154.3	5.0	53.5	0.50	182.0	12.3	0.10	1.05	23.0	189.8
	Percentile - 90	159.6	14.6	54.6	0.54	184.0	12.6	0.11	1.17	23.5	194.6
Percentile - 95	163.1	25.0	54.9	1.00	190.3	12.8	0.12	1.28	24.1	196.1	
Freshet (May-July)	N of Cases	54	74	44	74	34	44	53	54	52	43
	Minimum	115.0	0.0	38.6	0.00	135.0	8.6	0.02	0.13	9.1	132.0
	Maximum	157.0	87.2	62.7	1.50	208.0	12.7	0.13	1.02	20.1	191.0
	Mean	133.3	7.7	46.6	0.54	154.8	10.2	0.06	0.67	13.6	158.5
	Standard Dev.	11.5	12.8	5.0	0.48	15.3	1.1	0.03	0.15	2.9	16.3
	Percentile - 10	119.0	0.0	41.7	0.00	137.8	8.9	0.02	0.54	10.6	137.0
	Percentile - 25	124.0	0.0	42.8	0.00	145.0	9.3	0.04	0.58	11.4	144.3
	Percentile - 50	131.5	5.0	45.8	0.50	151.0	10.0	0.05	0.63	13.4	159.0
	Percentile - 75	142.0	7.8	49.2	1.00	160.0	11.0	0.08	0.78	15.6	169.0
	Percentile - 90	151.1	25.0	51.7	1.20	176.1	11.8	0.10	0.88	18.0	184.0
Percentile - 95	153.0	25.0	56.9	1.38	181.0	12.4	0.12	0.94	19.3	188.3	
Receding Limb (Aug-Oct)	N of Cases	19	19	19	19	19	19	19	19	19	17
	Minimum	123.0	5.0	41.5	0.00	136.0	8.9	0.01	0.54	11.5	139.0
	Maximum	147.0	6.7	51.2	1.90	170.0	11.2	0.08	0.78	21.7	177.0
	Mean	137.5	5.2	46.2	0.72	154.4	10.1	0.03	0.64	15.7	158.9
	Standard Dev.	7.1	0.4	2.4	0.53	8.9	0.7	0.02	0.07	2.6	10.2
	Percentile - 10	127.8	5.0	43.3	0.00	144.4	9.1	0.01	0.57	12.8	148.2
	Percentile - 25	133.3	5.0	44.8	0.50	148.5	9.5	0.01	0.57	13.8	152.5
	Percentile - 50	137.0	5.0	45.9	0.50	153.0	10.2	0.02	0.64	15.5	156.0
	Percentile - 75	144.0	5.0	47.4	1.18	159.5	10.7	0.05	0.69	17.0	165.0
	Percentile - 90	147.0	5.7	49.9	1.36	168.4	10.9	0.05	0.72	19.3	174.2
Percentile - 95	147.0	6.3	50.8	1.68	170.0	11.1	0.07	0.75	20.8	176.3	
Low Flow (Nov-Jan)	N of Cases	21	25	21	25	21	21	21	21	21	17
	Minimum	138.0	0.0	46.8	0.00	158.0	11.0	0.03	0.72	17.6	157.0
	Maximum	154.0	10.0	54.5	1.20	180.0	12.9	0.12	1.06	23.8	231.0
	Mean	147.4	3.8	51.2	0.51	173.3	11.8	0.08	0.87	21.3	177.1
	Standard Dev.	4.0	2.4	2.2	0.44	5.6	0.5	0.03	0.08	1.8	17.0
	Percentile - 10	141.6	0.0	48.0	0.00	166.6	11.1	0.04	0.76	18.9	161.4
	Percentile - 25	145.8	2.5	50.0	0.00	169.8	11.6	0.06	0.82	19.8	166.8
	Percentile - 50	148.0	5.0	51.6	0.50	174.0	11.8	0.09	0.88	21.7	174.0
	Percentile - 75	150.0	5.0	52.6	1.00	178.0	12.0	0.11	0.90	22.9	180.8
	Percentile - 90	151.8	5.6	53.6	1.20	180.0	12.5	0.11	0.94	23.4	191.8
Percentile - 95	153.4	7.6	54.1	1.20	180.0	12.9	0.12	1.01	23.7	217.3	



APPENDIX B

Amphibian Study Design

DATE 5 August 2016**REFERENCE No.** 1523293-3100**TO** Nick Manklow
Teck Coal Ltd.**CC** Mark Digel (Teck)**FROM** Gary Lawrence (Golder), James Elphick (Nautilus) **EMAIL** glawrence@golder.com**UPDATED STUDY DESIGN—AMPHIBIAN TOXICITY TESTING OF NITRATE AND SULPHATE IN 2017 TO SUPPORT PERMIT REQUIREMENTS**

1.0 INTRODUCTION

This document outlines proposed study designs for testing of amphibians exposed to nitrate and sulphate, focussing on tests to be conducted in spring/summer of 2017. The amphibian testing is part of a broader program of chronic toxicity testing, including a Nitrate Chronic Toxicity Study and a Sulphate Chronic Toxicity Study at high hardness concentrations. The Nitrate Chronic Toxicity Study is being completed by Teck Coal Ltd. (Teck) in response to a condition included in a letter approving the Regional Aquatics Effects Monitoring Program (RAEMP) issued by the BC Ministry of Environment (BC MOE) on November 14, 2014 (hereafter referred to as the RAEMP Approval Condition). The Sulphate Chronic Toxicity Study is being completed in accordance with Section 9.8.1 of Environmental Management Act Permit 107517.

The amphibian testing will entail assessing the sensitivity of amphibians to nitrate and sulphate using a representative species (leopard frog, *Lithobates pipiens*) in a laboratory setting using waters collected from the Elk Valley and tested at hardness concentrations relevant to the Elk Valley. These studies represent a continuation of work to better understand toxicity to aquatic species of the Elk Valley, and they build upon laboratory testing completed in 2015 as part of the pilot stage investigation of amphibian toxicity testing. Their primary purpose is to address permit and approval requirements pertaining to amphibian chronic toxicity testing.

This document incorporates minor revisions in response to EMC queries and other recent updates to the technical details of the study design (i.e., updates to 15 April 2016 study design). Minor revisions include additional information on reference toxicant testing, egg source, analytical measurements in water, interim stage biological measurements, study timing, and selection of reference location. This document revision also acknowledges the attempted amphibian toxicity testing in 2016, and associated control failures that necessitated deferral of the remaining amphibian testing to 2017. No substantive changes to the broad experimental design have been made.

1.1 Background

BC MOE issued Permit 107517 to Teck Coal Ltd. in November 2014, under the provisions of the Environmental Management Act. The permit includes Site Performance Objectives for sulphate, nitrate, selenium and cadmium, which were developed based on site-specific toxicity testing using a variety of species.



The RAEMP Approval Condition indicates that testing should be performed to characterize their sensitivity to nitrate under site-relevant conditions. Specifically, the RAEMP Approval Condition requires “*additional toxicity testing to study the effects of nitrate, including: amphibian toxicity testing to assess the sensitivity of representative species to nitrate using long-term metamorphosis tests.*”

The permit requirements for sulphate resulted from the lack of site-specific information for amphibians, particularly for high hardness concentrations (greater than 250 mg/L as CaCO₃). For sulphate, these requirements are reflected in the wording of Section 9.8.1 of Permit 107517, which specified:

“The Permittee must develop with input from the EMC, and implement a toxicity testing program specifically to assess sulphate toxicity at high hardness concentrations. Results will be used to support finalization of long term sulphate site performance objectives.”

Amphibians were identified as organisms that were potentially sensitive to sulphate, and for which testing might be appropriate. Specifically, the permit specified that, in addition to chronic testing with the fathead minnow, “*other sensitive species (amphibian, trout, water flea, etc.) shall be included.*”

1.2 Pilot Testing

Attachment 1 presents the methods and results of a pilot toxicity testing program conducted by Nautilus Environmental Inc. (Burnaby BC) in 2015 using *Lithobates pipiens*. The purpose of the pilot program was three-fold:

- evaluate the test methodology for chronic tests of *L. pipiens* to ensure that amphibian testing for nitrate and sulphate can be conducted in a reliable manner, confirming that practical details (e.g., organism source, feeding regime, etc.) are appropriate for future tests;
- compare toxicity between dechlorinated municipal water (soft water) and reconstituted hard water to assess whether hardness differences influence amphibian toxicity; and
- conduct preliminary trials of nitrate and sulphate exposures to *L. pipiens*, providing range-finding results to assist in establishing appropriate test concentrations for definitive tests.

The pilot test program (Attachment 1) yielded several findings of relevance to the study design for 2017 testing:

- The organism source and transportation, handling practices, temperature, control water type, water renewals, feeding regime, and other test methods employed in the trial were found to be suitable to produce viable control performance of this species. These methods are therefore considered appropriate for future exposures using *L. pipiens* including the proposed sulphate and nitrate testing with site waters.
- Exposure to reconstituted hard water (simulated to approximate the background hardness in the Elk Valley) resulted in a modest but statistically significant decrease in survival when compared to laboratory water (83.3% in hard water compared to 96.7% in dechlorinated municipal water). Hard water also resulted in a statistically significant increase in the mean number of days to metamorphosis (51.6 ± 1.1 days for hard water and 44.2 ± 4.0 days for dechlorinated municipal water). These findings suggested that water hardness may be a modifying factor of importance in the assessment of amphibian toxicity. Nautilus recommended that any future testing conducted using high hardness site water be accompanied by control/reference treatments using laboratory water of similar hardness and/or a site reference water (Attachment 1).

- The results of nitrate testing indicate that *L. pipiens* survival is a sensitive endpoint when tested in soft laboratory water. The LC₅₀ (with 95% confidence limits) for nitrate in laboratory control water was 28.8 (21.7 – 35.3) mg/L N, and the LC₂₀ was 19.2 (11.5 – 24.6) mg/L N. These effect levels are applicable to the very soft water associated with the laboratory control, but may not be relevant to higher hardness water associated with the Elk Valley. These nitrate concentrations are similar to those that elicited minor responses in other amphibian tests with nitrate (Schuytema and Nebeker 1999a,b; Allran and Karasov 2000).
- The results of sulphate testing indicate that adverse effects (survival, growth, and/or development) are not expected at sulphate concentrations up to 1000 mg/L in chronic exposures with *L. pipiens*. Concentrations higher than 1000 mg/L sulphate were not evaluated in this program.

1.3 2016 Testing

The remainder of this document describes testing procedures (now planned for 2017) that were originally designed for implementation in 2016. Amphibian (*L. pipiens*) tests were initiated by Nautilus in their Burnaby BC laboratory, with testing commencing in June 2016. However, a high rate of mortality was observed early in the exposure period, including the negative controls, ultimately causing a control failure and termination of the test. As described in Teck (2016), a second round of testing in July 2016, including copper amendment to control for potential microbial effects, also failed to meet laboratory control performance criteria. Consequently, the 2016 amphibian testing program was terminated. The laboratory theorizes that poor test performance was related to specimen batch health, and may be related to a viral or bacterial infection within the supplied egg masses. This theory of a viral or bacterial infection is supported by similar poor survival observations in other testing utilizing the same batch of specimens for another client at the laboratory. To further investigate the health of the specimens, select specimens have been preserved and will be sent to the University of Prince Edward Island where specimen health will be evaluated and assessed for potential viral presence or bacterial infection.

The consequence of the control failures described above is that all amphibian tests must be reinitiated in 2017 using new organism cultures. Leopard frogs have a single annual development testing window, requiring that testing will be postponed until late Spring of 2017. At this time, no other changes to the implementation of the amphibian testing program are anticipated.

1.4 Study Objectives

The studies described in this memorandum are designed to satisfy the Permit 107517 and RAEMP Approval Condition requirements that apply to amphibians. In so doing, they will generate site-relevant information to evaluate the sensitivity of amphibians to nitrate and sulphate relative to other aquatic species.

The amphibian toxicity testing component will address much of the residual uncertainty associated with previous test data reported in the literature and the pilot study. These uncertainties include:

- Limitations of literature data—The literature data, which were relied upon in the development of the EVWQP and the provincial freshwater guideline for nitrate (Meays 2009), have uncertainty related to the interpretation of test endpoints (i.e., the biological significance of observed responses and the requirement, if any, for application of safety factors). For example, the minor growth responses observed in the Allran and Karasov (2000) study of leopard frogs were considered by CCME (2012) to be of questionable ecological significance and therefore were not included in the data-set for long-term guideline derivation. Developmental responses

were observed in a chronic amphibian study examining the toxicity of sodium nitrate to the Pacific treefrog (Schuytema and Nebeker 1999a,b) and yielded a lowest observed effect level of 30 mg/L N, but the long-term guideline derivation applied a safety factor of 0.1.

- Lack of site-specific tests—Unlike fish and invertebrates, no site-specific tests with amphibians have been conducted using Elk Valley water samples. Further assessment of nitrate toxicity to ranids is required to evaluate risks to the Columbia spotted frog (*Rana luteiventris*), as indicated by the Toxicology Working Group (TWG) of the Technical Advisory Committee engaged in the development of the EVWQP. Site-specific testing accounts for modifying factors in site waters than may mediate amphibian toxicity.
- Unknown hardness-dependence—The hardness-dependence of nitrate toxicity to amphibians is less understood relative to fish and invertebrates. Most toxicity tests with amphibians have been conducted in soft water conditions, and insufficient data are available to quantify hardness-dependence for any amphibian species.

In the case of sulphate, pilot testing conducted in 2015 indicated that sulphate concentrations of up to 1,000 mg/L had no adverse effect on development of *L. pipiens*, which is in excess of the SPO of 429 mg/L sulphate. Consequently, the testing program described herein is designed to confirm that the SPO remains protective under site-relevant conditions. A secondary objective is to identify the concentration of sulphate required to elicit biologically significant responses under site-relevant conditions. However, the concentration of sulphate that can be introduced into test solutions is limited by the solubility constraints of the sulphate salts used to amend samples. Therefore, it is possible that the toxicity threshold for sulphate will be unbounded within the range of dissolved test concentrations that can be administered in the laboratory.

In the case of nitrate, preliminary testing conducted in 2015 indicated that *L. pipiens* survival is a sensitive endpoint when tested in soft laboratory water. Consequently, the testing program described herein is designed to evaluate whether sensitivity is influenced by increasing hardness, and the nature of such dependence, if present. A secondary objective is to identify the concentration of nitrate required to elicit biologically significant responses under site-relevant conditions (e.g., water hardness and major ion composition reflective of mine-influenced conditions).

2.0 GENERAL METHODS

This section discusses the methods that apply to both the nitrate and sulphate tests. The details of water sampling locations and concentration series, which differ for the two substances, are discussed separately in Section 3.1 (nitrate) and Section 3.2 (sulphate). Although the nitrate and sulphate tests fulfill distinct regulatory requirements, concurrent testing will be conducted for both substances.

2.1 Water Types and Volumes

The 2017 testing will be based primarily on exposures using waters collected from the Elk Valley, including both unamended samples (both upstream reference and mine-influenced) and site waters that will be amended across a gradient of nitrate and sulphate exposures. Site water will be collected from the Fording and Elk Rivers and transported to the Nautilus Environmental laboratory in Burnaby, BC, on approximately a weekly basis throughout the exposures.

The purpose of water replacements is to avoid deterioration of the water samples held in the laboratory (i.e., loss or generation of toxicants over the holding period), to provide water renewal rates consistent with the test protocol, and to characterize the variations in water quality conditions that occur over the period of amphibian development and metamorphosis (late spring and early summer). The logistical effort associated with testing using this species is substantial, with weekly volume requirements of 75 L of water per week for each test concentration. The overall test plan, as described, will require weekly collection and delivery to the laboratory of approximately 2600 L of water from the Elk Valley.

For both nitrate and sulphate exposures, two laboratory controls will be tested: one using dechlorinated municipal tap water and a second that is hardness adjusted to approximately match the hardness of the upstream reference waters. The upstream Elk River reference site (GH_ER2) has been selected for the amphibian toxicity testing program based on low concentrations of constituents of concern, past use as a reference station, and representation of water quality (e.g., ionic composition and hardness) without mining influence. Separate negative laboratory controls (dechlorinated municipal tap water) will be run for sulphate and nitrate testing (4 replicates each) to account for potentially different set up days in the laboratory and to provide greater samples size for control performance evaluation.

The water used in testing consists of three broad types, including clean laboratory water (dechlorinated municipal tap water and synthetic hard water), base waters supplied from the Elk Valley, and modified experimental waters (i.e., base waters amended through addition of sulphate or nitrate salts). The laboratory water quality is monitored as part of routine laboratory quality assurance/quality control. Subsamples of unamended base waters from each Elk Valley sampling location will be submitted for a full chemical analysis, with rapid turnaround time to facilitate calculation of the required chemical amendments each week. The full chemical analysis will include major ions (calcium, magnesium, sodium, potassium, chloride, sulphate, and alkalinity), a high resolution metals scan for both total and dissolved metals, total dissolved solids, and nutrients (nitrate, nitrite, ammonia, phosphorus). Sulphate or nitrate (as applicable) will be measured in all test concentrations of the modified experimental waters weekly throughout exposure. These measurements will provide confirmation that the amended test concentrations are consistent with the target test concentrations. Routine, water quality (pH, dissolved oxygen and temperature) will also be measured in the toxicity laboratory before and after water exchanges throughout the exposure (three times per week).

The 2017 amphibian toxicity testing will incorporate a 96-h reference toxicant test using sodium chloride as the reference toxicant for *L. pipiens* (following Environment Canada draft procedures). A complete laboratory control chart will not be available for this test due to limited use of this test organism in previous investigations. The previous reference toxicant results at Nautilus have tested Gosner Stage 25 at test initiation, which will be continued in this program to facilitate comparison to previous results. The results from this test will also be compared to a reference toxicant control chart produced by Environment Canada during their work to develop test methodology with this species.

2.2 Test Organisms

The company that supplied the egg masses for the 2015 pilot study did not renew their collection permit in 2016, requiring consideration of alternate providers. The leopard frog egg masses used in the 2016 testing were obtained from Dr. Vance Trudeau at the University of Ottawa. These eggs were sourced from a local experimental pond, then transported to the laboratory where gravid females were induced to spawn in clean laboratory water using the hormone mixture Amphiplex, which is a combination of a gonadotropin-releasing hormone agonist and a

dopamine antagonist. Eggs were then shipped in a cooler overnight to the Nautilus Environmental laboratory in Burnaby, where they were held, allowed to develop, and reared in a controlled environment room where temperature was slowly raised from shipping to testing temperature (23°C). The hatch rate and fertilization rates in the laboratory spawned eggs were confirmed to be sufficiently high for use in the study.

Given the negative control failures observed in the 2016 study, consideration will be given to alternate suppliers in 2017. This decision will be made once results of the ongoing investigations of specimen batch health are available for the organisms tested in 2016. Nautilus preserved select specimens from the failed 2016 study for this purpose; these specimens will be sent to the University of Prince Edward Island for biological assessment, including viral assessment. Should a factor be identified that is specific to the University of Ottawa source, other options for egg mass collection will be explored. One option would entail returning to the Manitoba wetland source that was used in the successful pilot study. This would require making a new application for a collection permit.

Although the test temperature exceeds typical Elk Valley conditions, the higher temperature is preferable because it is consistent with that used in the test protocol development; lower temperatures could influence the rate of development of amphibian larvae in a manner that makes test duration impractical or growth endpoint data more variable. Egg masses will be placed in glass aquaria, containing a minimum of 10-L of continuously aerated moderately hard water. Water renewal will occur three times per week and water quality measurements (temperature, dissolved oxygen, pH) will be measured before and after renewals. Upon hatching, tadpoles will be randomly distributed among additional aquaria to reduce organism loading density. Water renewals will continue as described throughout tadpole rearing. Tadpole developmental stage will be monitored, and once a sufficient number of tadpoles have reached Gosner stage 27, tadpoles will be distributed among test aquaria for test initiation.

2.3 Testing Protocol

Testing conditions will be based on the draft methods described by Environment Canada (Lo et al., 2014) that are summarized in Table 1. Exposures will be initiated using tadpoles in the early stages of pre-metamorphosis (Gosner stage 27) and continue until >70% of control tadpoles reach the onset of metamorphosis (Gosner stage 42). The duration of the test is not a fixed number of days but rather is dependent on the rate of development of tadpoles, which can differ among treatments. The maximum duration of testing is expected to be approximately two to three months.

Survival, growth, development and deformity endpoints will be recorded at test termination (survival, wet weight at stage 42, snout to vent length, time to reach stage 42 and incidence of deformities). Exposures will be conducted in a controlled environment room at $23 \pm 1^\circ\text{C}$ with a 16 h light: 8 h dark photoperiod. Four replicates of ten tadpoles will be used for the treatments. Water will be renewed three times per week.

In addition to the measurements made at test termination, interim stage measurements will be made. The Environment Canada draft procedure (under development) does not currently specify interim measurements. Although frequent measurement of test organisms is discouraged, due to the potential for handling stress on the developing organisms, one round of interim measurements has been incorporated in the study design. The time duration (i.e., number of days) will not be specified in advance because the developmental rate is difficult to predict. Instead, visual observations will be made during the test to identify when the organisms are approximately halfway through the development span of the test (i.e., Gosner Stage 34-35). If necessary, one replicate of the negative control and reference water will be handled to confirm the developmental status prior to conducting detailed measurements such as weight, snout to vent length, developmental stage, and incidence of deformities.

Table 1: Summary of test conditions: Northern leopard frog (*Lithobates pipiens*) tadpole development

Attribute	Test Details
Test organism	<i>Lithobates pipiens</i> (formerly <i>Rana pipiens</i>)
Test organism source	Field collected gravid females collected in Ontario by University of Ottawa (Vance Trudeau) and spawned in laboratory water prior to transport. Organism source may be changed pending biological assessment of preserved 2016 specimens.
Test organism age at initiation	Gosner stage 27
Test type	Static-renewal
Test termination criteria	≥70% of control organisms reach onset of metamorphosis; ≥80% survival
Test vessel	18-L glass aquaria
Test volume	8-L
Test replicates	4 test replicates per treatment
No. of organisms	10 per replicate
Control water	Dechlorinated municipal tap water and synthetic hard water controls ^(a)
Test solution renewal	Three times per week (75% renewal)
Test temperature	23 ± 1°C
Feeding	Daily, approximately 3% body weight. The administered food will be Sera Micron®. This is a commercially available tadpole food that has been demonstrated in validation studies to support proper growth and development of amphibian larvae.
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	Continuous
Statistical software	JMP, CETIS
Test endpoints	Survival, weight, length, snout to vent length, developmental stage, incidence of deformities. Test endpoints measured at end of test (Gosner stage 42) and intermediate stage (approximately Gosner stage 34-35 depending on observed rate of development).
Reference toxicant	96-h test using sodium chloride

^(a) Applies to laboratory control waters. Upstream water from the Elk River (GH_ER2) will also be tested as a reference water treatment.

Previous tests conducted by Environment Canada and Nautilus Environmental have been initiated using both Gosner stage 25 and stage 27 tadpoles. For the present study, Gosner stage 27 has been selected, and this stage is also being proposed by Nautilus Environmental for the standard test method that is under development by Environment Canada. At Gosner stage 25, tadpoles tend to be similarly sized, whereas by Gosner stage 27, the tadpoles tend to differentiate into smaller and larger tadpoles. By waiting until stage 27 to initiate the test, it is possible to remove this source of variance from the test, since tadpoles of similar size can be selected to initiate the test. As a result of the reduced variance, the test is more statistically sensitive to detect adverse effects on growth when they occur. Because there is relatively little morphological change during this transition, it would not be expected that there would be a difference in overall toxicological sensitivity, and the increased statistical sensitivity that is achieved by reducing variance is considered to be beneficial. For comparison, the standard test method that has been developed for another standardized test species (African clawed frog *Xenopus laevis*) is initiated using a stage that is equivalent to Gosner stage 28.

2.4 Statistical Analyses

Statistical calculations will be based on the average of measured concentrations of sulphate and nitrate (i.e., mean exposure over the full test duration). Although some variations in water chemistry are expected from week to week, an evaluation of the seasonal water chemistry data (e.g., parameters measured in Fording and Elk River samples [Figures 1—3]) indicates that these variations are not expected to be large over the amphibian development period. The data will be analyzed using curve fitting such that the observed responses are modelled as a mathematical function of concentration (Environment Canada 2005). Curve fitting allows for derivation of point estimates to identify concentrations most likely associated with specific levels of effect. Statistical analyses will be performed using CETIS version 1.8.7.16 (Tidepool Scientific Software, McKinleyville, CA, USA).

2.5 Quality Assurance/Quality Control (QA/QC)

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

- Negative controls to ensure that appropriate testing performance criteria are met;
- Positive controls to evaluate sensitivity of the test organisms;
- Use of appropriate species, life stage, and test methods to meet the study objectives;
- Appropriate number of replicates to allow for 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 the correct 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 they are of good quality and are scientifically defensible prior to release to the client.

3.0 SAMPLING LOCATIONS AND SAMPLE AMENDMENTS

This section summarizes the selection of site waters and the types of sample amendments that will be applied for the nitrate and sulphate amphibian toxicity testing program in 2017. The two substances have different requirements in regard to sample amendment.

3.1 Nitrate

The nitrate exposure will be conducted in mine-influenced water from the Fording River (Order Station FR4), the Elk River (Order Station ER2), and from an Elk River upstream reference location (i.e., GH_ER2, not mine-influenced) collected upstream of Greenhills Operations (Table 2). The water quality characteristics of these stations bracket the range of water quality from non-mine influenced conditions (i.e., Elk Valley reference conditions) to the mine-influenced conditions of the mainstem Fording River. The Fording River (Order Station FR4) station was selected because it exhibits higher concentrations of mine-related constituents relative to other candidate stations in the Fording River that were included in previous chronic toxicity testing (e.g., Order Station FR5 or Fording Bridge [FR-B] sampling locations).

Table 2: Sampling Locations for Amphibian Toxicity Testing with Nitrate

Watercourse	Sampling Location	Teck WQ Station ID	EMS Location ID
Fording River	Fording River Mine-Influenced (Order Station FR4)	GH_FR1	0200378
Elk River	Elk River upstream reference	GH_ER2	0200389
	Elk River Mine-Influenced (Order Station ER2)	EV_ER4	0200027

The purpose of the two mine-influenced locations is to capture conditions of water quality, including ionic composition, that are representative of current conditions in these watercourses. The concentrations of constituents observed in weekly samples collected in Spring and Summer of 2017 will depend in part on the hydrological conditions, such as the characteristics of the spring freshet flows. However, the concentrations observed in 2015 should provide a reasonable basis for estimating conditions in 2017. The water quality of the unamended Elk River upstream reference water is expected to include low concentrations of nitrate (<0.1 mg/L N), selenium (<1 µg/L total selenium), and sulphate (<20 mg/L SO₄) (Figure 1). The typical hardness condition in upstream water is expected to be approximately 150 mg/L as CaCO₃ based on results from 2015 (Figure 1).

The water quality of the unamended Fording River (Order Station FR4) water is expected to include nitrate concentrations in the approximate range of 6 to 10 mg/L over the course of the test (Figure 2), along with hardness values in the range of 250—400 mg/L as CaCO₃. Concentrations of sulphate are predicted to remain well below the WQG of 429 mg/L over the duration of testing.

The water quality of the Elk River (Order Station ER2) station will be intermediate between that of the Elk River upstream reference condition and the Fording River (FR4) station (Figure 3). Characterization of these three sample types (reference, Elk River mine-influenced, Fording River mine-influenced) will provide a gradient of water hardness for site waters.

Figure 1: Water quality characteristics in Elk River upstream reference water (Elk River upstream of Greenhills; GH_ER2) during 2015 amphibian development season.

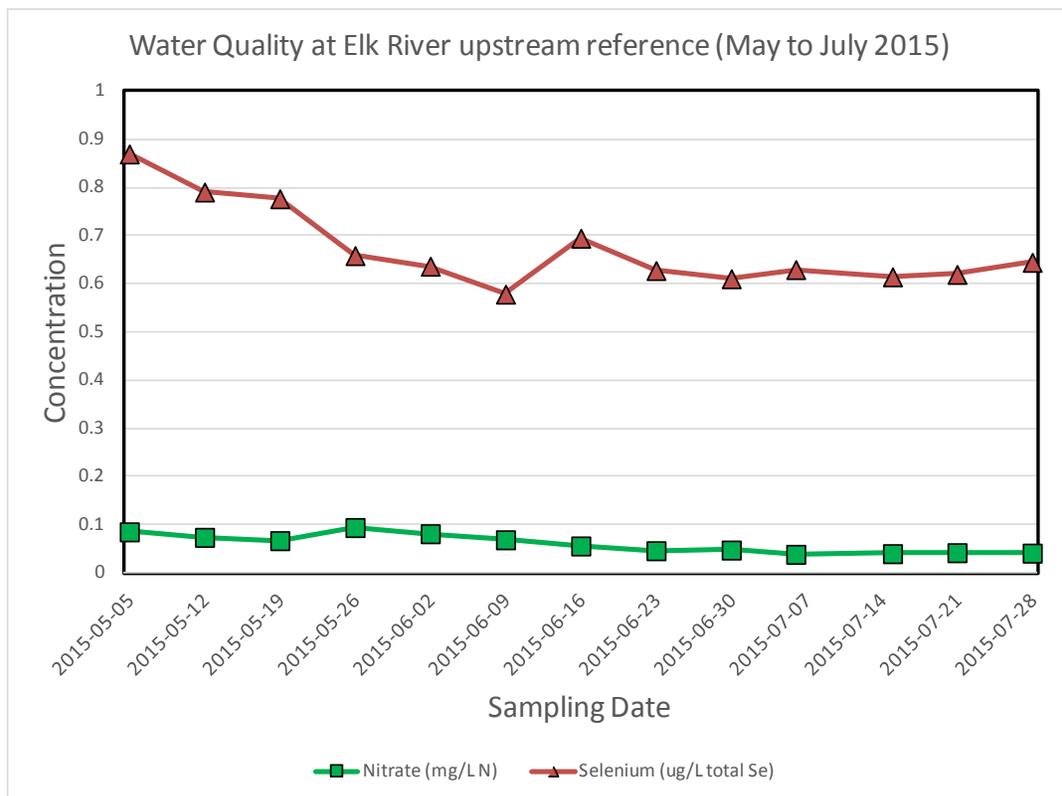
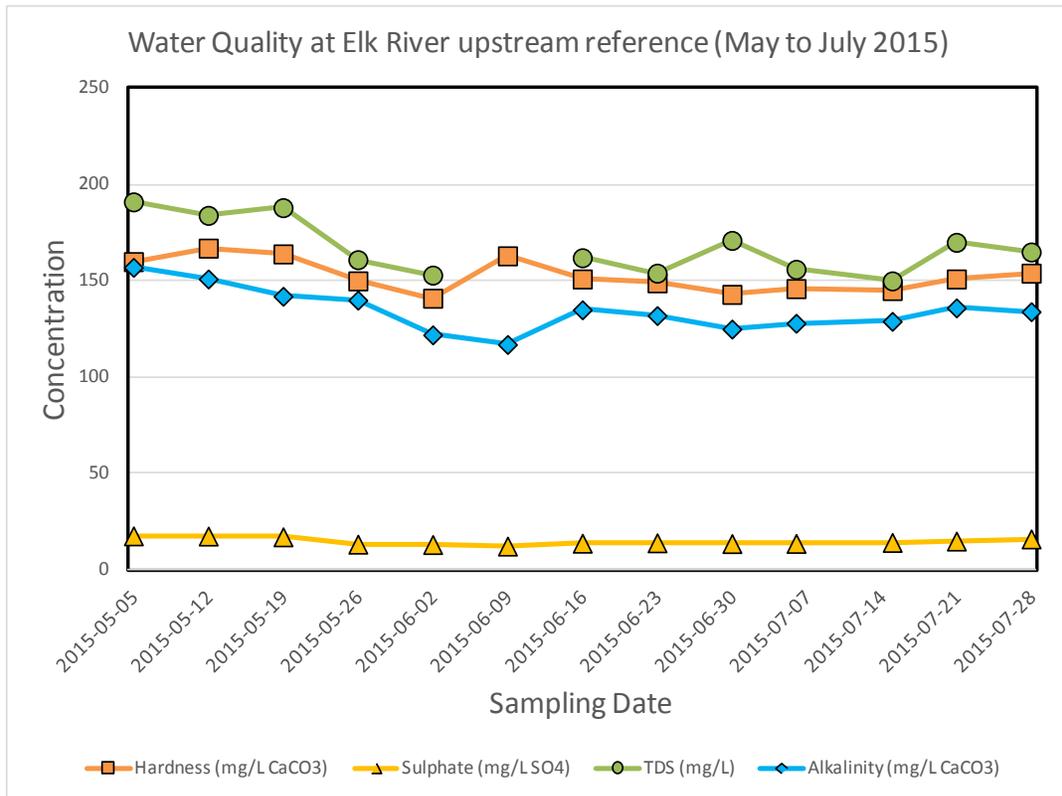


Figure 2: Water quality characteristics in Fording River (FR4) mine-influenced water during 2015 amphibian development season.

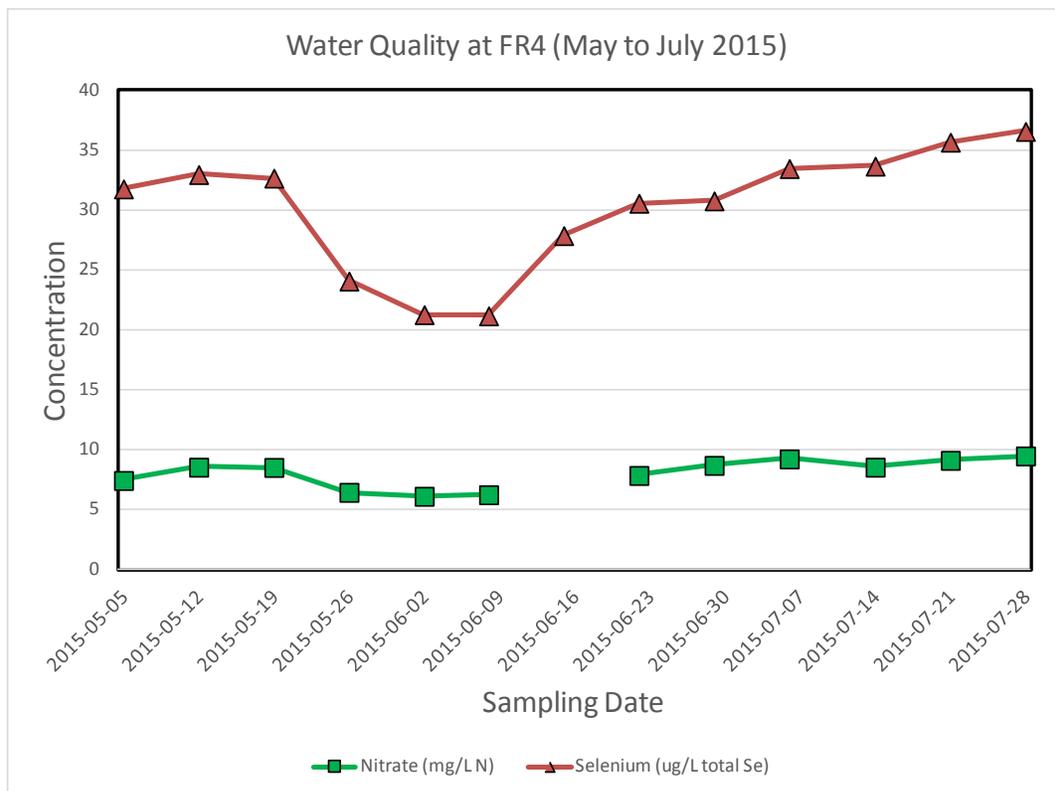
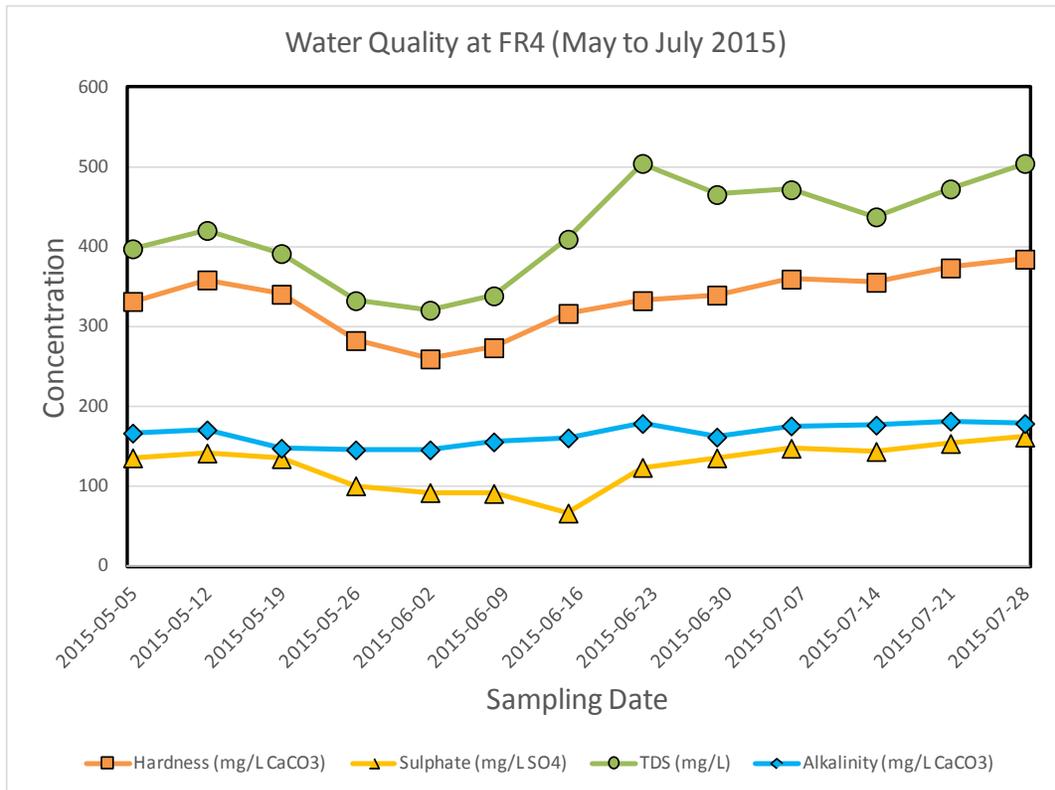
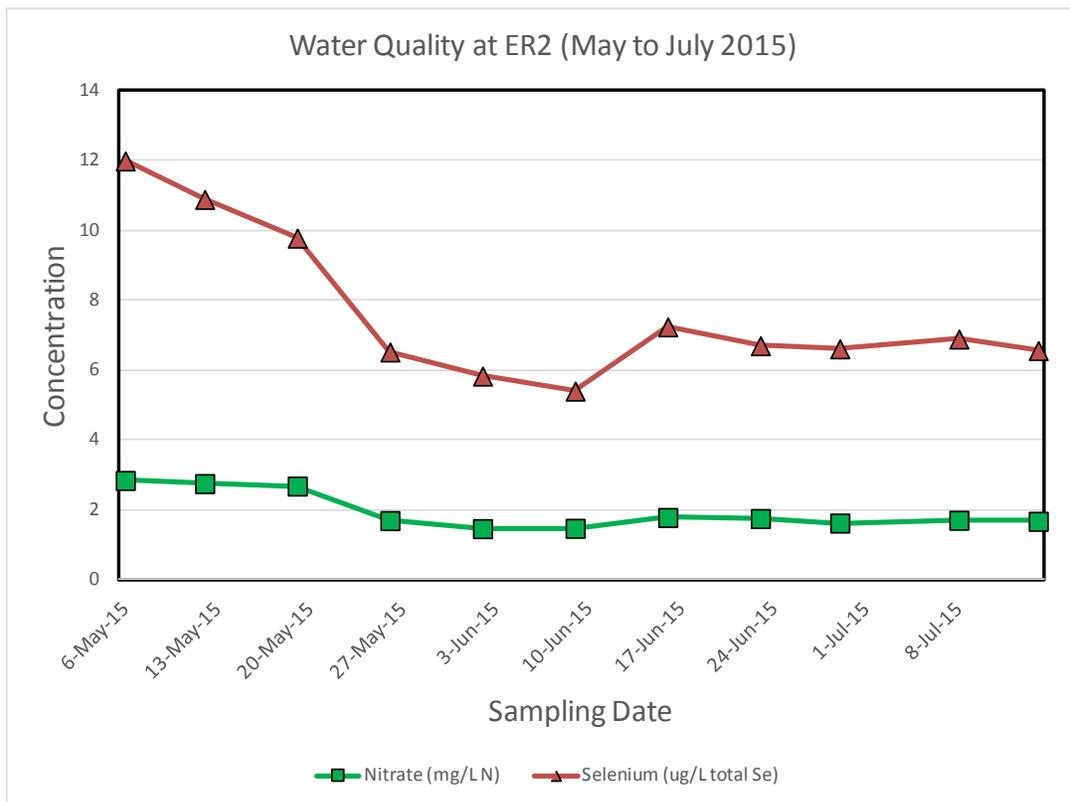
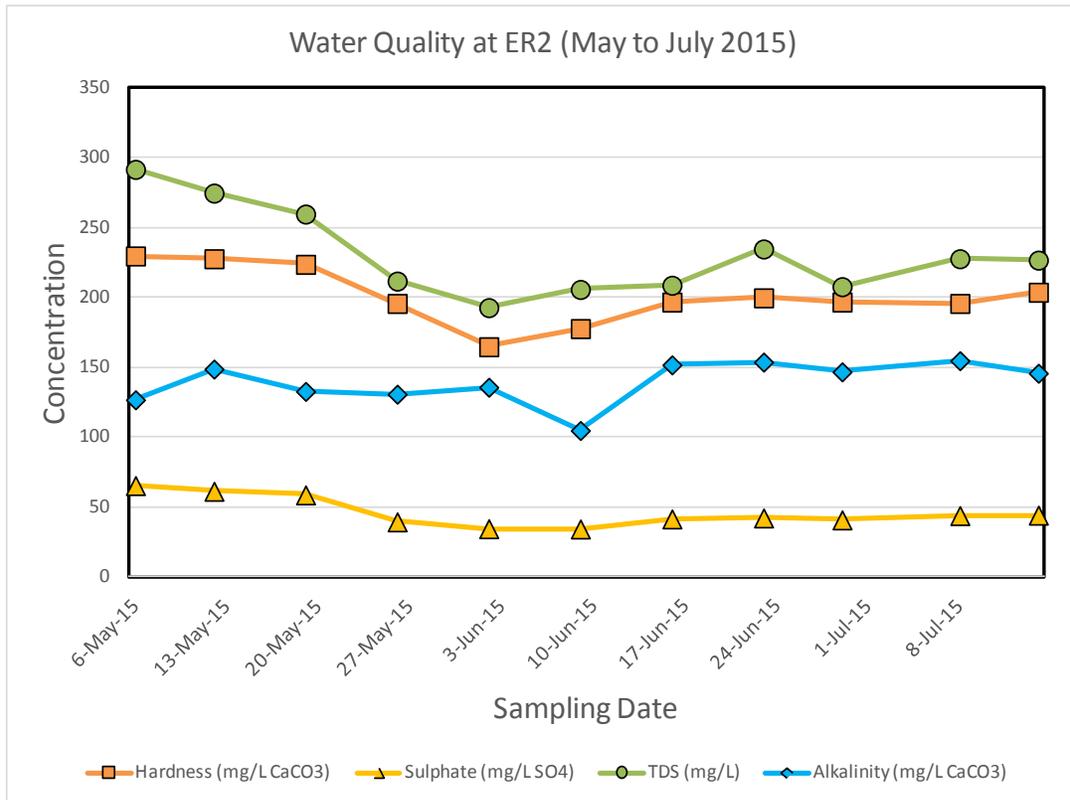


Figure 3: Water quality characteristics in Elk River (ER2) mine-influenced water during 2015 amphibian development season.



The mine-influenced site waters (Order Stations ER2 and FR4) will each be tested unamended, as well as amended with six different supplementation levels of nitrate, for a total of seven treatments in each water type. The amount of amendment required will be calculated based on the difference between the base concentrations measured in site waters and the target total concentration of nitrate.

The target concentrations of nitrate have been selected considering the results of previous testing of amphibians, including the 2015 pilot testing results and other tests documented in the literature. The middle portion of the concentration series is intended to cover the range of nitrate concentrations for which low level responses (i.e., statistically significant growth/length reductions but with inhibition effect size less than 10%) have been observed in previous tests with sensitive endpoints. The upper end of the concentration series is intended to exceed effects concentrations from testing in soft water. If there is no hardness dependence, and sensitivity to nitrate is similar to that observed in the 2015 pilot study, these upper bound concentrations would be expected to elicit large adverse responses (i.e., greater than 50% inhibition), in which case these results will assist in the fitting of a concentration-response curve through the data.

The target concentrations (i.e., total nitrate include both the base concentration plus amendments) have been calculated using a 1.6-fold concentration increment among treatments. This spacing is intended to provide improved precision around the inhibition concentration (IC_x) endpoints relative to a wider spacing among concentrations that would result from a smaller number of amendments. The proposed nitrate concentration levels for Elk River (ER2) and Fording River (FR4) mine influenced waters, expressed as the sum of base concentrations plus chemical additions are:

- Base concentration only (varies by location, but expected to be below 10 mg/L N in all water samples);
- Amendment 1—10 mg/L N;
- Amendment 2—16 mg/L N;
- Amendment 3—26 mg/L N;
- Amendment 4—41 mg/L N;
- Amendment 5—66 mg/L N; and
- Amendment 6—105 mg/L N.

In addition to the above treatments, Elk River upstream reference waters (GH_ER2) will be tested unadjusted to represent reference water quality conditions, and will also be tested with hardness adjustment to match the Fording River (Order Station FR4) and Elk River (Order Station ER2) hardness conditions. The purpose of the hardness adjustments is to establish whether the hardness itself alters survival and developmental rate of the amphibians, as distinct from influence of nitrate. The range of hardness levels covered in these treatments will be determined based on the water chemistry observed in the field at the time of sampling, and is expected to range from approximately 150–400 mg/L as $CaCO_3$.

3.2 Sulphate

Sulphate exposures will be conducted using Elk River upstream reference water and mine-influenced Fording River (FR4) water (Table 3).

Table 3: Sampling Locations for Amphibian Toxicity Testing with Sulphate

Watercourse	Sampling Location	Teck WQ Station ID	EMS Location ID
Fording River	Fording River Mine-Influenced (Order Station FR4)	GH_FR1	0200378
Elk River	Elk River upstream reference	GH_ER2	0200389

In addition to testing unamended water from both FR4 and Elk River upstream reference locations, these two waters will also be amended to 429 mg/L (i.e., the sulphate SPO), 800 mg/L, and 1,200 mg/L sulphate as CaCO₃. As shown in Figures 1 and 2, the majority of sulphate present in the exposures will result from sample amendment, because the base sulphate concentrations in field collected samples will likely be less than half the sulphate SPO. Sulphate will be amended using calcium and magnesium sulphate salts at the approximate ratio of Ca:Mg that is present in the Elk Valley in mine-influenced conditions (i.e., 2.6:1). This approach is considered preferable to amending the site water using sodium sulphate, which is commonly used in toxicological investigations of sulphate toxicity, because the sodium concentration is very low in waters in the Elk Valley. Consequently, amending sulphate using calcium and magnesium salts is considered to be reflective of the ionic composition in which elevated sulphate concentrations would be expected to occur. The amendment using calcium and magnesium salts will also increase water hardness relative to the unamended water.

The rationale for the emphasis on Fording River (FR4) site waters and exclusion of Elk River (ER2) waters from the sampling design for sulphate is linked to two factors that distinguish the sulphate program from that of nitrate:

- The sulphate program is linked to permit requirements "specifically to assess sulphate toxicity at high hardness concentrations." (Section 9.8.1 of Permit 107517). The high hardness conditions referenced in the permit are those greater than 250 mg/L as CaCO₃. For hardness conditions below 250 mg/L as CaCO₃ the site performance objective was set equal to the BC chronic water quality guideline for sulphate in hard water (429 mg/L sulphate). Figure 2 illustrates that hardness levels at ER2 are expected to remain below 250 mg/L as CaCO₃ over the duration of the tests.
- The sulphate toxicity program entailed simultaneous amendment of both hardness and sulphate, using site relevant ratios of calcium and magnesium sulphate salts. Therefore, the concentration series will already incorporate a gradient in hardness, such that collections of multiple Fording River waters are not required.

In addition to the treatments with site water, a negative laboratory control (dechlorinated municipal tap water) and a synthetic hard water control will be conducted. The latter treatment will assess whether high hardness conditions, in the absence of elevated sulphate, may affect the growth and development of *L. pipiens*. The synthetic hard water control will have be adjusted to the approximate hardness associated with the upstream site water. Although similar laboratory controls are already being conducted for the nitrate testing program, the controls for the nitrate and sulphate testing programs will be conducted as separate experimental units. This approach will provide additional control performance data relative to use of a "shared" laboratory control, and may be necessary to account for logistical issues in the laboratory, specifically the need to distribute the test initiation date over multiple days given the large number of test chambers.

The sulphate concentration series will focus on the 429 to 1,200 mg/L sulphate range to overlap the effect benchmark levels developed for other organisms in the EVWQP; this concentration range also includes concentrations that could occur in mine-influenced waters under future conditions. Testing of sulphate concentrations higher than 1,200 mg/L sulphate is not proposed in this program because the laboratory would likely experience challenges with the introduction of calcium sulphate (CaSO_4) within the solubility constraints of the site water.

4.0 CLOSURE

We trust the above information meets your current needs. Please contact the undersigned if you have any questions or require additional information.

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GSL/JE/AMD/asd

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5.0 REFERENCES

- Allran JW, Karasov WH. 2000. Effects of atrazine and nitrate on northern leopard frog (*Rana pipiens*) larvae exposed in the laboratory from posthatch through metamorphosis. *Environmental Toxicology and Chemistry* 19:2850—2855.
- CCME. 2012. *Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Nitrate Ion*. Canadian Council of Ministers of the Environment, Winnipeg MB. May 2012.
- Environment Canada. 2005. *Guidance document on statistical methods for environmental toxicity tests*. Environmental Protection Series. Report EPS 1/RM/46, March 2005. Method Development and Application Section, Environmental Science and Technology Centre, Ottawa, ON, Canada. 280 pp.
- Lo BP, Van der Vliet L., Elphick JR, Marlatt VL, Jackman P, Trudeau VL, Taylor L. 2014. Update on development of a standardized amphibian test method using *Lithobates* spp. *41st Annual Aquatic Toxicity workshop*: 28 September - 1 October 2014, Ottawa, ON. Platform presentation.
- Meays, C.L. 2009. *Water Quality Guidelines for Nitrogen (Nitrate, Nitrite, Ammonia)*. Addendum to technical appendix. Water Stewardship Division, Ministry of Environment, BC, Canada.
- Schuytema GS, Nebeker AV. 1999a. Comparative toxicity of ammonium and nitrate compounds to Pacific treefrog and African clawed frog tadpoles. *Environmental Toxicology and Chemistry* 18:2251—2257.
- Schuytema, G.S. and A.V. Nebeker. 1999b. Effects of ammonium nitrate sodium nitrate, and urea on red-legged frogs, Pacific treefrogs and African clawed frogs. *Bulletin of Environmental Contamination and Toxicology* 63:357—364.
- Teck (Teck Coal Ltd.). 2016. *Reference: Amphibian Chronic Toxicity Testing - Failed Laboratory Control Performance Criterion #2*. Submitted by Nick Manklow (Lead, Adaptive Water Management, Teck Coal Limited) to Lana Miller (Environmental Impact Assessment Section Head – Mining Operations, Ministry of Environment). August 2016.

ATTACHMENT 1

Amphibian Pilot Study



January 21, 2016

Memo: Pilot toxicity testing using *Lithobates pipiens*

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Background

As outlined in the Regional Aquatic Effects Monitoring Program (RAEMP) Approval Letter (November 14, 2014), the BC Ministry of Environment has requested that Teck Coal Ltd. (Teck) investigate the effects of nitrate on amphibians, invertebrates and early life stage rainbow trout in site water. With respect to amphibians, testing should be a long-term test, encompassing metamorphosis of the organisms and use a representative species. In addition, Permit 107517 under section 9.8.1, requires Teck to develop and implement a toxicity testing program specifically to assess sulphate at high hardness concentration which is to include fathead minnows and other sensitive species including amphibians, trout, water fleas etc. Currently, a standardized method for assessing toxicity in amphibians is under development by Environment Canada (EC). The exposures conducted by EC, have primarily focused on testing using the leopard frog, *Lithobates pipiens* (formerly called *Rana pipiens*). EC identified *L. pipiens* a suitable species in part, due to its relevance to a wide range of Canadian environments.

While EC has made significant progress in methodological development, some elements require further refinement (Lo et al. 2014). Therefore, prior to undertaking amphibian testing as specified by the RAEMP letter and Permit 107517, method development based on the draft EC methods was undertaken to ensure that amphibian testing can be conducted in a reliable manner. During this preliminary phase of testing, practical details (e.g., organism source, feeding regime, etc.) were evaluated. As part of this method development, organisms were exposed to nitrate and sulphate, thus providing some preliminary information regarding the sensitivity of *L. pipiens* tadpoles to these compounds under chronic exposure conditions. These range-finding results will help in establishing appropriate test concentrations for definitive tests with this species.

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Methods

Testing conditions were adapted from draft methodology described by EC (Lo et al., 2014). Tadpoles in the early stages of pre-metamorphosis (Gosner stage 27) were exposed to five treatments of nitrate (3.3, 10, 30, 90, 270, mg/L as NO₃-N). The exposure continued until >70% of control tadpoles reached the onset of metamorphosis (Gosner stage 42). In addition to survival, non-lethal growth and development endpoints were recorded (weight, snout to vent length, length and developmental stage). The laboratory control and dilution water consisted of dechlorinated municipal tap water; however, a second water type, reconstituted hard water, was also tested to assess whether water hardness would impact the growth and development of *L. pipiens*. The water hardness was approximately 10 mg/L for the laboratory control water and 180 mg/L (as CaCO₃) for the hard water treatment.

Two concentrations of sulphate, 500 and 1000 mg/L, were also tested. The sulphate treatments consisted of dechlorinated municipal tap water amended with calcium and magnesium sulphates at a ratio of 2.6 Ca: 1 Mg (on a mass basis). The hardness of these two treatments was approximately 569 mg/L for the 500 mg/L sulphate and 1106 mg/L for the 1000 mg/L sulphate treatment.

Laboratory control, hard water and nitrate treatments were tested in triplicate while sulphate was tested in duplicate as a result of a shortage of test organisms of the correct life stage. Treatment waters were measured for nitrate or sulphate three times during exposure.

Dunnet's method was used to compare growth and development results to the control using JMP (SAS, 2015). The Spearman Karber model was used to estimate a LC50 value for nitrate and linear regression was used to estimate an LC20 value. The point estimates were calculated using CETIS (Tidepool Scientific Software, 2013).

Results and Discussion

The results of the tests are summarized in Table 1. Mean (\pm standard deviation) control survival was $96.7 \pm 5.8\%$ and the average time to metamorphosis was 44.2 ± 4.0 days. The number of days to metamorphosis was similar to the results from various exposures conducted by EC using *L. pipiens* tadpoles. Thus, the organism supply, control water type, feeding regime, and other test methods employed in the trial were suitable to produce viable control performance of this species.

Exposure to reconstituted hard water resulted in a statistically significant decrease (p-value of 0.047) in survival when compared to laboratory water (83.3% in hard water compared to 96.7% in dechlorinated municipal water); however, this difference was not large and the rate of survival (i.e., 83.3%) met the performance criterion for control performance as well. Hard water also resulted in a statistically significant increase in the mean number of days to metamorphosis (51.6 ± 1.1 days for hard water and 44.2 ± 4.0 days for dechlorinated municipal water). Significant differences in growth endpoints were not observed between the two water types.

The LC50 (with 95% confidence limits) for nitrate in laboratory control water was 28.8 (21.7 – 35.3) mg/L NO₃- N, and the LC20 was 19.2 (11.5-24.6) mg/L NO₃-N. For growth and developmental endpoints, the 11.7 and 35.1 mg/L NO₃- N did not produce statistically significant adverse effects relative to the control exposure. The effect level presented here is relevant to very soft water associated with the laboratory control, and may not be relevant to higher hardness water associated with the Elk Valley.

Survival rates in the 500 and 1000 mg/L sulphate treatments were 75.0 ± 7.1 and $90.0 \pm 14.1\%$, respectively. The growth and development endpoints of tadpoles was not significantly different between 1000 mg/L sulphate and the control, suggesting that adverse effects are not expected at sulphate concentrations up to 1000 mg/L.

Table 1. Results of *Lithobates pipiens* tadpole exposures.

	Treatment	Survival (%)	Days to metamorphosis	Length (mm)	Snout to Vent length (mm)	Wet weight (g)
	Control	96.7 ± 5.8	44.2 ± 4.0	48.8 ± 2.9	16.1 ± 0.1	0.65 ± 0.06
	Hard Water	83.3 ± 5.8	51.6 ± 1.1	45.3 ± 2.2	15.1 ± 0.8	0.58 ± 0.05
Nitrate (mg/L as N)	4.2	100.0 ± 0.0	43.3 ± 2.9	46.2 ± 1.4	15.1 ± 0.6	0.63 ± 0.03
	11.7	93.3 ± 5.8	45.4 ± 2.1	46.1 ± 2.1	15.5 ± 0.8	0.63 ± 0.07
	35.1	36.7 ± 5.8	28.8 ± 24.1	47.4 ± 2.9	17.1 ± 2.2	0.71 ± 0.11
	87.7	0.0 ± 0.0				
	289	0.0 ± 0.0				
Sulphate (mg/L)	531	75.0 ± 7.1	46.4 ± 2.8	40.7 ± 2.2	13.6 ± 0.6	0.47 ± 0.06
	1047	90.0 ± 14.1	41.0 ± 1.3	44.8 ± 0.5	14.9 ± 0.7	0.57 ± 0.02

The results of this preliminary study suggest that testing conditions used in this exposure (e.g., organism source and transportation, handling practices, temperature, feeding regimes, water renewals) were suitable for testing with this species and are appropriate for future exposures. The difference in survival and time to metamorphosis between hard water and the laboratory control treatments suggest that if future testing is conducted using high hardness site water, a laboratory water of similar hardness and/or a site reference control should also be tested to serve as a representative benchmark for organism performance, although subsequent tests may show that the difference observed between waters types in the present test related to random variability, rather than being a real effect.

References

JMP, Version 12. SAS Institute Inc., Cary, NC, 1989-2015.

Lo, BP, Van der Vliet L, Elphick, JR, Marlatt, VL, Jackman, P, Trudeau, VL, Taylor, L. 2014. Update on development of a standardized amphibian test method using *Lithobates spp.* 41st Annual Aquatic Toxicity workshop: September 28-October 1, 2014, Ottawa, ON. *Platform presentation*

Tidepool Scientific Software. 2013. CETIS comprehensive environmental toxicity information system, version 1.8.7.16 Tidepool Scientific Software, McKinleyville, CA. 222 pp.



APPENDIX C

Summaries of Test Conditions for Laboratory Toxicity Tests



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Table C-1: Summary of Test Conditions: Northern Leopard Frog Tadpole Development Test

Attribute	Test Details
Test organism	<i>Lithobates pipiens</i> (formerly <i>Rana pipiens</i>)
Test organism source	Field collected gravid females collected in Ontario by University of Ottawa (Vance Trudeau) and spawned in laboratory water prior to transport ^(b)
Test organism age at initiation	Gosner stage 27
Test type	Static-renewal
Test termination criteria	≥70% of control organisms reach onset of metamorphosis; ≥80% survival
Test vessel	18-L glass aquaria ^(b)
Test volume	8-L
Test replicates	4 test replicates per treatment
No. of organisms	10 per replicate
Control water	Dechlorinated municipal tap water and synthetic hard water controls ^(a)
Test solution renewal	Three times per week (75% renewal)
Test temperature	23 ± 1°C
Feeding	Daily, approximately 3% body weight. The administered food will be Sera Micron®. This is a commercially available tadpole food that has been demonstrated in validation studies to support proper growth and development of amphibian larvae ^(b) .
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	Continuous
Statistical software	JMP, CETIS
Test endpoints	Survival, weight, length, snout to vent length, developmental stage, incidence of deformities. Test endpoints measured at end of test (Gosner stage 42) and intermediate stage (approximately Gosner stage 34-35 depending on observed rate of development) ^(b) .
Reference toxicant	96-h test using sodium chloride ^(b)

^(a) Applies to laboratory control waters. Upstream water from the Elk River (GH_ER2) will also be tested as a reference water treatment.

^(b) Denotes refinement from the previous study design (Golder and Nautilus 2016).



Table C-2: Summary of Test Conditions: Water Flea Survival and Reproduction Test

Attribute	Test Details
Test organism	<i>Ceriodaphnia dubia</i>
Test organism source	In-house culture
Test organism age	<24 h old neonates produced within 12 h
Test type	Static-renewal
Test duration	7 ± 1 day
Test vessel	20 mL test tube
Test volume	15 mL
Test replicates	10 test replicates per treatment ¹
Number of organisms	1 per replicate
Control water	20% Perrier water
Test solution renewal	Daily
Test temperature	25 ± 1°C
Feeding	<i>Pseudokirchneriella subcapitata</i> and YCT
Light intensity	100 to 600 lux at water surface
Photoperiod	16 hours light/8 hours dark
Aeration	None
Test protocol	Environment Canada (2007a) EPS 1/RM/21
Test endpoint	Survival and reproduction
Test acceptability criteria for controls	≥80% survival; ≥15 young per surviving control producing three broods; ≥60% of controls producing three or more broods ²
Reference toxicant	Sodium chloride

¹ Test replication shown refers to the standard replication required by Environment Canada (2007a) and applies to the reproduction endpoint. Based on EMC advice, increased organism replicates (30 first-generation females per treatment) will be incorporated for the survival endpoint only.

² Test will be deemed complete when field reference and lab control samples all meet requirement for production of three broods (rather than just the lab control).



Table C-3: Summary of Test Conditions: Rainbow Trout Early Life Stage (Embryo-Alevin) Test

Attribute	Test Details
Test organism	<i>Oncorhynchus mykiss</i>
Test organism source	Duncan, BC
Test organism age	<30 min post fertilization, <24 h old gametes
Test type	Static renewal
Test duration	~30 days (or ~40 days for extended testing to full yolk sac absorption).
Test vessel	2-L plastic containers
Test volume	2-L
Test replicates	4 test replicates per treatment (increased to 8 for sulphate testing)
Number of organisms	30 eggs per container
Control water	Dechlorinated water (hardness 12 mg/L CaCO ₃)
Test solution renewal	Daily
Test temperature	14 ± 1°C
Feeding	None
Light intensity	Dark
Photoperiod	24-h dark; low intensity light used during solution renewals
Aeration	6.5 ± 1 mL/min/L
Test protocol	Environment Canada (1998), EPS 1/RM/28
Test endpoint	Survival, normal hatch (number and percentage of nonviable alevins) ¹
Test acceptability criteria for controls	≥65% normal hatched fish
Reference toxicant	Sodium dodecyl sulphate

¹ The Environment Canada (1998) protocol for the embryo-alevin test specifies incidence of nonviable alevins (i.e., failure to reach alevin stage in a timely and normal manner) as the primary biological endpoint, for which the protocol requires calculation of formal statistical endpoints. Narrative statements are to be made regarding observations of delayed hatching (either time required to achieve median hatch, or proportion hatched) and presence of deformed alevins.



FINAL STUDY DESIGN FOR NITRATE AND SULPHATE

Table C-4: Summary of Test Conditions: Fathead Minnow Survival and Growth Test

Attribute	Test Details
Test organism	<i>Pimephales promelas</i>
Test organism source	Aquatic BioSystems, Fort Collins, CO
Test organism age	<24 hours
Test type	Static renewal
Test duration	32 days
Test vessel	1-L plastic container
Test volume	1-L
Test replicates	4 test replicates per treatment
Number of organisms	10 per replicate
Control water	Moderately-hard water (hardness 80-100 mg/L CaCO ₃)
Test solution renewal	Daily
Test temperature	25 ± 1°C
Feeding	Twice a day with newly hatched brine shrimp (<i>Artemia nauplii</i>)
Light intensity	100 – 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test protocol	USEPA (1996) and ASTM (2013)
Test endpoint	Survival, length, biomass
Test acceptability criteria for controls	>66% hatch; ≥70% post-hatch survival
Reference toxicant	Copper

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APPENDIX D

Analysis of Covariance—Model Summary Statistics

NITRATE

C. dubia Reproduction

Tukey's Honestly-Significant-Difference Test

Water Source	Compared to Water Source	Statistical Difference	P-Value	Conclusion
EV_ER4	GH_ER2	10.37	0.004*	Reference water different from mine-influenced
EV_ER4	GH_FR1	-7.44	0.044*	Marginal result, considered not different once effect of simultaneous multiple comparisons considered
EV_ER4	GH_FR1-HH	-4.34	0.42	Not different
GH_ER2	GH_FR1	-17.81	<0.001*	Reference water different from mine-influenced
GH_ER2	GH_FR1-HH	-14.72	<0.001*	Reference water different from mine-influenced
GH_FR1	GH_FR1-HH	3.09	0.70	Not different

Pairwise comparison statistically significant at $\alpha=0.05$.

ANCOVA—Best Fit Model Statistics

Locations	Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	IC ₁₀	IC ₂₀	IC ₅₀
GH_ER2	Quadratic	70	89.60	-0.5825	-0.00084	0.274	<0.001	89.60	15.06	29.52	69.91
Pooled (EV_ER4, GH_FR1, GH_FR1-HH)	Quadratic	210	93.75	0.9050	-0.02149	0.584	<0.001	93.75	50.71	57.33	72.29

NITRATE

Rainbow trout Embryo-Alevin Test

Survival

Tukey's Honestly-Significant-Difference Test

Water Source	Compared to Water Source	Statistical Difference	P-Value	Conclusion
EV_ER4	GH_ER2	50.74	<0.001*	Reference water different from mine-influenced
EV_ER4	GH_FR1	12.62	0.37	Not different
EV_ER4	GH_FR1-HH	14.40	0.28	Not different
GH_ER2	GH_FR1	-38.13	<0.001*	Reference water different from mine-influenced
GH_ER2	GH_FR1-HH	-36.35	0.001*	Reference water different from mine-influenced
GH_FR1	GH_FR1-HH	1.78	0.996	Not different

*Pairwise comparison statistically significant at $\alpha=0.05$.

ANCOVA—Best Fit Model Statistics

Locations	Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	EC ₁₀	EC ₂₀	EC ₅₀
GH_ER2	Quadratic	28	99.04	-2.029	0.00225	0.676	<0.001	99.04	4.91	9.87	25.11
Pooled (EV_ER4, GH_FR1, GH_FR1-HH)	Quadratic	84	111.1	-0.1944	-0.00376	0.134	0.003	111.1	34.35	55.26	98.44

NITRATE

Rainbow trout Embryo-Alevin Test

Length

Tukey's Honestly-Significant-Difference Test

Water Source	Compared to Water Source	Statistical Difference	P-Value	Conclusion
EV_ER4	GH_ER2	6.987	0.002*	Reference water different from mine-influenced
EV_ER4	GH_FR1	-4.361	0.034*	Difference between mine-influenced
EV_ER4	GH_FR1-HH	0.289	0.998	Not different
GH_ER2	GH_FR1	-11.349	<0.001*	Reference water different from mine-influenced
GH_ER2	GH_FR1-HH	-6.698	0.006*	Reference water different from mine-influenced
GH_FR1	GH_FR1-HH	4.650	0.031*	Difference between mine-influenced

*Pairwise comparison statistically significant at $\alpha=0.05$.

ANCOVA—Best Fit Model Statistics

Locations	Best Fit Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	IC ₁₀	IC ₂₀	IC ₅₀
GH_ER2	Linear	28	98.11	-0.4298	-	0.549	<0.001	98.11	22.83	45.65	>111
GH-FR1	Linear	28	104.2	-0.2476	-	0.456	<0.001	104.2	42.08	84.17	>111
EV_ER4 + GH_FR1-HH	Linear	56	97.43	-0.1621	-	0.463	<0.001	97.43	60.10	>111	>111

NITRATE

Rainbow trout Embryo-Alevin Test

Weight

Tukey's Honestly-Significant-Difference Test

Water Source	Compared to Water Source	Statistical Difference	P-Value	Conclusion
EV_ER4	GH_ER2	8.308	0.115	Not different
EV_ER4	GH_FR1	-6.611	0.133	Not different
EV_ER4	GH_FR1-HH	1.821	0.940	Not different
GH_ER2	GH_FR1	-14.920	0.0006*	Reference water different from one of three mine-influenced waters
GH_ER2	GH_FR1-HH	-6.487	0.330	Not different
GH_FR1	GH_FR1-HH	8.433	0.046*	Marginal result, considered not different once effect of simultaneous multiple comparisons considered

*Pairwise comparison statistically significant at $\alpha=0.05$.

ANCOVA—Best Fit Model Statistics

Locations	Best Fit Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	IC ₁₀	IC ₂₀	IC ₅₀
All	Quadratic	112	100	-0.3505	0.001333	0.223	<0.001	100	32.56	83.71	>111

NITRATE

Rainbow trout Embryo-Alevin Test

Proportion Swim Up

ANCOVA—Best Fit Model Statistics

Locations	Best Fit Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	EC ₁₀	EC ₂₀	EC ₅₀
All	Quadratic	112	93.09	-0.8401	0.003896	0.184	<0.001	93.09	11.72	25.08	>111

SULPHATE

C. dubia Reproduction

ANCOVA—Best Fit Model Statistics

Locations	Best Fit Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	IC ₁₀	IC ₂₀	IC ₅₀
All	Quadratic	140	99.13	0.01311	-1.6E-05	0.02	0.251	99.13	1297.05	>1345	>1345

Rainbow Trout Embryo-Alevin

ANCOVA—Best Fit Model Statistics

Variables	Locations	Best Fit Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	EC/IC ₁₀	EC/IC ₂₀	EC/IC ₅₀
Survival	All	Quadratic	112	97.87	0.02434	-6.2E-05	0.114	0.001	97.87	639.44	791.47	>1008
Viability	All	Quadratic	112	97.32	0.02481	-6.3E-05	0.112	0.002	97.32	636.50	786.59	>1008
Length	All	Quadratic	112	100.1	0.001154	-7E-06	0.081	0.012	100.10	>1008	>1008	>1008
Weight	All	Quadratic	112	101.6	-0.0092	0.000005	0.004	0.808	101.60	>1008	>1008	>1008

Fathead minnow

ANCOVA—Best Fit Model Statistics

Variables	Locations	Best Fit Model	Sample size	B ₀ (Intercept)	B ₁	B ₂	R ²	p	max	EC/IC ₁₀	EC/IC ₂₀	EC/IC ₅₀
Survival	All	Quadratic	56	93.99	0.00207	-1E-06	0	0.995	93.99	>1248	>1248	>1248
Hatch Rate	All	Quadratic	56	99.43	0.0024	-6E-06	0.126	0.03	99.43	>1248	>1248	>1248
Normal Development	All	Linear	56	99.21	0.000624	-	0.017	0.35	99.21	>1248	>1248	>1248
Biomass	All	Linear	56	87.67	0.003938	-	0.008	0.509	87.67	>1248	>1248	>1248
Length	All	Quadratic	56	102.5	-0.00664	-1E-06	0.099	0.067	102.50	>1248	>1248	>1248

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